

## Animal Science: Enabling Preventive Dentistry

Over the course of millions of years of evolution, animals have developed some remarkable traits and survival systems. Think of it as the most thorough research and development program. As a result, certain characteristics are so perfect that nothing man develops is any more effective meaning. In fact the best we can do is mimic natural science in our efforts to develop effective medical technology. Here are three examples from the animal kingdom that have contributed to modern medical science and one to Preventive Dentistry.

### #1 Sharks<sup>1</sup>

Sharks reached their evolutionary peak approximately 370 million years ago and, for the most part, have changed very little since then. This is a remarkable success story – in fact, sharks have survived every mass extinction event that we are aware of, making them one of the planet’s most resilient inhabitants.

One of the secrets to the shark’s success story is its skin. Comprised of layers and layers of small tooth-like scales (called denticles), sharkskin is very easy to keep clean. Nothing can stay attached for long – which is why you never see sharks covered with algae or barnacles like other large marine animals. Troublesome bacteria also have a hard time finding a foothold on sharkskin, making the sharks themselves very resistant to bacterial infection.

Understanding this, scientists have started to develop sharkskin-like materials that can be used to help repel germs. One company, called Sharklet, is currently testing these materials on hospital surfaces to aid with decontamination. They have also started to devise a catheter using the same sharkskin design, to help prevent urinary tract infections.

### #2 Tardigrades<sup>2</sup>

More commonly known as ‘water bears’, these micro-animals are renowned for being some of Earth’s greatest survivalists. A single tardigrade can subsist in temperatures near absolute zero or above 150°C, withstand 1,000 times more radiation than any other animal on the planet, go more than a decade without water and even stay alive in the vacuum of space. It does this through an ingenious survival mechanism that replaces all of the water in its tiny body with sugar. In this ‘candied’ state, it can survive in extreme conditions for years. All it needs to be ‘resurrected’ is a little bit of water.

This process would never work for humans – replacing all of the water in our bodies with sugar would simply kill us – but scientists have discovered another important use for the tardigrade’s survival system: preserving vaccines. Many vaccines cannot survive for long in adverse conditions – most commonly found in parts of the world where the vaccines are most needed. To help with transporting these essential medicines, scientists have adapted the tardigrade’s sugar preservation mechanism for use with vaccines, allowing them to be kept for far longer in very hot environments.

### #3 Spiny-headed worms<sup>3</sup>

This parasitic worm is just as unpleasant as it sounds. Using the spine on the top of its head, the worm attaches to its host's intestinal wall – from which it is almost impossible to remove. As nasty as that sounds, the idea has actually inspired a new surgical technique for skin grafts. The results are incredibly promising, with the worm-inspired adhesive displaying almost three times as much strength as surgical staples.

Mimicking the spiny-headed worm's cactus-shaped head, researchers have developed a needle mechanism that swells when exposed to water, making a very strong tissue-level adherence. This method causes far less damage to the soft tissue and is easily reversible and is being considered for use with patients who need skin grafts because of burns, infections or cancer.

### #4 Jellyfish<sup>4</sup>

We're probably all aware that there are some species of jellyfish that glow in the dark. This bioluminescence is caused by a photoprotein and is generally used by the jellyfish as a signalling system to other animals. However, scientists have been able to use a similar photoprotein in humans to help track the spread of cancer cells, or HIV infections. By introducing the gene that creates the photoprotein into a patient, cells can be made to glow – making them far easier to see and analyse.

Photoproteins lend themselves ideally to use in preventive dentistry too. UK-dental biotech company, CALCIVIS, has developed a unique imaging system that applies a calcium ion specific photoprotein to the surface of a patient's tooth, where it can then be used to identify active demineralisation. The "demin map" presented by the CALCIVIS system helps engage patients to commit to preventive approaches early, when caries and erosive conditions are easily reversible.

While humans have an almost infinite capacity for innovation, there are simply some things that the natural world has already perfected. By mimicking these amazing characteristics, we can better our understanding of human health and develop effective solutions.

To find out more, contact the expert CALCIVIS team today at [www.calcivis.com](http://www.calcivis.com)

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<sup>1</sup> Live Science: *Shark Skin-Like Surfaces May Ward Off Hospital Superbugs*. Published online: 16/09/14. Link: <http://www.livescience.com/47870-shark-skin-hospital-superbugs.html> [accessed 23/03/17]

<sup>2</sup> Live Science: *Key to Tardigrades' 'superpowers' identified in their DNA*. Published online: 17/03/17. Link: <http://www.livescience.com/58309-how-tardigrades-survive-drying.html> [accessed 23/03/17]

<sup>3</sup> Live Science: *Parasitic worm inspires surgical technique*. Published online: 16/04/13. Link: <http://www.livescience.com/28747-worm-inspires-surgical-tech.html> [accessed 23/03/17]

<sup>4</sup> Live Science: *How a jellyfish protein transformed science*. Published online: 27/10/11. Link: <http://www.livescience.com/16752-gfp-protein-fluorescent-nih-nigms.html> [accessed 23/03/17]