Understanding Public Speaking

Preparatory Workshops

Week 11, November 29, 2023

Cancer: Bad to the bone

Speaker: Nancy Mourad
From School of Clinical Medicine, University of New South Wales

Taking a human life is the ultimate crime, yet breast cancer gets away with it every day. Sometimes it'll try and kill you, but you escape. You think you've gotten away and that you're not going to be the victim anymore. But the fact is there is a fearful possibility that it would come back for you. And at the moment, yes, it sometimes does.

Whilst we all know about how to catch breast cancer cells committing crime, what we're starting to realize is that the cancer cells that should be on our hit list aren't the ones that are doing the dirty work, but are the ones that are behind the door, the ones that are out of sight, and the ones that come back. Likened to a gang leader, these hidden or dormant cancer cells can remain in hiding for years, possibly decades, waiting, planning the perfect opportunity to commit the ultimate crime: growing violent and fatal tumors.

Our current treatments against cancer are great, but are inadequate with treatments leaving the hidden gang leaders unharmed and ready to strike again. Different treatments will catch different criminals. We can't expect the policeman on the streets to be able to take out a gang leader. We need a special kind of treatment to target this type of criminal. But the problem is we still don't know what at dormant cancer cells even look like, let alone trying to figure out how to catch them. The one important lead we do have is that we know that they like to hide out in your skeleton.

Acting on this lead, the aim of my research is focused on looking for rare dormant breast cancer cells in bone and defining their genetic fingerprint in order to eradicate them. I want to know what getaway highways these cells are using to escape treatments, the phone conversations they're having with neighboring cells, and how they are disguising themselves on a day-to-day basis.

To do this, I've used the labeling method that allows me to distinguish dormant cancer cells from active cancer cells. By using this method for the first time, I have been able to identify and visualize rare dormant breast cancer cells in bone. What's more is I have interrogated and extracted the genetic information from dormant and active cancer cells so that I can begin to ask questions like: What are the genes that are switched on in dormant cancer cells compared to the active ones?

By answering such questions, my research will determine how cancer cells go into hiding and what triggers them to escape. The implications in understanding this process will almost certainly lead to a change in how we understand cancer, and how we diagnose and treat the disease, do we prosecute dormant cancer cells with the death penalty, or do we serve them with a life sentence, keep them dormant so that patients die with the cancer instead of dying from it. My research is helping to bring the perpetrators of crime to justice so that you don't have to live in fear. If we beat it the first time, we can beat it for good.

Mount Taranaki has a plumbing problem

Speaker: Henry Hoult
From School of Earth and Environment, University of Canterbury

Taranaki Maunga is an active volcano with a 40 percent chance of erupting in the next 50 years. This could cause billions of dollars worth of damage to Aotearoa New Zealand. The bad news is Taranaki has a plumbing problem. We know that it changes eruption style quickly with little to no warning. The good news is: I'm a volcano plumber.

While most of us like to visualize volcanoes as just being the tap at the top of a single cylindrical pipe that magma flows up to reach the surface, my research is showing that the plumbing system beneath Taranaki is actually more complicated than this and is also blocked.

Imagine you've just bought an old house and the councilors are about to turn the water back on. You might naturally be a bit concerned that maybe some of the pipes are going to start leaking, the shower won't drain properly, or, worse, the toilet explodes. Taranaki's pipes haven't been used in a long time either. The difference is: to study the plumbing system of your house, all you have to do is open the cupboards under the sink or maybe pull up some floorboards. With volcanoes, however, this is a little bit trickier. The doors are a lot heavier and a lot lot hotter.

So what I'm doing is looking at pieces of the plumbing system that are thrown out during an explosive eruption. These pieces of the plumbing system are called "lithics", and my research has shown that the physical characteristics of different lithics are different by measuring their permeability in the lab. Some have very high permeability. This allows gases to escape easily, preventing any pressure buildups within your system. Some lithics, however, have very low permeability. This prevents gases from escaping, leading to pressure buildups, which then lead to explosive activity.

Studying the lithics thrown out by Mount Taranaki allows me to piece together the structure of the plumbing system and identify which pipes are blocked and with what. Imagine trying to solve a puzzle where all the pieces have been thrown out of a volcano. This allows us to forecast which pipes are likely to explode next time and how severe it might be. We know that Taranaki has erupted from different pipes in the past with different consequences each time. For example, Phantom's Peak has oozed runny lava flows, while the summit has exploded violently. And while lava flows within the national park might be a manageable local hazard, ash fall from explosive summit activity could cover the North Island including Auckland in ash. This has the potential to cause billions of dollars of economic damage.

So me studying the plumbing system of Taranaki and identifying which pipes are blocked and with what is helping risk mitigators and economic modelers better prepare Aotearoa New Zealand for future activity from Taranaki Maunga. But that's not all. Similar volcanoes around the world have similar shallow plumbing systems, such as Mount Vesuvius in Italy or Mount Rainier in the United States. So me solving this puzzle is helping other puzzle plumbers understand their systems better and helping risk mitigators elsewhere better prepare for eruptive activity from volcanoes around the world. Job done.
