

---

---

**Biomimetics — Biomimetic materials,  
structures and components**

*Biomimétisme — Matériaux, structures et composants biomimétiques*



This document is a preview generated by ERS



**COPYRIGHT PROTECTED DOCUMENT**

© ISO 2016, Published in Switzerland

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Ch. de Blandonnet 8 • CP 401  
CH-1214 Vernier, Geneva, Switzerland  
Tel. +41 22 749 01 11  
Fax +41 22 749 09 47  
copyright@iso.org  
www.iso.org

# Contents

Page

|                                                                                                        |           |
|--------------------------------------------------------------------------------------------------------|-----------|
| <b>Foreword</b>                                                                                        | <b>iv</b> |
| <b>Introduction</b>                                                                                    | <b>v</b>  |
| <b>1 Scope</b>                                                                                         | <b>1</b>  |
| <b>2 Normative references</b>                                                                          | <b>1</b>  |
| <b>3 Terms and definitions</b>                                                                         | <b>1</b>  |
| <b>4 Abbreviated terms</b>                                                                             | <b>3</b>  |
| <b>5 Biological materials</b>                                                                          | <b>3</b>  |
| 5.1 Characteristics                                                                                    | 3         |
| 5.1.1 General                                                                                          | 3         |
| 5.1.2 Biological materials: multifunctional, fault-tolerant, modular, and adaptive                     | 5         |
| 5.1.3 Technical components: monofunctional, durable, with a limited ability to adapt                   | 5         |
| 5.2 Performances                                                                                       | 6         |
| <b>6 Methodology of biomimetic material and component development</b>                                  | <b>14</b> |
| 6.1 Analysis                                                                                           | 14        |
| 6.2 Examination of analogies                                                                           | 15        |
| 6.3 Abstraction                                                                                        | 16        |
| 6.3.1 General                                                                                          | 16        |
| 6.3.2 Modeling and simulation                                                                          | 17        |
| 6.4 Material selection                                                                                 | 18        |
| <b>7 Reasons and occasions for using biomimetic materials, structures, and components in companies</b> | <b>18</b> |
| <b>Annex A (informative) Examples of biomimetic materials, structures, and components</b>              | <b>20</b> |
| <b>Annex B (informative) Analytical methods</b>                                                        | <b>31</b> |
| <b>Bibliography</b>                                                                                    | <b>36</b> |

## Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see [www.iso.org/directives](http://www.iso.org/directives)).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see [www.iso.org/patents](http://www.iso.org/patents)).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see the following URL: [www.iso.org/iso/foreword.html](http://www.iso.org/iso/foreword.html).

The committee responsible for this document is ISO/TC 266, *Biomimetics*.

## Introduction

The increasing complexity of technical solutions and products requires new approaches. Classic research and development methods and innovation approaches often reach their limits, especially in the development and optimization of materials, structures, and components. The identification of suitable biological principles and their transfer to technical applications in the sense of biomimetics, therefore, can make an important contribution to the development of functional, adaptive, efficient (in terms of resources), and safe (in terms of toxicity to humans and the environment) materials, structures, components and manufacturing techniques.



# Biomimetics — Biomimetic materials, structures and components

## 1 Scope

This International Standard provides a framework of biomimetics for the development of materials, structures, surfaces, components, and manufacturing technologies.

This International Standard specifies the principles of biological systems, and especially the performance of biological materials, structures, surfaces, components, and manufacturing technologies that provide the motivation and reasons for biomimetic approaches. It specifies the methodology based on analysis of biological systems, which lead to analogies, and abstractions. The transfer process from biology to technology is described based on examples of biomimetic materials, structures, surfaces, components, and manufacturing technologies. This International Standard describes measurement methods and parameters for the characterization of properties of biomimetic materials. This International Standard provides information on the relevance of biomimetic materials, structures, surfaces, components, and manufacturing technologies for industry.

This International Standard also links to other subareas in biomimetics because fundamental developments in materials, structures, surfaces, components, and manufacturing technologies often form the basis for a wide variety of additional innovations. It provides guidance and support for all those who develop, design, process, or use biomimetic materials, structures, surfaces, components, and manufacturing technologies. This International Standard can also serve for those who want to learn about and investigate these topics.

## 2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 18458, *Biomimetics — Terminology, concepts and methodology*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 18458 and the following apply.

### 3.1

#### **adaptivity**

ability to adapt to variable environmental conditions

### 3.2

#### **efficiency**

relationship between the useful outputs to all inputs of a system

### 3.3

#### **generative manufacturing process**

manufacturing process in which three-dimensional components are produced, for instance, by applying material layer-by-layer

Note 1 to entry: These technologies can be used in four different levels of manufacturing:

- Concept model (additive manufacturing): A mechanical load cannot be applied to these models and they only serve to provide a three-dimensional view.