THE STRAITS TIMES

[I AM A SCIENTIST]

This cage could save lives one day

Unlocking potential of protein cages is one fascinating aspect of bioengineer's job

Grace Chua

Q: You were born in Jakarta to parents in the faucet distribution business; how did your upbringing influence your career choice?
My mum was the big driving force. When I was young, my mum used to take us to bookstores and plop me and my brother at the science section, and we just started reading. From there I developed an interest in science. My mum was also very interested in what I was doing; she liked science but she didn't have the chance to do it.

Q: What is biomedical engineering?
It's basically applying engineering principles to biology, to solve problems that pertain to human health and medicine.

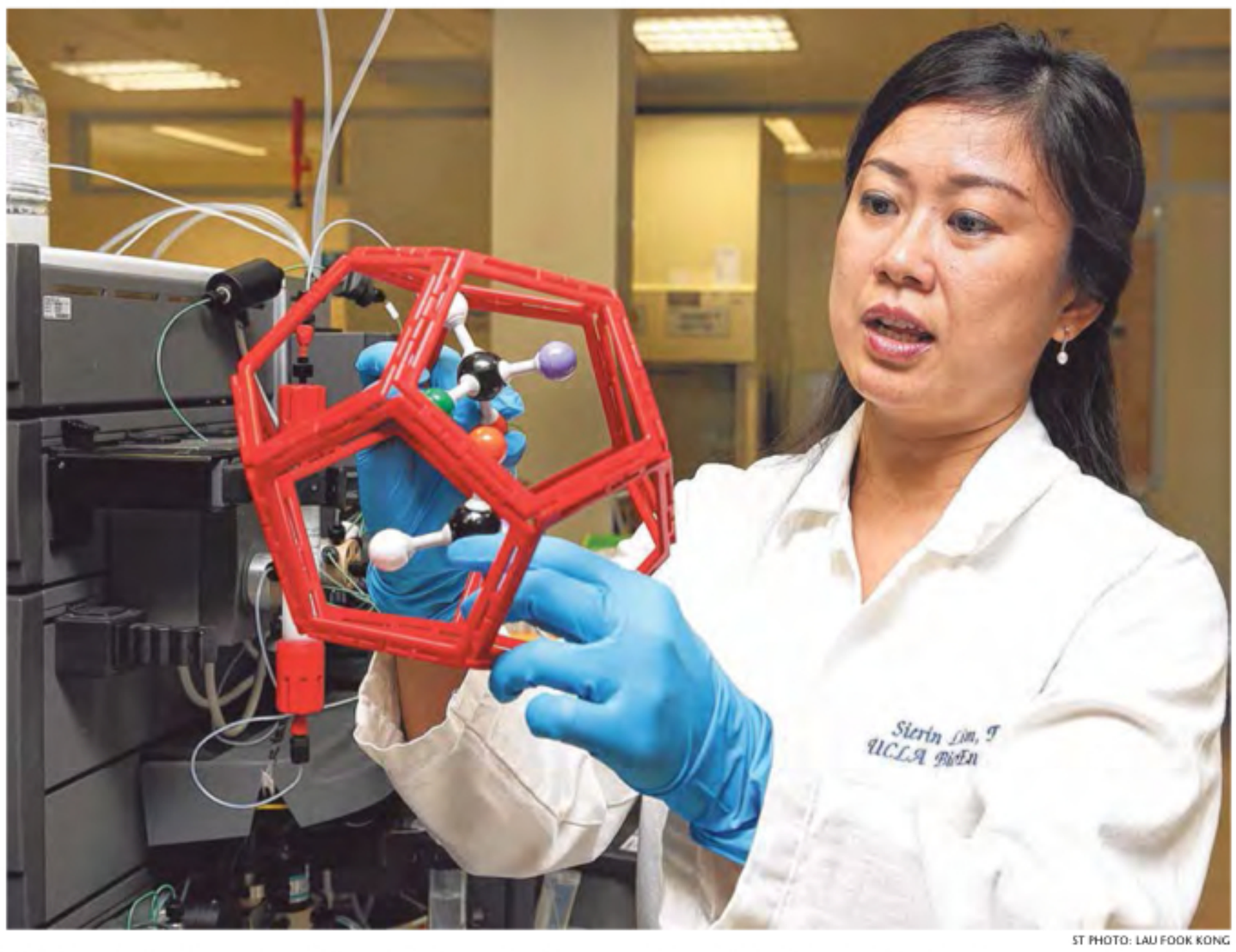
Q: How did you get interested in your field of research?
In 1997, I started my undergraduate studies at UCLA (University of California, Los Angeles). I was in a chemical engineering class that I really enjoyed, and asked if I could work with the professor, who studied enzymes and scaling up the bioreactor process.

