

# Biomimicry: learning from evolution in nature

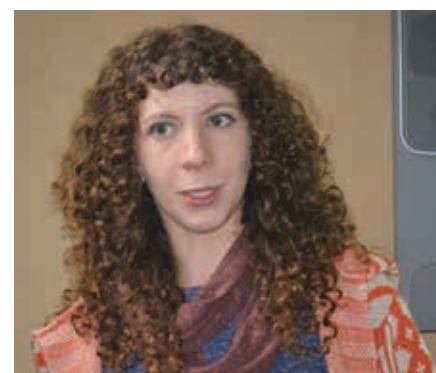
Following the SAICHe IChemE AGM on April 10, 2018, the Gauteng member group held its annual dinner at the Wanderers Club in Johannesburg. *MechChem Africa* attends and highlights the presentation by biomimicry practitioner and chemical engineer, Yuma Langenbach.

“Humans are clever, but without intending to, we have created massive sustainability problems for future generations. Fortunately, solutions to these global challenges are all around us. Biomimicry is an approach to innovation that seeks sustainable solutions to human challenges by emulating nature’s time-tested pattern,” begins Langenbach.

She says that the classic process engineering development cycle involves putting materials through a process to produce a product. It’s a linear model, with some additional complications, such as optimising the use of energy and the activation conditions for specialised processes. “But almost all of our engineering process endeavours are inefficient and produce undesirable waste along with the intended product,” she says.

Combined global production is currently too much for the environment to sustain. Industrial processes are intensive with respect to materials, energy and environmental pollutants, all of which puts our planet at risk. “Clearly, we need more dramatic and innovative solutions to ensure a safer environment,” Langenbach says.

Returning to her biomimicry theme, she says that humans have been living on Earth for around 200 000 years, but the first living cells date back some 3.8-billion years and, over this time, these have developed the most sustainable and efficient ways of surviving.



“What better model, therefore, than the natural world to learn about efficient and long lasting solutions?” she asks.

She cites various biomimicry opportunities that have already emerged from studies of the bio diverse natural world:

- Wetland eco-systems are teaching us about filtration and water treatment.
- The structures and energy flows in tropical forests are inspiring cities of the future.
- Leaves and plants capture energy every day, inspiring more efficient renewable energy solutions.
- Termite mounds and how they regulate temperature are being mimicked to improve the energy efficiency of buildings.
- The way the coral reefs are built from carbon dioxide and calcium is being imitated to improve cement-production processes by capturing the CO<sub>2</sub> emissions and reusing it to produce calcium carbonate.
- Mushroom fungi have been found to break down hydrocarbons, which makes them ideal for oil spill remediation.

Another innovative example Langenbach presented was a material developed to mimic the skin of a shark. “Shark skin is made up of countless overlapping scales called dermal denticles with grooves running down their length to align with the water flow. These grooves disrupt the formation of turbulence, while the rough shape also discourages bacterial biofilm growth, which cannot form on this surface.

“This has been replicated for use in swimsuits and for the bottom of boats – and the technique is now being used in to create sur-

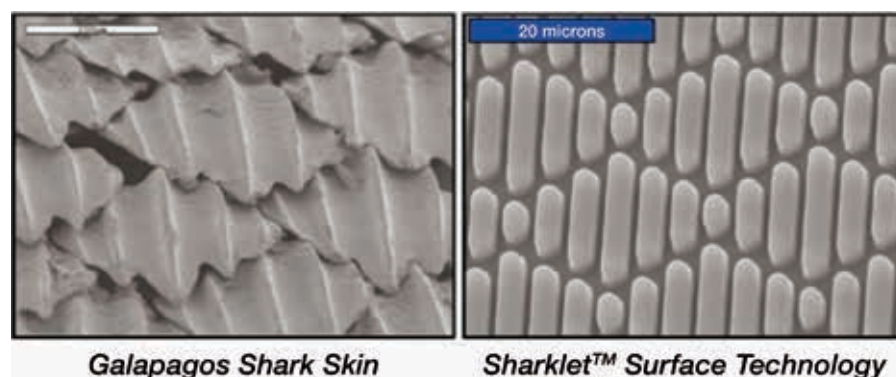
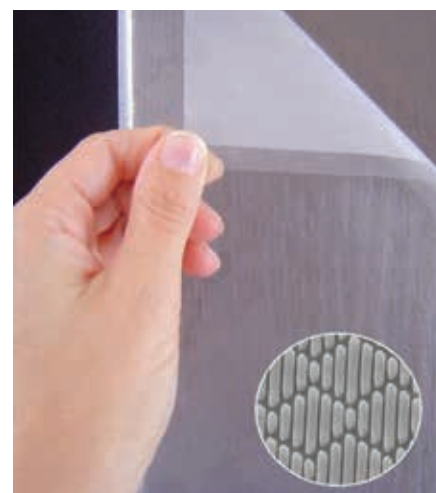
faces in hospitals that resist bacteria,” she says.

