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## INNOVATIVE APPLICATIONS OF BIODESIGN AND BIOMIMICRY IN SUSTAINABLE FURNITURE DESIGN

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*Biodesign and biomimicry bring innovation to sustainable furniture design. By integrating biological features, they enhance performance and environmental friendliness. Utilizing renewable energy sources achieves energy self-sufficiency and reduces environmental impact. Guiding material selection and promoting the use of eco-friendly materials decreases resource consumption and pollution. Furniture design is shifting towards sustainability, considering not only utility and aesthetics but also environmental protection and resource efficiency. This innovative application fosters the sustainable development of the furniture industry, contributing to a greener, more sustainable future.*

**Key words:** *biodesign, biomimicry, sustainable, furniture design*

### INTRODUCTION

As the importance of global sustainable development becomes more and more prominent, people's concern for environmental protection and resource efficiency is increasing. In this context, furniture design, as an important field, has also begun to gradually shift towards sustainable development. Biodesign and biomimicry, as an interdisciplinary research field, draws on the excellent characteristics of living organisms in nature and provides new ideas and methods for solving problems in the fields of engineering and design. At the same time, Biodesign and Biomimicry, as a source of inspiration from nature, provides a rich resource for sustainable furniture design. Furniture is not only a practical object, but also a carrier that reflects personal taste, cultural background and social values. In the era of sustainable development, furniture designers not only need to consider its practicality and aesthetics, but also need to incorporate environmental protection and resource efficiency into the design considerations. Therefore, by drawing on the structure, function and biological processes of living organisms, biological design and biomimicry provide new ideas and methods for sustainable furniture design.

### PURPOSE

Through an in-depth discussion on the integration of bio-design and biomimicry with sustainable furniture design, we aim to provide new ideas and insights to drive the furniture industry in a more environmentally friendly and sustainable direction. We hope to bring more innovative solutions to furniture design, which will reduce the impact on the environment and increase the efficiency



of resource utilisation. Through this paper, we hope to inspire more designers to incorporate the concepts of bio-design and biomimicry into their innovative practices and work together to build a more sustainable future. This paper also aims to promote communication and collaboration between interdisciplinary fields, and to promote the integration of biodesign and biomimicry into the furniture design field, contributing to the creation of more environmentally friendly and sustainable furniture design solutions.

## **RESULTS AND DISCUSSION**

Biological design and biomimicry are interdisciplinary fields that integrate principles of biology, technology, engineering, and design, involving the process of drawing inspiration from biological organisms and systems and applying it to engineering, design, and technological domains. Designers delve into the mysteries of biological design and biomimicry aiming to create more intelligent, efficient [1] and environmentally friendly solutions for humanity by harnessing the wisdom of nature.

Biological design represents an innovative approach that combines principles of biology and technology with the field of design [2]. It involves the use of biological concepts, principles, and techniques to inspire and guide the design process, aiming to create novel, efficient, and sustainable products, systems, or solutions. Biomimicry aims to design more efficient, intelligent, and adaptive artificial systems by imitating the structure and functionality of biological organisms. The concept of biomimicry refers to achieving sustainability by seeking solutions from nature. It can span across various domains including robotics, materials science, aerospace, biomedical engineering, and others [3]. The subjects of biomimicry research can range from microorganisms to large animals, and even entire ecosystems [4].

By integrating the principles of biological design and biomimicry into furniture design, innovation and sustainability in furniture design can be achieved. This innovative application not only enhances the performance and efficiency of furniture but also reduces environmental impact, driving the furniture industry towards a more environmentally friendly and sustainable direction.

Designers draw inspiration from nature to create furniture that more efficiently utilizes resources. This involves maximizing the use of available resources and minimizing resource wastage during furniture design and manufacturing processes. Biological design and biomimicry can provide innovative solutions for improving the efficiency of resource utilization in furniture. Designers emulate the growth mechanisms of plants to design furniture capable of self-charging using solar or wind energy. Such furniture can be equipped with solar panels or small wind turbines to convert solar or wind energy into electricity, thus providing power for electronic devices or lighting within the furniture, reducing reliance on traditional power sources (Fig.1).

By harnessing renewable energy sources, these pieces of furniture can achieve sustainable energy use, reduce the consumption of non-renewable energy sources, and consequently decrease environmental impact. This design approach not only helps conserve energy resources but also lowers operating costs for furniture, enhancing its utility and sustainability.



**Fig.1.** Outdoor solar energy reclining chair (A team of MIT students, USA)



**Fig. 2.** Modular furniture Kit (PLAY WOOD, Italy)

Biological design and biomimicry can guide material selection in sustainable furniture design, promoting the use of environmentally friendly, renewable, and biodegradable materials to reduce consumption of natural resources and environmental pollution. It is possible to mimic the structure of natural fibers to design eco-friendly materials or utilize biodegradable materials to manufacture furniture that is easy to recycle, thereby achieving material recycling. By imitating the circulatory systems of organisms in nature, designers can create furniture components that are decomposable or reusable, using waste or discarded materials to manufacture furniture, thus realizing resource reuse and recycling (Fig.2). Moreover, by mimicking the structure and functionality of organisms, materials with antibacterial, antifungal, waterproof, and other functions can be designed, reducing reliance on harmful chemicals and thereby lowering risks to the environment and human health.

### CONCLUSIONS

The combination of biological design and biomimicry has brought new possibilities for sustainable furniture design, making a significant contribution to building a more environmentally friendly and sustainable future. Biological design and biomimicry can support and generate innovative designs [5]. Moreover, this



interdisciplinary collaboration also promotes communication and cooperation between different fields, driving the dissemination and application of sustainable development concepts in the field of furniture design.

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## ВЕН Х., ПАШКЕВИЧ К.

### ІННОВАЦІЙНЕ ЗАСТОСУВАННЯ БІОДИЗАЙНУ ТА БІОМІМІКРІЇ В СТАЛОМУ ПРОЕКТУВАННІ МЕБЛІВ

*В роботі розглянуто поняття «біодизайн» і «біомімікрія», які вносять інновації в екологічний дизайн меблів. Інтегруючи біологічні властивості об'єктів, вони підвищують ефективність і екологічність продуктів дизайну. Використання відновлюваних джерел енергії забезпечує енергетичну самодостатність і зменшує вплив забруднень на навколишнє середовище. Керівництво вибором матеріалів і сприяння використанню екологічно чистих матеріалів зменшує споживання ресурсів і забруднення. Визначено що сьогодні дизайн меблів зміщується в бік екологічності, враховуючи не лише корисність та естетику, але й захист навколишнього середовища та ефективне використання ресурсів. Ця інноваційна програма сприяє сталому розвитку меблевої промисловості, сприяючи більш екологічному та екологічному майбутньому.*

**Ключові слова:** біодизайн, біомімікрія, стійкий дизайн, дизайн меблів.