Then in 1999, I was walking around campus and saw a poster describing the Nobel Prize-winning work of UCLA chemist Paul Boyer, John Walker and Jens Skou, who studied ATP (the "engine" that drives cells). I wrote to the Royal Swedish Academy of Sciences to ask for a copy, and never expected they would respond. But a few months later, a tube containing the poster arrived. So maybe that was a sign for me to go to graduate school!

For my PhD, also at UCLA, I switched to biomedical engineering, studying how enzymes break down and reassemble carbon sources into amino acids.

The idea was to use those enzymes to do other things eventually, such as making new molecules.

Four-and-a-half years later, the day before I filed my PhD thesis, I met Paul Boyer. I asked him what his advice was for young scientists, and he told me: "Keep looking for new problems to solve."



ST PHOTO: LAU FOOK KONG

NTU's bioengineer Sierin Lim works on folding proteins into "cages" that can smuggle drugs into the right part of the body. Protein cages can also be used to hold MRI contrast agents which help parts of the body show up better on scans, so tumours can be detected at earlier stages, for example.

Q: What is your work about?
As a post-doctoral researcher at UC Irvine (University of California, Irvine), I studied nano-scale protein "cages". These are strands of proteins folded into cage-like structures. Protein cages are found in nature. For instance, ferritin (a protein produced in the body) stores and releases iron.

When I came here, I wanted to further engineer these things – to understand the assembly mechanism of this cage so we can specifically control their disassembly. Protein cages are good for drug delivery. You can engineer them very specifically to home in on cancer cells instead of spreading drugs all over the body, and break apart when they get to their destination.

Protein cages can also be used to hold MRI contrast agents which help parts of the body show up better on scans, so you can detect tumours at earlier stages, for example.

Q: What is a typical work day like?
As a professor, I'm a scientist, teacher, writer, business manager, motivator, mentor, and PR person all rolled into one! I come to the office and read and write papers and proposals, and prepare for lectures. For every hour of lecture, I have an hour or two of preparation. I live on campus so it's too easy to never go home.

Q: How do you encourage young people to go into science?
I'm involved in the Biomedical Engineering Society (Singapore) and helped to set up the student chapter, which helps students understand what the field is and how it fits into society.

I've opened my lab to students. Mostly they are from secondary schools or junior colleges, but sometimes are even in Primary 5 or 6. For them, I leverage on the "wow" factor. That spark of interest might help them decide on science in the future.

And on Nov 7, Marie Curie's birthday, I'm organising a symposium to get women in engineering, science and technology to speak to younger students.

Q: Why women in particular?
Because we would like to encourage more future female scientists, engineers and technologists; I want to encourage more young girls to consider this as their career path. If we don't, we are losing talent and different ways of looking at problems.

Q: What keeps you going and why do you keep looking for new problems to solve?
I think there are a lot of things we don't understand in science. How do protein cages assemble? Why do they bother doing that kind of assembly? Why is that important in terms of function? From an engineering point of view, after we understand them, what do we do with that understanding?

Once I understand how these molecules come together I can engineer them in a very particular way, so they respond to pH or different cues in the body.

It's not always easy. Many times the experiments don't work; or you write grants, and the grants don't get funded. After so many of those, you hit some hard times. The ability to tell yourself to keep going, and that at some point you will get somewhere, is another skill you need to learn.

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AN AWARD-WINNING RESEARCHER

Assistant Professor Sierin Lim, 37, is with Nanyang Technological University's School of Chemical and Biomedical Engineering.

She engineers long strands of proteins into tiny "cages" that hold drug molecules in a hollow core.

These protein cages, a thousandth of the width of a human hair, can then be coaxed to deliver their deadly payload into cancer cells.

Prof Lim, who is single and lives on the university's campus, received both her Bachelor of Science in chemical engineering and PhD in biomedical engineering from University of California at Los Angeles (UCLA).

She joined NTU at the end of July 2007 after 2½ years of postdoctoral research at University of California at Irvine.

During her graduate study, she received the UCLA Biomedical Engineering Departmental Fellowship and was actively involved in the Biomedical Engineering Society UCLA student chapter, serving as president from 2003 to 2004.

In 2012, she was the Singapore recipient of the Asia Pacific Research Networking Fellowship from the International Federation for Medical and Biological Engineering.

