**Post-Doctoral opportunity: A paper-based DNA testing device for species detection**

If you are interested in being part of a team dedicated to changing how conservation is conducted around the world by developing new genetic technologies for conservation, and if you want to be part of the new wave of scientists paving a much-needed new path to saving the world’s dwindling biodiversity, this position is for you. Are you interested in the interface between conservation and cutting-edge biosensor research to empower more people to be a part of the global conservation movement?

McMaster University in partnership with WildTechDNA (<https://wildtechdna.com/>) are in the process of developing a sensitive, easy-to-use, real-time, portable and inexpensive **paper-based DNA technology** to identify wildlife (and plants) from small samples of genetic material. The project has already attracted huge global interest and endorsement from many conservation angles.

https://geographical.co.uk/nature/wildlife/item/3760-dna-sequencing-device-could-rapidly-detect-illegal-wildlife-products

<https://news.sky.com/story/snow-leopard-dna-helps-develop-pregnancy-test-technique-that-could-quickly-identify-endangered-species-in-wild-using-faeces-11778859>

<https://www.abc.net.au/radionational/programs/offtrack/snow-leopard-poo-2018/8852958> and article <https://mobile.abc.net.au/news/2017-10-14/snow-leopard-poo-dna-test-could-solve-conservation-riddle/9043102>

<https://thejaguarandallies.com/2017/11/09/qa-with-conservation-geneticist-natalie-schmitt/>

We have recently acquired funding to initially develop the technology for the detection of fecal samples from caribou with the University of Calgary.

**Further funding will take the technology to a whole new level and develop assays for all the big cats for fecal, skin, hair and bone detection in parallel.** To achieve this,we are partnering with academic and government institutions as well as NGOs including the Senckenberg Institute, the Wildlife Conservation Society, the South African National Biodiversity Institute, and the Snow Leopard Trust.

**We are looking for an exceptional researcher to help in the development of the technology and will include an attractive salary offer:**

The Post-doctoral fellow will focus on the development and optimization of a DNA extraction and amplification method on paper for fecal samples initially, which will be linked to a colour change signal. The researcher will work with Dr. Carlos Filipe (Department of Chemical Engineering), Dr Yingfu Li ( Department of Biochemistry and Biomedical Sciences) and Dr Natalie Schmitt (Conservation geneticist and Director at WildTechDNA <https://wildtechdna.com/>).

Requirements: Previous experience in functional nucleic acid research in the development of point-of-care diagnostic biosensors, strong communication skills and an interest in their application to conservation, essential. Experience in DNA nanotechnologies and microfluidics, and working on multi-disciplinary collaborations, desirable.

The position is funded for two years but there is substantial opportunity to become a permanent member of the team within WildTechDNA a work with global partnerships in conservation.

As a member of this team, you will be exposed to the most advanced science in conservation genetics, and you will work with researchers that have already received world acclaim.

There are many more options for you to continue developing this project within the science/policy interphase, with local communities, and in the private/public sector interphases.

The connections that you will make as part of this team will give you global opportunities within the conservation technology and biomedical engineering realms.

**Project Overview**

Finding effective, inexpensive ways to wildlife is paramount to national and global conservation efforts, especially in biodiversity-rich but economically poor developing countries, where this aspect is becoming increasingly more urgent. Conservationists and authorities need to analyze population dynamics, identify threats of local extinction, identify illegally trafficked wildlife products, and assess the effectiveness of mitigation actions. Detecting wildlife from the DNA profile of their remains has become a critical method in conservation that would otherwise be difficult or impossible to obtain through other means. Currently, DNA retrieved from materials (e.g., feces, skin and bone) collected in the field need to be analyzed using traditional methods in the lab or using expensive and complex portable DNA sequencers.

The specific challenges with these traditional laboratory methods that limit the widespread adoption of genetic species detection include: a) they are time-consuming and require specialized expertise; 2) they are sensitive to the samples’ age and quality; 3) laboratory costs are too high for large-scale studies or for developing countries, precisely the regions that need this information the most.

Such challenges prevent the inclusion of the largest proportion of the international conservation community, **the public**, and prevent many developing countries (including biodiversity hotspots) from solving conservation problems due to socio-economic reasons

**Our solution is to develop an innovative, ground-breaking, and unique technology - a portable, effective, affordable, paper-based DNA testing device for the real-time detection and monitoring of elusive (or indeed all) wildlife.**

We aim to solve two major scientific challenges that have been roadblocks to the engineering of low-cost, in-field DNA testing devices.

