A Portuguese academic believes nature still has a lot to teach the textile industry and suggests some potential new areas of investigation for companies interested in biomimetics.

New possibilities in biomimetics



Professor Mário Duarte de Araújo of the textile engineering department at the University of Minho in northern Portugal won the Autex Lifetime Achievement Award in June 2010, recognition from his textile academic peers that he is a person worth listening to and worth taking seriously.

He is the author of 11 books on textile development and has been involved in several projects to promote stronger links between academics and businesses in the field. When he addressed the Autex conference, in Vilnius, Lithuania, this year he decided to be more imaginative than pragmatic and spoke about the future of biomimetics. In the context of product development in an era of rapid change, he wanted to point out to product designers that "we can manipulate and shape nature almost to our heart's desire". But he sees his role as suggesting ideas. It's for the product development professionals to do the manipulating and shaping.

"Products are made to satisfy consumers," he says. "What do they buy? Why do they prefer product A to product B? What is it designers are trying to satisfy?" He acknowledges that these are difficult questions to answer, given the disparity among the tastes of different consumers. And while he accepts that many companies in the sports apparel industry have to live by the 'innovate or die' mantra, he feels that, to fulfil this, there are still examples in nature that product developers can follow, even

Nanoparticles give the surface of these textile fibres a structure with an effect similar to that of the lotus plant's leaves: water and dirt just roll off.

BASF

though biomimetics is well established as an idea and plenty of applications have already come to market.

The first example he mentions of existing biomimetics applications is the Menelaus Blue Morpho butterfly, a native of Central and South America, whose colour appears to change depending on the angle from which you look. The insect's metallic blue colour is not the result of pigmentation, the professor points out, but of iridescence–the scales on the butterfly's wings are the same distance apart as the wavelength of light, leading to the attractive colour effects it can produce.

He's also keen on pine cones. He believes it to have been well worthwhile for enterprising textile manufacturers to produce fabrics with flaps that open when it's hot to improve the wearer's comfort. Cones remain closed while growing on the pine tree, but after they fall to the ground they gradually open, allowing their seeds to be released. They can do this because the cone's scales have two layers of stiff fibres that run in different directions.

And he finds it fascinating that spiders appear to come out of water completely dry. The bristles and hairs on their bodies are laid out in such a way as to trap air, which allows them to keep water out. Sharkskins have also been imitated in textiles and Mário Araújo doesn't mind that some of the swimsuits that came out of analysis into water-resistance have since been banned from competition. "That's a separate question," he says. "FINA banning swimsuits is not the scientific aspect. The idea seemed to work and that's what interests me, not that the governing body of the sport then decided to ban the innovation."

Arguably, the most famous example of all is the lotus effect, which has led to the development of self-cleaning fabrics, but these are all ideas that have already attracted the attention of technicians and design teams.

Swim through sand

Among the biomimetic possibilities that, so far, have not attracted so much attention is the sandfish lizard. Found in the deserts of North Africa and Arabia, it seems to swim through the sand, the Portuguese academic says. "The skin has scales, the scales have ridges and the ridges have spikes one nanometre long," he explains. "These spikes never wear out, and the theory is that they (the spikes) generate a static charge on contact with the sand, which means the sand never clings to the body." He foresees applications in producing super-soft fabrics, but also, in the context of sport, in making a football shirt that is almost impossible for an opponent to grab hold of.



The Blue Morpho butterfly. Its wings appear to change colour depending on the angle from which you look.

Bilboq/Wikipedia

Snakes shedding their skins and insects shedding their exoskeletons interest him too. He thinks there could be much to gain from finding a way of including the chitin molecules found in insects' exoskeletons into fabric as a way of providing a scaffold for building in a range of performance attributes from the bottom up.

Other examples include polar bear hair and spider silk, although textile companies have been working on ideas to imitate these for some time. Of the former, he simply says that the hollow hairs on a polar bear's body offer such good insulation that companies should keep trying to imitate them. Spider silk, he says, is probably the Holy Grail in biomimetics. "Lots have tried," he observes, "and, although there have been no real results yet, we have to carry on. When you combine biotechnology, nanotechnology and information technology, you create lots of options."



Charged up. The sandfish lizard creates enough of a static charge to make it impossible for sand to stick to its body.

Wilfried Berns/Tiermotive.de/Wikipedia