And last year, the Indonesian citizen and Singapore permanent resident received the L'Oreal Singapore For Women In Science National Fellowship, a $30,000 award that recognises the contributions of talented women to science.

Beautiful Science

PHOTO: WANG BO/BONN UNIVERSITY

Behold the Golden coffin, an insect trapped for eternity in amber dug out near the north-east Chinese city of Fushun.

Apart from India, Fushun is the only significant site in Asia where amber – the fossilised resin from ancient forests – has been found.

Chinese palaeontologist Wang Bo, who is with Germany's Bonn University, is systematically cataloguing the preserved insects, and an analysis is under way with other fossil experts from Europe and the United States.

So far, the researchers have been able to identify arachnids and insects from more than 80 families – a snapshot of the tiny animals that populated East Asia 53 million years ago.

IN BRIEF

Something to look forward to

Researchers have developed a new display technology that automatically corrects for vision defects – no glasses or contact lenses required.

The technique could lead to dashboard-mounted GPS displays that long-sighted drivers can consult without putting on their glasses, or electronic readers that eliminate the need for reading glasses, among other applications, said the Massachusetts Institute of Technology.

The work was done by researchers at the MIT Media Laboratory and the University of California at Berkeley.

"The first spectacles were invented in the 13th century," said Dr Gordon Wetzstein, a research scientist at the Media Lab and one of the display's creators.

"Today, of course, we have contact lenses and surgery, but it's all invasive in the sense that you either have to put something in your eye, wear something on your head, or undergo surgery. We have a different solution that basically puts the glasses on the display, rather than on your head. It will not be able to help you see the rest of the world more sharply, but today we spend a huge portion of our time interacting with the digital world."

The vision-correcting display projects slightly different images to different parts of the viewer's pupil.

A vision defect is a mismatch between the eye's focal distance – the range at which it can actually bring objects into focus – and the distance of the object it's trying to focus on. So the new display simulates an image at the correct focal distance – somewhere between the display and the viewer's eye.

Toxic depth of oil spill

Bacteria in the Gulf of Mexico have consumed many of the toxic components of the oil released during the Deepwater Horizon spill four years ago, but not the most toxic contaminants.

A Florida State University researcher found that a species of bacteria called Colwellia likely consumed gaseous hydrocarbons and perhaps benzene, toluene, ethylbenzene and xylene compounds that were released as part of the oil spill.

But it did not consume the most toxic parts of the spill in the water column plume or in the oil that settled on the seafloor. The most poisonous contaminants are called polycyclic aromatic hydrocarbons, a group of organic compounds found in crude oil which can cause long-term health problems such as cancer.

The April 2010 disaster which killed 11 people on the rig and spilled more than four million barrels of oil into the Gulf of Mexico is the worst in US history.

Some of that oil has never been accounted for, and could continue to affect marine life for years.

Organs on tap with 3-D printing

Technology could one day make actual kidneys, livers, hearts and other organs for patients who desperately need them, and scientists are reporting new understanding about the dynamics of 3-D bioprinting that takes them a step closer to realising their goal of making working tissues and organs on demand.

Producing tissues and organs, or biofabricating, has the potential to address the shortage of organ donations. And biofabricated ones could even some day be made with a patient's own cells, lowering the risk of rejection, says the American Chemical Society, reporting on new research.

Inkjet printing has emerged as a front runner in biofabrication, it said. It has been used to print live cells, from hamster ovary cells to human fibroblasts which form connective tissue and are a common type of cell in the body.

Researchers tested "bioinks" with different concentrations of mouse fibroblasts, plus a hydrogel made out of sodium alginate, which comes from seaweed. They discovered, among other findings, that adding more cells in the material reduces both the droplet size and the rate at which it gets dispensed.

The new results will help scientists move forward with this promising technology, said the society.

Compiled by Chang Ai-Lien

Birds' survival

"Birds evolved through a unique phase of sustained miniaturisation in dinosaurs. Being smaller and lighter in the land of giants, with rapidly evolving anatomical adaptations, provided these bird ancestors with new ecological opportunities, such as the ability to climb trees, glide and fly. Ultimately, this evolutionary flexibility helped birds survive the deadly meteorite impact which killed off all their dinosaurian cousins."

ASSOCIATE PROFESSOR MICHAEL LEE, School of Earth and Environmental Sciences, University of Adelaide, who is also with the South Australian Museum.

A new study led by him has revealed how massive, meat-eating, ground-dwelling dinosaurs evolved into agile flying birds by shrinking and evolving for more than 50 million years.