She goes on to describe the Lily impeller developed by PAX Scientific, which replicates nature’s spiral flow pattern to significantly improve the performance and energy usage when mixing water in storage tanks. This Lily-inspired impeller is only 21 cm long, yet it is capable of circulating millions of gallons of water with the same energy footprint as three 100 W light bulbs. “Nature never moves in a straight line. It always prefers a spiral path, which turns out to be the path of least resistance/fluid friction,” Langenbach says.

“All these naturally occurring processes occur at ambient temperatures and pressures,” she notes, adding: “The number one thing we can learn from nature is that life involves changing conditions. Sunflowers track the sun during the day and plants all tend to seek ways of stabilising themselves when the climate changes. And the way organisms on forest floors pass on their waste for use by other organisms can teach us a lot about how to create and manage a more circular economy,” she argues.

“We humans are a social species,” she says. “We need to work together to innovate solutions for our current survival, for that of the environment and for future generations.

“Biomimicry innovations are the future. Bio-architecture and -structures; biomimicry in textile and chemical manufacturing; new power and transportation systems; and a host of waste management solutions are just a few areas that are enthusiastically adopting biomimicry principles,” she concludes. □



The proprietary Sharklet™ surface technology has replicated the advantages of sharkskin for use in swimsuits, the bottom of boats and to create surfaces in hospitals that resist bacterial growth.

# National AGM and president’s report

The SAICHe IChemE annual general meeting was held on 10 April 2018 at the Wanderers in Illovo, Gauteng, starting with the association’s president, Craig Sheridan, welcoming attendees, going through the minutes and the agenda, before delivering his Annual Report for the 2017 year.

SAICHe IChemE is small voluntary association of professionals and as such cannot afford a full-time executive with support staff to manage and run the institution as some of the larger professional associations do. It relies on volunteers and voluntary committees to handle its activities. “What we are pleased to note is that SAICHe IChemE has not had any radical or negative changes. We have remained a stable entity, offering our niche suite of services to our profession, which at a personal level culminates in getting chartered as a full member,” reported Sheridan.

“Bronwynne Ferreira, our CPD expert, is leaving and we offer our gratitude for her services over the years in getting courses accredited. Fortunately, she is still an active member. In her place, we welcome Albert de Bondt and Hamied Mazema who are actively developing new policies towards improving the CPD service,” he continued.

The *South African Journal of Chemical Engineers* continues to attract and publish high quality papers through its peer review process and publication on the ScienceDirect platform. This is a fully open-access journal, which means that anyone, including all SAICHe IChemE members, can download papers for free. “We wish to thank Professor Milan Carsky for his on-going hard work as Editor-in-Chief, and we welcome Professor Thoko Majozi in his role as deputy editor-in-chief.”

Sheridan said that he was pleased to announce that planning has begun for SACEC 2020. The conference will be staged as an international conference, to be held at the University of the Witwatersrand, Johannesburg.

“Elly Obwaka continues to assist with the membership committee. As part of the services we offer, corporate members still get free CPS accreditation. Michelle Low continues to serve as the head of the communications portfolio. She maintains the Facebook page, and does an excellent job of herding and rallying everyone to provide photos of events, and to keep in touch with *MechChem Africa*,” he continued.

“The branches remain active and represent SAICHe IChemE at a regional level. We wish to offer a special word of thanks to the branches, since they are where most Institute

activity happens,” Sheridan says.

“SAICHe IChemE remains financially sound as a going concern and continues to be a vibrant institution in fulfilling its mission. The membership remained steady and we are continuously building to grow the institution.

“To all our members, many thanks for your support and I would like to encourage all to get more involved in SAICHe IChemE activities. Above all, SAICHe IChemE cares for your professional development and security,” Sheridan concluded. □



Japie Scholtz is awarded Honorary Fellow membership of SAICHe IChemE and thanked for his contribution to chemical engineering and the Institution by its president, Craig Sheridan.



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## SAICHe IChemE Gauteng Branch AGM and dinner 2018

For the second year in a row, the Gauteng branch AGM 2018 was held directly after the national AGM at the Wanderers Club with some members electing to attend both events.

Attendance of the branch AGM was good and we elected Kasturie Premall as a new member while Zita Harber and Jeffrey Pilusa have stepped down at the end of their terms. The chair, Carl Sandrock, gave a summary of the previous year’s events, noting that attendance had been improving as the schedule of the events became more regular. The speaker, Yuma Langenbach, gave a very interesting talk on biomimicry, relating natural artefacts to designed

products. There was much discussion after the talk about a wide-ranging number of topics, including questions by members about the current regulatory environment for engineers.

The 2018/2019 Gauteng branch committee members are:

**Chair:** Carl Sandrock  
**Vice Chair:** Danielle Bearman  
**Secretary:** Doctor Tshikotshi  
**Treasurer:** Linda Jewell  
**Public Relations:** Qasim Fakir  
**Catering:** John Bewsey  
**IChemE Contact:** Nirvana Ramparsad  
**Unassigned portfolio:** Shaan Oosthuizen, Michael Daramola, Celo Mause