1. First, it is difficult and time-consuming to isolate target DNA from biological samples as the process requires multiple chemical, physical and thermal steps.
2. Second, it is difficult to detect a small amount of target DNA in a sample containing a large amount of background material.

Our paper-based hand-held device will operate much like a pregnancy test, performing three functions in one:

* capturing the DNA from a variety of genetic sources (e.g feces, bone, skin etc.),
* producing readable copies of the DNA, and
* detecting the target species DNA through a simple colour change.

This technology will be truly revolutionary, in its ability to detect wildlife quickly, easily and cheaply. The applications and benefits to address the critical issues currently threatening the world’s biodiversity include:

1. **Illegal Wildlife Trade Monitoring.** The technology will provide a powerful tool for real-time detection of illegally traded wildlife products, thereby dramatically increasing the effectiveness of law-enforcement. The device will solve three major hurdles for effective law enforcement in one stroke: time, cost and technical capacity. Quickly, easily and cheaply distinguishing between legal and illegal samples is essential to addressing wildlife crime.
2. **Endangered Species Detection**. The technology will significantly increase the capacity to monitor the occurrence of threatened species in sensitive areas and assess the effectiveness of Environmental Impact Assessments through fecal detection. Real-time detection will allow field teams (and other collaborators and stakeholders) to make on the spot decisions. Many developing countries without access to specialist lab facilities currently have no capacity to conduct species genetic field surveys.
3. **Community Based Conservation**. The simplicity and ultra-low cost of the technologywill enable participation in global conservation efforts by non-experts, effectively creating a new paradigm in crowd-based wildlife monitoring through the involvement of communities, schools and individuals.

**Project team**

Below are the individual researchers that bring strategic expertise and opportunities to the project and will be hands-on in the development of the technology:

**Dr. Carlos Filipe (McMaster University – Chemical Engineering)** is an expert in developing ultra-low-cost paper-based sensors, with a focus on environmental monitoring applications. He has ~90 publications (h-index: 30, ~6,600 citations) including a widely used textbook, and 14 granted patents. He has supervised ~100 Highly Qualified Personnel (HQP) and his group now have 16 trainees. He will lead the design of the device and the integration of DNA capture and amplification-reporting.

**Dr. Yingfu Li (McMaster University – Biochemistry and Biomedical Research)** is a leader in the area of functional nucleic acids and their applications as biosensing tools. He has published ~200 papers and book chapters (h-index: 57, ~13,000 citations), filed more than 20 patents and presented more than 150 invited talks to date. He has supervised ~150 HQP and currently runs a research group of ~20 trainees. He will be responsible for developing an RCA-based strategy to report the presence of specific genomic DNA and will work with Filipe on the capture of genomic DNA from complex samples.

**Dr. Marco Musiani (University of Calgary)** is a Professor in conservation biology at the University of Calgary, who specializes in wildlife management and molecular ecology, with a focus on field projects conducted in Alberta and BC. He has ~90 publications (h-index: 34, ~5,000 citations), including papers in Nature and Science, and edited two books on wolves and wildlife management. He has supervised over 40 HQP and currently runs a research group of 13 trainees. He will lead the field-testing component of the project for caribou and the development of species-specific markers.

**Dr. Natalie Schmitt (McMaster University – WildTechDNA – Explorers Club 50 people changing the world 2022)** as a conservation geneticist specializing in genetic methods for the detection of rare and elusive species, saw the immense potential in adapting methodologies developed at McMaster University for human health, to the detection of wildlife and plants for conservation. She spent a year working with the Li Lab to develop a proof of concept for snow leopard detection based on that method, and isnow in a strong position to over-see, coordinate and bridge the gaps between the conservation, biomedical and chemical engineering worlds, including the laboratory development and field testing(18 publications, ~155 citations). She also formed a company around the technology (WildTechDNA: https://wildtechdna.com/) to bring in business and investor opportunities to scale up the technology for many threatened species in many corners of the world. She has built collaborative networks and support not only within Canada but also internationally where there has been keen interest from government, industry, NGOs, INGOs and academic institutions from over 27 countries including the 12 snow leopard range countries and the 14 continental countries that form the Latin American Jaguar Conservation Alliance. After attending the recent CITES CoP in Geneva and having representation at the Convention on Migratory Species (CMS) CoP in India, it was clear that this technology will be an important tool for implementing wildlife trade regulations and for monitoring ecologically important migratory species.