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Hive of activity as dnature goes high-profile

The Business Quarterly last reported on DNA diagnostics and research business dnature five years ago. In March this year, the business relocated from the industrial subdivision into what was a muffler shop on the fringes of the CBD. Mark Peters reports on the business's expansion.

GENE SCIENCE: Genetic scientist and dnature co-owner John Mackay and laboratory manager Tammy Waters inspect varroa mites in a small vial.

Picture by Paul Rickard

The size of your desk is how you measure the progress of your business, jokes gene scientist, entrepreneur and dnature co-owner John Mackay.

He regards a one square metre table that two or three staff members sat at when Mr Mackay and his wife Belinda first started up dnature behind a dusty truck yard in the Awapuni Road industrial strip.

"You work around one small desk, then you get a bigger desk."

The new location is three and a half times bigger than the industrial subdivision laboratory and office. And it has multiple desks.

Doorways are 2.13 metres high to accommodate Mr Mackay's height.

"This was a four-wall shell when we got it," says Mr Mackay.

"The old lab had little room to expand. Here we have a meeting room and a mezzanine floor."

INDUSTRIAL CHIC AND HIGH TECHNOLOGY

The new lab features industrial-chic design by architect James Blackburne of Architects 44. By keeping or enhancing some of the features of the former muffler outlet, it was easier to modify the building to suit dnature's controlled environment needs rather than build a new lab.

Beams and girders are exposed and painted in a uniform white. Industrial-modern lights hang from the ceiling while a raw timber feature wall adds textural contrast in the foyer area.

Rooms are electronically accessed, sealed ("you have positive and negative air pressure") and unadorned.

The rooms are bigger in the new building but Mr Mackay's work is essentially molecular, so lab equipment is still mostly made up of a small agitator that can reduce insect material into a few millilitres of soup; a new-generation machine that copies the DNA and generates fluorescent traces, tiny vials, a laptop and a fridge.

EXPANSION

dnature offers diagnostic services and products to some of New Zealand's key horticulture-based businesses.

Mr Mackay started dnature designing and developing DNA tests that could identify specific genes in organisms such as Psa on kiwifruit vines, viruses in grapes or truffles in oak.

With its upgraded technology, broader product distribution base and diagnostic platforms, the business has extended into tests for manuka honey, the cattle disease Mycoplasma bovis and bee bacteria American foulbrood.

dnature has also become a distributor for specialised equipment.

Along with the bigger site, staff numbers have grown. Former part-time laboratory manager Tammy Waters is now full-time at dnature. Ms Waters' role is to run the labs and "generally sort John out". The DNA-dedicated testing lab also has a sales representative in Auckland and one in Wellington.

"They'll tell people about our range of tests and new equipment for analysing DNA," says Ms Mackay, who runs the commercial side of the business.

"It's good to be able to expand our business into areas we hadn't looked at previously."

Plans are afoot to upscale the lab to biosafety level PC2.

PC stands for "physical containment" while the 2 designates the biosafety level. A biosafety level is a set of containment precautions required to isolate biological agents in an enclosed laboratory facility. Levels of containment range from the lowest biosafety level 1 to the highest at level 4.

"With PC2 you can handle different types of organisms in the lab where previously you couldn't" says Ms Mackay.

"It means we can bring in samples from overseas to test that we previously couldn't."

PC2 is about being able to handle those organisms correctly, says Ms Waters.

MANUKA

"Our work has become more high-profile since we began working with manuka," says Mr Mackay.

In collaboration with Scion, a research institute in Rotorua, the original project was to see if DNA methods could be used to distinguish between manuka and kanuka.

"The following year, MPI (Ministry of Primary Industries) asked 'could you develop new methods for the extraction of pollen DNA from honey?'"

MPI scientists identified four chemical markers while Mr Mackay and his team identified the genetic marker that needs to be present to authenticate manuka honey.

"By the end of 2016 they had an accredited test which has been submitted for publication."

Although New Zealand has a significant shortage of beekeepers, the manuka honey rush has resulted in a flurry of new and inexperienced beekeepers on the scene.

"Many of them don't know about American foulbrood (AFB)," says Mr Mackay.

AFB is the most widespread and destructive of the bee brood diseases. It is one of three pests subject to biosecurity in New Zealand. The other two are bovine tuberculosis and PSA in kiwifruit.

The increase in hive theft greatly increases the risk of spreading AFB. If AFB is found in bees the hives are burned and honey destroyed. Because of AFB, 500 to 600 hives have been incinerated in New Zealand this year.

"Until recently, beekeepers thought our rate of American foulbrood was down," says Mr Mackay. "In fact it has increased at about 15 percent a year over the past few years."

No test for diseases such as AFB is perfect, including tests the dnature team have developed.

"It's about having tools in the toolbox. We're also working with people who train dogs to sniff out AFB."

Part-funded by the Eastland Community Trust, one of dnature's research projects is to develop faster sampling methods to detect the bacteria.

"With these new methods we can detect spores but the question is will they lead to clinical disease?"

If the spore level is not too high, bees are able to clean them out of the hive.

A MITE-Y HYPODERMIC

The parasitic varroa mite that entered New Zealand in 2000, and is the most damaging honey bee pest worldwide, is becoming more resistant to treatment.

Mr Mackay, who with beekeeper Barry Foster and entomologist John McLean is part of a New Zealand Apiculture science and research group, has developed a new test to detect chemical resistance markers. The new test is cheaper than the previous one that would have cost around $4000 to set up.

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THE BUSINESS SIDE: Belinda Mackay, "the brains behind the logistics of making dnature a commercial success", handles the business side of the business of diagnostics, research and product distribution.

Picture by Paul Rickard

Discovering the unknown

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"It tests for any of the three DNA mutations that are present and scans in the region of the DNA where the three mutations are, and looks for any other mutations. We've tested dozens and dozens of varroa but haven't detected the ones reported around the world yet."

In human scale, the varroa mite would be about the size of a dinner plate attached to the body. It injects, as if with a "big, dirty hypodermic needle", a virus into the host bee.

"We're interested to know what strains of virus there are and if we have an immunity strain in New Zealand," says Mr Mackay.

"We can get the DNA directly out of the varroa then we can test it quickly for one of the mutations."

He holds up a rack of small vials with a little liquid, and a varroa mite in the bottom of each one. Pipettes are used to transfer small amounts of varroa material into a 15cm cube in which reagents copy and amplify the target DNA.

"Every time the target DNA is copied it generates a fluorescent signal."

The process is known as polymerase chain reaction (PCR) and is part of the design and implementation of industry tests for which dnature is internationally recognised.

The business is also a distributor for PCR machines, DNA quantification instruments and other reagents used in the process.

"A lot of tools we use had no distributor in New Zealand," says Mr Mackay.

PCR involves a specific target, such as AFB in bees or manuka pollen in honey, that is copied billions of times. Mr Mackay likens the process to "looking for a needle in a haystack then creating a haystack of needles".

The new, cube-like machine that makes that haystack is a quarter of the size of the machine dnature used previously. It can also talk via bluetooth to a laptop in another room.

dnature is now looking at next-generation sequencing — the technique now used to sequence human genomes — in which a large, USB stick-like instrument sequences everything in the sample material.

An Australian research group recently used the technique on bees and found 27 new viruses, says Mr Mackay.

"Rather than look for something you know, you can now discover the unknown."