

# Biomimicry in Engineering



## Student Worksheet: What is Biomimicry?

People have always been inspired by nature -- and engineers are no exception! Throughout history, structures, systems, and materials developed by engineers have had roots in natural structures, systems, and materials. For example, the echolocation used by bats in the dark have helped lead to improvements in cane technology for blind people.

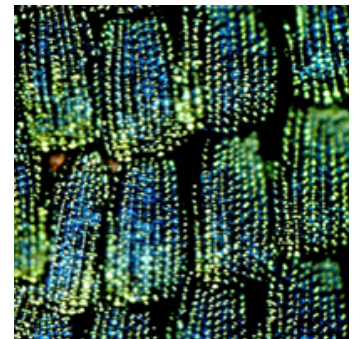
Others have looked to the methods beetles use to draw water from fog, or how the structure of a lotus leaf can help keep moisture away from the surface -- this has led to changing the surface of fabrics at the nanoscale so they too repel water. And, gecko tape mimics the feet of a gecko lizard by including nanoscopic hairs. Other engineers have looked to the way tower building termites have structures designed to maintain a constant temperature in climates with wide temperature swings. The Eastgate building in Harare, Zimbabwe has passive, self-cooling systems modeled on termite mounds. The building, a mixture of offices, shops and car parking, uses an average of 90 per cent less energy than a comparable structure saving more than \$3.5 million since opening in the 1990s.



### ◆ How butterflies' wings could cut bank fraud

University of Cambridge scientists and engineers recently discovered a way of mimicking the stunningly bright and beautiful colours found on the wings of tropical butterflies. The findings could have important applications in the security printing industry, helping to make bank notes and credit cards harder to forge. Mimicking nature's most colourful, eye-catching surfaces has proved elusive. This is partly because rather than relying on

pigments, these colours are produced by light bouncing off microscopic structures on the insects' wings. Mathias Kolle, working with Professor Ullrich Steiner and Professor Jeremy Baumberg of the University of Cambridge, studied the Indonesian Peacock or Swallowtail butterfly (*Papilio blumei*) (Image at right is courtesy: University of Cambridge), whose wing scales are composed of intricate, microscopic structures that resemble the inside of an egg carton. Because of their shape and the fact that they are made up of alternate layers of cuticle and air, these structures produce intense colours. Using a combination of nanofabrication procedures - including self-assembly and atomic layer deposition - Kolle and his colleagues made structurally identical copies of the butterfly scales, and these copies produced the same vivid colours as the butterflies' wings. As well as helping scientists gain a deeper understanding of the physics behind these butterflies' colours, being able to mimic them has promising applications in security printing.



### ◆ China Winter Olympics

The National Aquatic Center in Beijing, China structure stands on enormous twisted beams around the exterior similar to a nest. The designing team studied some countless natural nests for understanding the weaving pattern of the threads. Some hundreds of models were created for the design.

