

We're recruiting undergraduate and master's students to work on microbial metal cycling in e-waste

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This is a template adapted from Dr. Paul Carini's newsletter *Uncultured*

What you need to know

You will lead your own research project that examines how microbes control the fate of iron or cobalt in habitats contaminated with e-waste. This research is funded by an NSERC Discovery Grant awarded to Dr. Daniel Grégoire to launch the Environmental Biogeochemistry and Biotechnology lab at Carleton. Your work will expand the known biodiversity of microbes living in contaminated habitats and identify novel pathways that can be used for sustainable waste reclamation. You will use a combination of meta-omic (i.e., whole community DNA and/or proteins) and geochemical analyses to develop metabolic models for microbes living in e-waste. You will design enrichment experiments to establish stable microbial consortia that will be the first step in developing sustainable biotechnology to reclaim metals from e-waste. You will be one of the inaugural members of the Environmental Biogeochemistry and Biotechnology lab at Carleton. This means you will work with Dr. Daniel Grégoire, who will use a "learning-by-doing" approach to make sure you are comfortable with the techniques you'll be using in your research. You will play an integral role in organizing the lab's first field campaign, generating sequencing datasets, and optimizing methods that will be used for metal analyses. Once you are comfortable in the lab, you'll be encouraged to take more ownership over your research. We're open to hearing your creative ideas!

Background on the projects

As the demand for consumer electronics has increased in the last decade, so has the environmental footprint associated with their manufacturing and disposal. The inability to properly manage e-waste has created a scenario in which managing e-waste is challenging because it represents a contamination source but also contains valuable metals that could be recycled. The global growth of e-waste has also created a new and important environment for microbes that can directly interact with metals. To date, microbial influence on the fate of metals in e-waste is poorly understood.

We're recruiting for two projects: one is focused on **iron**, and the other, **cobalt**. Iron is essential to alloys used in consumer electronics and iron concentrations in e-waste are comparable to those in mine tailings. Whereas mine tailings have served as model systems to characterize microbial iron redox cycling, the microbial guilds that control iron's fate in e-waste have yet to be characterized. Similar knowledge gaps exist for cobalt, a major component of batteries. Microbes use a variety of pathways to maintain cobalt homeostasis that have yet to be leveraged in biological e-waste reclamation.

What you will be doing

There is no one skillset that will define who we hire to undertake these projects. Our lab focusses on biogeochemistry and biotechnology, which are interdisciplinary by nature. Your research will require you to characterize how microbes affect the fate of metals directly through their metabolic activities and indirectly by how those metabolic activities affect environmental chemistry on a larger scale. We're looking for someone with broad experience in environmental microbiology, ecotoxicology, geochemistry, or bioinformatics. You might be an expert in bioinformatics who has worked with sequencing datasets before. You might have in depth knowledge of environmental chemistry modeling how contaminants move through the environment. You may also be skilled in cultivation techniques used to grow microbes from diverse habitats. We encourage you to apply if you have experience in any of these areas and want to use it to mitigate the negative environmental impacts of e-waste.

In our lab, you can expect to grow your skills in contaminated site sampling, molecular biology, microbial physiology, and geochemical analyses. We will work with you to build your capacity for experimental design, project management, and science communication. You can expect to be part of an inclusive group that will support your growth and help you with troubleshooting experiments. When you start in the lab, you can expect to be onboarded slowly. This initial onboarding will involve you reading literature help you plan your research, giving you time to get used to balancing research with your academic commitments. Once you're settled in, we will work on an individual development plan to ensure your training in the lab aligns with your career goals. We want you to access diverse career paths inside and outside of academia.

Specific skills we are interested in

We are looking for **undergraduate** and **master's students** that are excited about combining meta-omics and geochemistry to better understand how microbes contribute to contaminant cycling. You will have your own way of learning, and we're committed to working with you so that you can excel in your research. You'll have an interest in using cutting-edge bioinformatics tools to characterize microbial communities and develop reproducible workflows to tackle large sequencing datasets. You're keen to develop knowledge of geochemistry to connect biotic and abiotic processes that control metal cycling in the environment. You will be able to communicate your research through written documents and presentations. Communication is a key facet of science and we're excited to hear about your work!

