



## Short Communication

# Brief review on significant therapeutic approaches of biomimetics: Next gen technology

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### ABSTRACT

Biomimetics is the study of natural phenomena to study various principles of their respective underlying mechanisms for their further integration in to such a modified mechanized way based on computerized systems and artificial intelligence science. Biomimetics has chosen to be used for betterment of human mankind by making various convenient products based on natural phenomenon of plants, animals, birds and insects. Hence, biomimetics will be emerging next generation the most lucrative technology to develop various products in the fields of chemistry, medicine and material sciences which will have further excellent approaches when used in the combination of regenerative medicine and tissue engineering medicine and biomedical engineering to treat various diseases, fatal anomalies, congenital disorders and physical disabilities.

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## 1. Introduction

The term “biomimetics” originated from the Greek words “bios” (life) and “mimesis” (to imitate). Biomimetics is very well known for ancient times to hunt the ideas and inspirations from nature and surrounding environmental natural phenomena and various creatures like birds, animals, plants and insects for further transforming them in to most preferable and most promising practical and functional applications for the betterment of human mankind.<sup>1</sup>

Regenerative medicine and tissue engineering are particularly most promising fields which require the use of various studied principles and applications of biomimetics especially in biomedical engineering.<sup>2</sup> Hence, next-generation biomimetics is used with newly advanced nanotechnology based clinical and medical solutions to understand the structural and functional properties of various biological components like proteins, amino acids and phospholipids to develop various bionanomaterials like protein functionalized nanoparticles, peptide-functionalized gold nanoparticles, and carbohydrate-functionalized

nanoparticles are areas of nanotechnology that are finding biomimetic applications.<sup>3</sup>

First time “flying machine” was invented by Leonardo da Vinci’s (1452–1519) based on the most fundamental example of bioinspiration to design “flying machine” and “turtleship,” was built a warship model to fight Japanese raiders during invasions.<sup>4</sup> The well-known ,the Wright brothers (1867–1948) inspired to plot the note of the wings of eagles and made a powered airplane which further succeeded in human flight for the first time in 1903.<sup>5,6</sup> Biomimetic technology has also been incorporated in many robotics innovations to rise novel field of biomimetic robotics by studying the mechanisms of cockroach legs to make robotic legs and feet and apply the mechanisms of bones and joints of a snake to form the arms of robots.<sup>7,8</sup>

So, integration of biomimetics in biomedical engineering was done to develop more advanced medical or clinical technologies in many ways like painless syringe microsilon needles developed by Kansai University (Osaka, Japan) to improve surgical operations for minimize nerve irritations. Further these were more modified to make these surgical needles more safer by using biodegradable polymer and polylactic acid which

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significant contributions to advancement of biomimetics and biomedical engineering.<sup>9,10</sup>

## 2. Medical approaches of biomimetics

**Antireflective coatings** were developed by taking inspiration to study the phenomenon of moth's eyes called "Areflexia" which reflect all wavelengths of light beyond the visible light spectrum to block them. The refraction of the light rays entering the eyes is increased, significantly decreasing reflection which allows the moth to avoid predators and to see prey in the darkness. Hence, this natural phenomenon is used for various military operations and to develop the solar cell light-emitting diodes.<sup>11</sup>

**High-strength carbon nanotubes (CNTs)** were synthesized by taking inspirations from "Mussels" which do not detach easily from rocks even when hit by powerful waves due to having high adhesive strength called byssi whose adsorptive power of byssi is greater than any adhesive found in nature. The structure of byssi is found to be composed of the crosslinking of collagen fibers and a protein known as Mefp-1, which is more durable than any fiber. Cultured carbon nanotube (CNT) fibers and cross-linked macromolecule adhesives acting as collagen and Mefp-1 proteins were used on combinations to prepare high-strength CNTs. This led to the innovative development of high strength which were further exploited in many modern medicine approaches for more efficient stitching wounds and more successful surgeries.<sup>12,13</sup>

**More advanced P hospholipids** were also prepared by using biomimetic approach to bio-engineer self-assembling phospholipids based nanoparticles and nanostructures for site specific drug deliveries according to the protocell mimicking the structural and functions of cellular organelles. The protocell has compartmentalized microarchitectures decoded with the assembly of protein-polymer nanostructure conjugates used for encapsulation to carry out selective permeation of biomolecules, protein synthesis, and enzymatic activities.<sup>14,15</sup>

**Multifunctional fibrous scaffolds** have been prepared which have high potential for bone regeneration and made of poly d,l-lactide-co-trimethylene carbonate (PLMC) which observed for biomimicking attributes of poly d,l-lactide-co-trimethylene carbonate nanofibers showing more improved efficacies and potency as scaffold materials for tissue repair and regeneration.<sup>16</sup>

**More advanced microwells** were developed by engineering the microenvironments which mimicked the cell-to-cell interactions in lymph nodes where two types of cells dynamically communicate upon immunological signals. Hence, clinical researchers can further inspire from these observations for finding the most preferable medical solution when biomimetic microenvironments become more elaborated, more sophisticated and enigmatic

interactions happens in between cells and their adjacent microenvironment.<sup>17</sup>

## 3. Conclusions

Biomimetics or biomimicry have been used more advanced to find alternative methods to engineer biomaterials, drug delivery vehicles and clinical devices. Hence, we believe that biomimicry has potential to be better coordinated with simple imitations of nature or naturally occurring phenomenon of animals, birds, insects and plants to get more potent clinical and medical outcomes than any artificial means to further develop more safe artificial intelligence technology based products. With the time, it can be further evolved more safe and efficient technology to develop biodegradable and more compatible products through integration and combination with fields of applied chemistry, advanced biochemistry, nanotechnology, nanomedicine, biomedical engineering to carry out more discovering of new advanced biomaterials in the combination of nano/micro/submicron structures.

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## 6. Conflict of Interest

None.

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