

Exchange programmes

SENIOR, PRINCIPAL AND CHIEF researcher levels (including Nobel winners) in research institutions and tertiary education institutions in South Africa and abroad qualify for exchange programmes, which create additional resources for leadership in science, particularly at mentorship level.



Jaco Zeevaart

Investigating chemistry: Science has never intimidated Dr Jaco Zeevaart. He excelled at the subject at school and university, passing with flying colours and collecting several awards in the process



Using computers to model compounds is new to Dr Jaco Zeevaart and the discovery chemistry group. He left for America in June to deepen his understanding of this technology

When the chemistry is just right

Dr Jaco Zeevaart has an overwhelming passion for chemistry, so much so that in his first year of undergraduate tuition at the University of Pretoria, he quickly changed the direction of his studies when he discovered it contained less of this discipline that underpins basic science.

JACO BEGINS TO unpack the chemistry between science and him. "I wanted to pursue the chemical engineering line but my passion was more in chemistry, so when I realised that there was more engineering than chemistry in chemical engineering, I quickly made another plan," says Jaco, who has, like his father, followed a career in the natural sciences and is now a synthetic organic chemist at the CSIR.

When he talks about his science experience and research work, that passion is captured in his voice. Like a historian, he meticulously unpacks the story of his life to date as a scientist. He began his career at the African Explosives and Chemical Industries (AECI), conducting research in

fine chemicals or speciality chemicals used in the flavour industry. "I was involved in trying to develop new processes to start a fine chemicals manufacturing sector in South Africa. Even now there are no industry leaders in this field, except perhaps Sasol." In 1998, AECI transferred its chemical research and Jaco soon found himself under the employ of the CSIR, where his research focus shifted dramatically from fine chemicals development to chemistry as a tool in the area of human health and the fight against diseases prevalent in southern Africa. In 2005 he completed his PhD titled 'Homogenous transition metal catalysis in enolate arylation', which was sponsored by the CSIR in line with its human capital development strategy.

Jaco is a member of the discovery chemistry research group where the focus is on elucidating potential new treatments for HIV (both protease and reverse transcriptase inhibitors), tuberculosis and malaria, using medicinal chemistry, which is a relatively new field in chemistry. One of these projects involves creating an alternative route for the production of cheaper first regiment HIV/Aids antiretrovirals by using biocatalysis. "Medicinal chemistry relates to developing new drug substances and getting the understanding of how molecules interact at enzyme level in the body and the various processes that are followed; how a drug is absorbed in the body, toxicity implications, how it is metabolised and ultimately excreted," he explains. "The ultimate aim is to under-



Dr Jaco Zeevaart enjoys technical work like woodwork in his spare time. Here he loads samples in the high pressure liquid chromatography machine for analysis of sample purity

DEFINITION OF TERMS

Protease: Any enzyme that conducts proteolysis, that is, begins protein catabolism by hydrolysis of the peptide bonds that link amino acids together in the polypeptide chain

Reverse transcriptase: Enzymes that are important for the replication of the HI virus in human cells. Reverse transcribing RNA viruses such as HIV, use reverse transcriptase to transcribe their RNA genomes into DNA, which is then integrated into the host genome and replicated with it. Reverse transcriptase inhibitors retard the enzyme to prevent this process from taking place

but will also exchange some of his synthetic organic chemistry skills. "Jorgensen is strong in physical chemistry. He has created a scaffold of compounds, completed screening and modelled more effective compounds, but needs these to be synthesised in the laboratory. It will also be a learning curve for me to see how synthesis is done in other laboratories," says Jaco of his role there.

The skills that Jaco will gain are related to the development of potential chemotherapeutics for the treatment of HIV infection, which together with computational design, is of interest to CSIR Biosciences. The development of fused heterocyclic compounds (similar to those under development at the CSIR) for clinical evaluation will be the primary focus of the secondment programme. The techniques Jaco learns through this exchange programme are expected to translate directly to the development of the class of aromatic heterocycles currently under development at the CSIR.

Jaco is excited at the prospect of establishing new collaboration networks and at the opportunity of experiencing his first 'white Christmas' that he will enjoy with his wife, seven year-old son and three year-old daughter in America.

On his return, he plans to use a financial award he recently secured from the Young Researcher Establishment fund to study further aspects of reverse transcriptase inhibition and gain a foothold in medicinal chemistry.

stand a specific disease, which enzymes are involved in its proliferation and how these enzymes can be inhibited, and then to come up with a suitable inhibitor that does not negatively impact normal cell function.

"Medicinal chemistry is much broader than chemistry and that's the challenge these days. Chemistry is rapidly incorporating elements from biochemistry and microbiology. As chemists we need to learn more about these fields that we traditionally don't know much about," says Jaco.

Jaco's research group is also beginning to investigate molecular modelling, a new technique to aid and improve their research. "We are still in the learning process," he says. "Collaboration is important, especially with groups like that of Professor William Jorgensen who have been working for the past 15 years to

build up competence in reverse transcriptase inhibitors." Jorgensen is a world-renowned scientist specialising in computer-assisted molecular design who invited Jaco to spend a year – starting in June – as a postdoctoral associate at Yale University in Connecticut, USA.

Jorgensen's primary research interest is the design and preparation of potential chemotherapeutics for HIV, through inhibition of reverse transcriptase and GP41 (a protein that helps to initiate the process of membrane fusion between the virus and cell membranes). GP41 research focuses on inhibiting attachment of the virus to the cell membrane. "Jorgensen designs and utilises computer programs to predict which chemical entities will be active against reverse transcriptase," Jaco explains.

Through this exposure, Jaco will gain experience in computational modelling,

- Asha Speckman