We're looking for someone with good project management skills that can help build the lab. We value someone who is a self-starter, autonomous, and can commit to a decision while clearly outlining their logic. We want to work with someone who understands the importance of troubleshooting and documenting solutions to help others. We recognize that mistakes will be made along the way, but we see these mistakes as an essential part of your learning.

We hope you will pay this forward because you'll play a key role in transferring knowledge to incoming students as the lab grows. We want people who see value in getting feedback and can incorporate it into their work. This is a two-way street, and you can expect that your voice will be heard. We will strive to provide you with professional development opportunities, such as attending workshops and conferences, that will help you meet your career goals.

Where you will work

You will be working in Ottawa, which is a fantastic city to do research in and pursue your education. You will be in a city where you can easily connect with people working in the private biotech industry or the government contributing to policy. Ottawa has several means of public transport (bus and train) and bike paths that make it easy to get to campus from most places in the city. Carleton Chemistry's Department is an interdisciplinary environment that equips students for diverse career paths after they graduate. Having access to the interdisciplinary Institute of Biochemistry will ensure you will learn about different research outside of your expertise. If you'd like to learn more about what we have planned, go to <https://carleton.ca/envbiotech/>.

Job logistics and pay

The Environmental Biogeochemistry and Biotechnology lab is located on Carleton University's campus in room 432 in the Steacie Building. The work for this position will necessitate some field work at contaminated sites such as landfills. You will also have to work in person in a large lab space that will be shared with members of other research groups. You will need to adhere to COVID-19 safety procedures put in place by Carleton and additional masking requirements that are part of the Environmental Biogeochemistry and Biotechnology lab's safety policies. You'll be supervised by a combination of in-person, asynchronous messaging, and remote communication.

Pay for undergraduates applying through the I-CUREUS or NSERC USRA program will be in line with those program requirements. Undergraduates applying through the Honours thesis program will receive academic credit towards the completion of their program. Pay for graduate students will be in line with Carleton's Chemistry Department norms. Information on benefits for graduate students can be found here: <https://gsacarleton.ca/healthplan/>. We will do our best to help you apply for any scholarships that will help you succeed during your time with us.

We want you to have a sustainable relationship with your work and will help you strike a good work-life balance. **Graduate students** are expected to work in the lab 20-24 hours a week while balancing their academic duties. **Honours students** are expected to work between 12-16 hours a week and we recognize that your course load is a priority. Undergraduates working through the **I-CUREUS** program will work 150 hours over an internship that can last 8 months. Undergraduates working through the **NSERC USRA** program are expected to work 40 hours a week over a 16-week period.

Diversity matters to us

We strongly encourage candidates of all different backgrounds and identities to apply. Equity, diversity, and inclusion are crucial to supporting innovation in academia by bringing people with diverse lived experiences together. This means that we want a diverse team that includes people from different backgrounds, experiences, and identities. If you identify as being part of a marginalized community, you are welcome here! We will put the work into providing you with an inclusive and supportive environment to do your research.

Please submit an application that speaks directly to this position

Please prepare an application package that consists of your CV and a statement outlining your research experience and why you will be a good fit for the lab. This research statement should be succinct, highlight your specific interests in the projects, and provide evidence of why your training is a good fit for the work described. Take your time and tell your story the best way you can, we're giving you our full attention. All applications can be emailed to danielgregoire@cunet.carleton.ca.

We will be evaluating applications on a rolling basis until we find the right candidates. Master's students would ideally start in January 2023. Undergraduate students can start as early as September 2022 but can also start in January 2023 depending on the program through which they are recruited.

Once we have your application, you will hear from us in two weeks about advancement to the interview stage. We expect one interview that will be an hour and a half long to take place remotely. We will send questions in advance so there are no surprises. These questions will focus on your professional experience, problem-solving ability, and communication skills.

For graduate students, if we decide to work together, you must be formally accepted into one of the M.Sc. programs in Chemistry at Carleton before you can start in the lab: <https://graduate.carleton.ca/cu-programs/chemistry-masters/>. After you are accepted into your M.Sc. program, we will work with the Department of Chemistry to draft a formal offer and send it you. We will aim for this letter to be sent shortly before the start of the Winter 2023 semester.