Categories of Inspiration for Bio-inspired Design

When looking to nature for inspiration, there is an overwhelming amount of biological information that can be considered. A single biological system can result in multiple engineering solutions. The categories of inspiration in Table 1 provide a framework to guide the designer past the noticeable features of biological systems, and to navigate the biological information to promote learning. The categories fall into two groups: 1) Physical or tangible aspects of biological systems (orange rows), and 2) non-physical or intangible aspects of biological systems (blue rows). These categories of inspiration can be understood and applied independently. Elegant solutions inspired by nature, however, occur when the connection between the physical and non-physical aspects within the biological system is understood and applied. For example, understanding the connection between form and function, or what is the function of a specific structure in an organism.

Table 1: Inspiration Category Definitions and Examples

Category	Definition	Examples
Form	Visual features including shape, geometry, and structure; external morphology	Mercedes-Benz bionic car inspired by fish body shape, High speed train inspired by kingfisher beak
Material	Attributes or substances that relate to material properties	PureBond Adhesive
Surface	Attributes that relate to topological properties; surface morphology	Sharklet Technologies Anti-bacterial surfaces, Gecko inspired dry adhesive
Architecture	Internal features including, geometry that support the form; internal morphology; Interconnections among sub-systems	Woodpecker inspired shock absorption, Pigment free color
Function	The actions of the system or what the biological system does; physiology	Termite mound inspired self heating and cooling buildings, IR detection inspired by fire beetles
Process	Series of steps that are carried out; behavior	Photosynthesis based solar cells, Locomotion for robotics
System	High level principle, strategy, or pattern; When multiple sub-categories are present	Wind Farm design inspired by schooling fish

References:

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