

# The chemistry of curiosity

Andi Horvath explores the winding career path of University of Melbourne Head of Chemistry Professor Frances Separovic.

## PROFILE

How does a person transform from lab technician and instrument washer, to research physicist with an Arts degree and then become Head of a Chemistry Department? The answer is the 'spirit of curiosity' and it describes University of Melbourne's Professor Frances Separovic to a tee. She admits "I didn't choose a career in science; I stumbled into it," but she believes that shows the way success usually follows the pursuit of one's passion.

Professor Separovic is one of those researchers who is a true explorer; her uncharted territory was the world of membrane models. Membranes are the thin lipid bags that hold together every living cell; they are also the surfaces where the chemistry of life happens. But for her they were fascinating physical and mathematical conundrums.

"I just wanted to know how membranes work. The application of the research is why you get funded but it's not really what drives me," she says.

Recalling her first job, Professor Separovic says she started working as a lab technician at a CSIRO microbiology lab.

"I used to count colonies all day, and do the washing up. I got very good at it and would finish my work by lunchtime. So I would go up and down the corridor asking people if I could help them. After they discovered I was good at maths, they suggested I help the new guy in food research. He was working on modelling lipid membranes, trying to find out why they leak in things like soggy tomatoes.

"He had this new machine called a nuclear magnetic resonance (NMR) spectrometer that analysed samples providing information at the level of the atom. We started getting curious about the basics and wanted to know how the lipids packed together in a membrane. At the time there was an argument among scientists in the field on how small you could make an enclosed membrane model, a tiny lipid bubble known as a vesicle. We just did some simple geometry, made very small vesicles and determined you can't make them smaller than a 10-nanometer radius. It was my first contribution



to a scientific paper: we had identified a physical limitation to the packing of lipid membranes. It was so exciting."

Today, work in Professor Separovic's research group relates to the growing problem of antibiotic resistance.

"One way of attacking the bacteria is to attack the membrane of the bacteria. Our group knows about membranes and how they interact with various defence peptides. This gives us clues to the physical chemistry of microbes and could lead to new antibiotics."

Professor Separovic completed a TAFE Biology Certificate as a young student, but turned her attention to mathematics and physics at Macquarie University.

"I decided I wanted to study maths and physics, however you couldn't get a Bachelor of Science degree then without studying chemistry. But maths and physics were all I was interested in, so I ended up with a Bachelor of Arts double major in maths and physics – both of which could be taken in an Arts degree then. At this

stage I was a single parent, still working at CSIRO and thought I was more likely to get a job as a physicist than a mathematician (although in retrospect that's not quite true), so I embarked on a part-time PhD in Physics at UNSW, which I finally finished in 1992."

Recalling a pivotal moment in her research, Professor Separovic says: "I came to love the predictive power of a theory. I remember the first time I did this. It made me feel both powerful and awestruck at the same time. I was working on an ancient computer, I think it was a PDP 11; it did the work of a modern pocket calculator but took up a whole room. I put together all the physical interactions that were responsible for my experimental signals, then I crunched the numbers. I got a set of messy looking lines and it looked exactly like the lines of my experimental data. I was so delighted the theory and experiment matched and that you can calculate how things happen at the level of the atom. It was wonderful."

So how does a number loving physicist end

up in a chemistry faculty?

"I saw this ad for a 'solid-state NMR spectroscopy person' in the University of Melbourne Chemistry department. They had people working on polymers and other materials but needed a physical chemist with solid-state NMR experience to work out structures. And that was me!"

After an impressive number of grants received, over 130 papers published and successful organisation of over 25 conferences, in 2005 she became the first woman appointed to a professorship in chemistry in Victoria. Then in 2012, for her work in biophysical chemistry, she was the first woman elected to the Australian Academy of Science in the field of chemistry.

She still goes up and down the corridor asking people if she can help but this time its in her capacity as head of department to ensure others are able to deliver their best scientific research and teaching.

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### Crush hour:

#### Explosive urbanization and its challenges for India

Housing and real estate researcher Associate Professor Piyush Tiwari discusses urbanization in India and its implications for policy makers. He also explains why Indian slums don't always deserve the bad rap they get in popular culture. Presented by Lynne Haultain.

Dr Piyush Tiwari is an Associate Professor in Property in the Faculty of Architecture Building and Planning at the University of Melbourne. He is also Associate Dean at the Royal Institute of Chartered Surveyors School of the Built Environment in Delhi.

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### Lines of sight:

#### Observing planets and galaxies with the help of gravity

Cosmologist Dr Bart Pindor explains gravitational lensing, in which the curvature of space by gravity allows us to view distant galaxies and other astral bodies. Presented by Dr Shane Huntington.

Dr Bart Pindor is a research scientist in the astrophysics group in the School of Physics at the University of Melbourne.

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Virologist Associate Professor Barbara Coulson explains how a common childhood infection could hasten the onset of type 1 diabetes. Presented by Dr Dyani Lewis.

Associate Professor Barbara Coulson is Principal Research Fellow at the Peter Doherty Institute for Infection and Immunity at the University of Melbourne.

Online 16 May

### It pays to obey:

#### Complying and over-complying with financial regulations

Political economist Professor Andrew Walter talks about approaches to financial regulation in the long aftermath to the Global Financial Crisis, and what happens when banks over-comply with the new rules. Presented by Lynne Haultain.

Andrew Walter is a political economist and Professor of International Relations in the School of Social and Political Sciences at the University of Melbourne.

Online 23 May

### What's not to "Like":

#### Social media and its impact on the political process

Political scientist Professor Victoria Farrar-Myers discusses the increasing, evolving impact of social media on political processes and communications, and details research into whether social media subverts democracy and increases hyper-partisanship. Presented by Peter Clarke.

Victoria Farrar-Myers is Professor in Political Science and Distinguished Teaching Professor with the University of Texas-Arlington, and is the 2013/14 Fulbright Flinders University Distinguished Chair

Online 23 May