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Advantage of these Bioinspired and Biomimetic Structures

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Abstract

In the field of biomedicine, bioinspired and biomimetic micro and nanostructures play a significant role. In this audit, the potential uses of these miniature and nanostructures that run over in our everyday existence and propelled commonly itself are introduced. In addition, the applications of bioinspired and biomimetic systems to biomedical micro and nanostructures are discussed. The job of bioinspired and biomimetic miniature and nanostructures in therapeutics, particularly in calming and wound recuperating, improvement of bioinspired clinical gadgets, tissue designing, drug conveyance, quality conveyance, pressure sensors, and bioprinting are talked about. Carbon-based nanostructures, polymer nanocomposites, hybrid scaffolds, polymer networks, and protein nanostructures are all used in biomimetic and bioinspired systems. When compared to synthetically derived micro/nanostructures, the advantages of these bioinspired and biomimetic structures stem from their high biocompatibility. These micro and nanostructures offer a promising solution to numerous unsolved issues in biomedicine by expanding our understanding and overcoming the obstacles that come with it.

Keywords: Biomimetic • Bioinspired • Bionics • Nanofolds

Introduction

The best model for humans is nature, which is the source of the ocean of knowledge. Acquiring information from Mother earth is basically as old as human existence. The bioinspired and biomimetic systems have come a long way in recent decades. Bionics, biomimicry and biognosis are additional descriptive terms for biomimetic. The Greek words "bios," which means "life," and "mimesis," which means "to imitate," are the source of the expression "biomimetic." Biomimetic framework straightforwardly copies the procedures or cycles displayed by the normal/organic framework and then again bioinspired framework straightforwardly or by implication emulates a characteristic/natural framework. The selection of novel ideas and principles, as well as their appropriate applications to the various engineered systems, are the key to the success of this novel strategy for the production of biomimetic and bioinspired micro and nanostructures [1].

The ability of various biological molecules to interact specifically with various systems or our body's targeted systems. A system that is comparable to or identical to the entire system can be developed from this concept. Unicellular organisms like bacteria, viruses, and others may serve as models or sources of inspiration. As a transport system for the world's largest animal, the whale, which serves as inspiration for ship design. Technology that is bioinspired or biomimetic will act as a link between science and nature. In addition, the creation of bioinspired and biomimetic micro and nanostructures has numerous applications, including the delivery of drugs and genes, the healing of biological systems, textile industries and waterproof effects. Furthermore, the concept of employing micro/nanostructures must be taken into account because both of these materials possess a wide range of properties and structural characteristics that must be utilized for upcoming discoveries [2].

Description

Both the lotus leaves and rose petals have superhydrophobic micro and nanostructures. Each of the micropapillae on the surface of a rose petal has an excessive number of nanofolds. Protrusion-shaped nanostructures coated in wax are found on the lotus leaves. The protrusions can be hairs, tentacles, or something else entirely depending on the species, such as *N. speciosum*, *N. komarovi* or *N. nelumbo*. The most one of a kind system, with its numerous remarkable characteristics, is the system of butterfly wings. Wings are covered with huge number of shaded sizes of miniature size; Plate-like setae, an antifogging surface, and tile like microstructures further alter these. Polar bears, a carnivorous animal, have thick layers of white hollow hairs that can keep them warm in cold conditions. Shells are the exoskeletons of spineless creatures and are mostly made out of calcium carbonate. It is enhanced with efficient bio-minerals having high warm conductivity, the strength from which bioinspired earthenware production are created. Spiders are one of nature's most impressive structures. Each of its microstructured spigots produces a protein-rich filament that is used to make silk threads. These threads are usually used to catch prey and are resistant to light and water, so they can be used to make different fabrics that are water resistant. Geckos and tree frogs have a high capacity for adhesion. Their paws are contained with large number of nanopillars answerable for both wet and dry attachment [3].

In contrast, micro and nanostructures play a significant role in a variety of biomedical applications, such as the delivery of therapeutically active moieties, tissue engineering, as cell-laden matrices, the fabrication of transdermal drug delivery systems, biosensing, bioimaging, bio-inks for three-dimensional printing, as prebiotics, and even as artificial cells. Biofabrication, scaffoldconstruction, and drug delivery are the most common applications for micro particles. Natural polymer-based microparticles can be used in biomedical applications, whereas synthetic polymer-based microparticles can be used in both biomedical and industrial settings. The miniature and nanostructures can entangle the bioactive or compound elements without losing their action and can convey it to the particular destinations in a controllable way [4].

As a result, newly developed bioactive chemical molecules can be delivered to future studies in a variety of micro- and nanostructures with less toxicity. Utilization of organic properties on miniature and nanostructures will get the consolidated impact of biocompatibility and biodegradability. Additionally, advantages include desirable inbuilt properties of micro and nanostructures for body conditions. Accordingly, the advancement of bioinspired and biomimetic miniature and nanostructures would have significant outcomes in their future biomedical applications. The bioinspired and biomimetic systems are emerging areas of research for the development of novel technologies in biomedicine. These systems play a vital role in the field of biomedicine. They can be a cost-effective and environment-friendly technique as compared to other available techniques. They can be used as a treatment strategy for many disease conditions. In cancer therapy, it can eliminate the side effects by targeting affected cells only [5].

An appropriate application of the bioinspired and biomimetic principles

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and strategies into different engineered systems is required for the successful fabrication and implementation of nano and microstructures. This nature-inspired technology serving as a bridge between nature and science is having tremendous opportunities in drug and gene delivery, tissue engineering, biomedical equipment, Bioprinting studies biomaterials, growth factors and other factors using the capabilities of 3D printing. To imitate the characteristics of living tissue and cells. This method supports the concept of artificial tissue or cells, which will fundamentally alter biomedicine. In a three-dimensional environment, bioprinting enables the hierarchical arrangement of cells or tissues [6].

Conclusion

The bioinspired and biomimetic frameworks are arising areas of exploration for the improvement of novel advancements in biomedicine. The field of biomedicine relies heavily on these systems. When compared to other methods that are currently available, they may be an environmentally friendly and cost-effective option. They can be utilized as a strategy for treating numerous diseases. By only focusing on the cells that are affected, it can eliminate side effects in cancer treatment. By combining biological and synthetic methods, biomimetic and bioinspired technology opens up a plethora of opportunities in biomedicine. For the successful creation and application of nano- and microstructures, the bioinspired and biomimetic principles and strategies must be appropriately incorporated into various engineered systems. Tissue engineering, biomedical equipment, and drug and gene delivery are just a few of the applications for this nature-inspired technology that serves as a link between science and nature.

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Conflict of Interest

None.

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