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Biomimicry a "Natural Lesson" in STEAM

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Abstract
The introduction of biomimicry as a theme in the classroom has some significant advantages when developing a STEAM curriculum. This growing field has many natural overlaps between the different disciplines within STEAM. There are many fascinating stories surrounding biomimicry connecting nature to simple solutions for many of our most difficult problems, especially related to the sustainability of our planet. Biomimicry cannot but help capture the imagination of our students.

Author/Artist Bio
Steve Pauls holds a joint position between Fresno Pacific University and the AIMS Center for Math and Science. Over the years he has taught a wide variety of courses in science and mathematics both in the traditional Undergraduate Program and the STEM and Mathematics Educational Graduate Program at FPU. For the AIMS Center Steve is a senior science researcher and is concentrating on the cognitive processes of learning focused specifically on visuospatial learning in K-12 education. Steve continue to research new ways of integrating cross-disciplinary topics and pedological methods into the classroom. He also has an interest in woodworking, ceramics, cartooning, and integrating microcircuit/sensor technology into the STEAM curriculum. Dr. Pauls received his Bachelors of Science degrees in Chemistry and Physics from Bethel College in Kansas and a PhD in Physical Chemistry from Kansas University.

Keywords
STEAM, Education, Biomimicry

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As a science professor and "closet artist" I have made a living in higher education integrating a variety of topics across the different STEAM disciplines. The goal is always to look for those relevant, real-world applications that will capture the student's attention and draw them deeper into the concepts we are discussing together. Lately I have been intrigued by the idea of applying biomimicry as an overarching theme to integrate STEAM concepts within all levels of education. Biomimicry can generally be described as a close examination of nature's time-tested designs and applying those strategies to help engineer innovation, efficient, and sustainable solutions. There has been an increased interest in the last few years both at the macroscale as well as the microscale in applying biomimicry in physics, chemistry, biology, engineering, and design.

Growing up on a farm I spent a lot of time as a child "playing" within nature. The patterns and symmetry of plants, animals, and the seasons were all part of my conscious and unconscious learning. As most children, I was curious about my environment and in that regard nature was often an excellent teacher. How can a red-winged blackbird build a reed covered nest lashed to a cattail stalk which can withstand gale force winds? What allows a water strider to stay suspended on the surface of a pond? How can a beaver use raw cut branches to dam up a stream? The symmetry and patterns found in nature's bounty of plants and animals also provided me with numerous opportunities to delve into the integral and direct connections between art and mathematics as well as science.

In today's technological based world which currently depends on diminishing fossil fuels and energy inefficiency, it has become increasingly clear that nature has more to offer us than just beauty. With millions of years of trial and error, nature has developed a fantastic array of simple

solutions to some of the world's most complex problems. Beautiful, elegant solutions which are often right in front of us if only we are paying attention.

I am not alone in my educational interest in biomimicry as a field of study. K-12 schools often struggle with a clear definition of STEAM and how to effectively integrate these overlapping disciplines into their school curriculum. Currently there is a growing community of educators who are beginning to see biomimicry as an opportunity to seamlessly integrate STEAM into the classroom environment.

Biomimicry has a unique advantage particularly suited for interdisciplinary aspect of STEAM learning. The wonders of the natural world cannot but help capture the imagination of all children, regardless of age, interest, or cultural background. Whether it is the seed pod that inspired Velcro or the gecko's sticky feet that inspired a new super adhesive, biomimicry has a rich story to tell within its naturally overlapping disciplines which will actively engage both girls and boys alike. Biomimicry can go a long way to inspire the next-generation of scientists, artists, engineers, architects, and out-of-the-box thinkers to become engaged in solving some of the world's most difficult problems and begin moving us toward a more sustainable future.