Organic chemist Nic Bason

NZASE scientist profile

Nic at the back with, from left, Graham Townsend, Jan Wikaira, Sarah Jamieson, Sarah Masters, Lily Hermanspahn and Lance Buckett, at the Big Science Day in Christchurch, 2015.

Born

Blenheim, 1991. "My grandfather was born in Taihape and moved to Blenheim, and his whānau has been there ever since."

Affiliations

Ngāti Hauiti, Ngāti Tūwharetoa, Ngāti Raukawa.

Schools and subjects

St Mary's Primary School, Blenheim; Garin College, Nelson. "I did Bio, Physics, Chem and Te Reo to Yr 12, and Bio and Chem in Yr 13. I studied Te Reo at uni; I have basic but not conversational Te Reo."

How he got into science

"I've always been very inquisitive, wanting to understand how things work, to the tedium of those around me. Chemistry clicked with me and I was good at it. I was adamant I wasn't going to do a PhD when I first went to uni, but my interest kept growing..."

Training and jobs

Bachelor of Science, 2014; his **Masters** became a **PhD** in organic chemistry, both at the University of Canterbury (UC). He was a Research Associate at UC in 2022; and becme an Applications Scientist, Syft Technologies, from Noema/November 2022.

Field of science

Synthetic organic chemistry, the creation and study of new carbon compounds.

Research topics

Making new polycyclic aromatic hydrocarbons

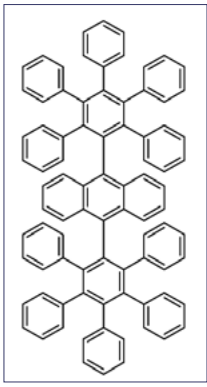
These benzene-like molecules contain a ring of six carbon atoms joined by alternating double and single bonds, which gives them a similar hexagonal shape to chicken wire. They are called aromatic, because historically, benzene-like substances had a distinct smell, although not all such new molecules are aromatic.

Nic's PhD and subsequent research were done as part of a synthetic organic chemistry research group. Nic's work on new molecules aimed to improve the efficiency of solar cells, and the very large redox flow batteries that store power in city electricity grids.

"Solar cells work by absorbing a photon of light as energy from the sun and converting that into an electron. Regular solar cells absorb one photon per electron they give out."

Nic and the group aimed to make molecules that underwent "a process known as singlet fission, which converts one photon into two electrons, doubling the efficiency".

"It's a bit like building with Lego. Then we'd test their properties to see whether they did what we wanted them to do."



One of the benzene-like molecules that Nic made.

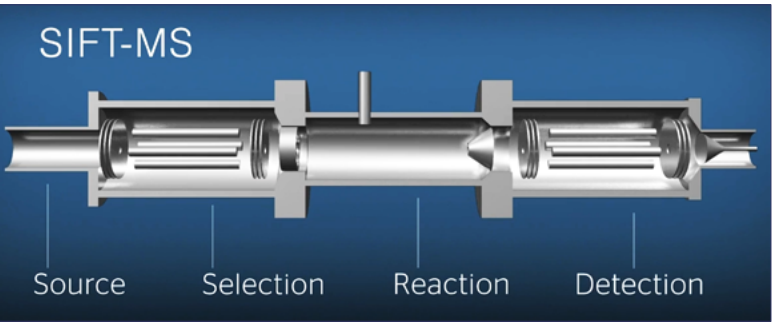
Analytical/ion chemistry

Syft Technologies, where Nic now works, grew out

Nic, right, with his only sibling Josh.

of research at the University of Canterbury in 2002; the company now operates in six other countries.

The SIFT-MS direct mass spectrometer has an ion flow tube. It selectively quantifies volatile organic and inorganic compounds in the environment (air, water or soil) or a sample, in real time.



A simplified diagram of the SIFT-MS instrument; the flow tube is where the reaction happens.

"The instrument uses microwave plasma to create reagent ions", says Nic. "It fires one reagent into a flow tube (the reaction chamber), where they react with what's in the air or the sample."

"Then it selects the next reagent ion and fires these, milliseconds later, because each reagent ion and molecule in the sample will react differently."

The instrument is used in ports to check safety after containers have been fumigated, and to control air quality in semiconductor manufacturing. It is also used by pharmaceutical companies, and in automotive, food, flavour and fragrance industries.

Nic works alongside engineers. "The scientists check that the instrument performs analytically, and design how customers can use the instrument for a new application, or for a particular mixture or compound."

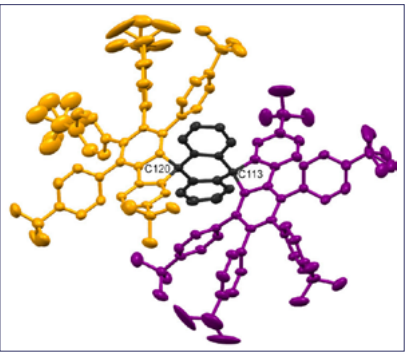
How he finds things out

Nic synthesised new molecules and tested to find their properties and possible uses.

Most interesting result

One of Nic's unexpected new polycyclic aromatic hydrocarbons.

"In my PhD I found that I'd made unexpected and fascinating molecules that weren't yet known. We were expecting them to react one way, and they reacted differently from other related molecules under the same conditions."



"We expected them to become big flat disks, but they became unconventional, three-dimensional structures. All new knowledge is useful, but I don't have the foresight to know how those molecules could be used after a decade."

Mātauranga Māori

"Tying mātauranga Māori into what I do is not direct," he says. "Improving the efficiency of a solar grid or power grid batteries helps protect the environment and move us away from fossil fuels."

Chemistry underlies life, Nic says. "In making a taiaha, you have to fire the wood to harden it, which is a chemical reaction. Preserving tītī with fat and salt is chemistry; cooking is a series of chemical reactions. The properties and types of pounamu and other tools relate to their chemical makeup. Humans are big sacs of controlled chemical reactions."

He values the holistic approach of mātauranga. "Scientists are trained to be experts in our small area of our chosen field. But we also need to collaborate and look outside of our area, using knowledge from physicists, biologists and other colleagues."

What he likes about science

"I like learning and understanding things; how they work, right to an atomic level. I like having a question, and working out how to investigate it and find an answer. I also like educating about chemistry."

"I organised and participated in several different outreach events and initiatives at UC: school visits, demonstrations, Chemistry Club – an educational activity with a local intermediate school, pre-exam tutoring sessions for undergraduates, mentoring Māori students, and spectroscopy workshops for the Yr 13 internal exam."

Link

Photovoltaics, Nic's Thesis in Three (minutes) video.

Ngā Kupu

From Paekupu and Te Aka Māori Dictionary

Honohono matū – Chemical bond
Horihori – Synthetic
Hanga matū – Chemical structure
Katote – Ion
Mātai matū – Chemistry
Mātai matū whaiwaro – Organic chemistry
Ōwehenga matū - Chemical composition
Pūhui matū – Chemical compound
Rāpoi ngota – Molecule
Tauhohe matū – Chemical reaction
Taiaha – Wooden spear
Taiwhanga pūtaiao – Science laboratory
Tākohukohu – Volatile
Tātari – Analyse; analysis
Tītī – Muttonbird
Whakamātau – Experiment, test, trial.