

# MATERIALS SCIENCE & ENGINEERING

**R**

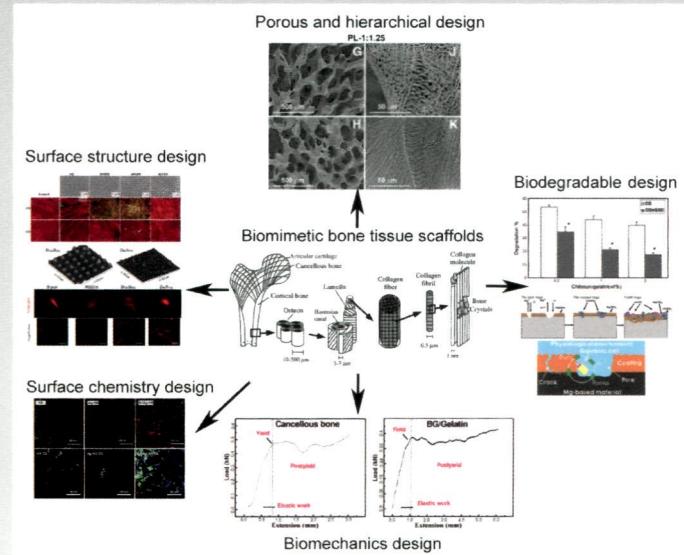
**Editor-in-Chief:**  
**Franky So**

**Guiding Editor:**  
**Paul Chu**

## Reports: A Review Journal

Biomimetic porous scaffolds for bone tissue engineering

Shuilin Wu, Xiangmei Liu, Kelvin W.K. Yeung,  
Changsheng Liu, Xianjin Yang



# Biomimetic porous scaffolds for bone tissue engineering

Shuilin Wu<sup>a</sup>, Xiangmei Liu<sup>a</sup>, Kelvin W.K. Yeung<sup>b,c,\*</sup>, Changsheng Liu<sup>d</sup>, Xianjin Yang<sup>d,e</sup>

<sup>a</sup>Hubei Collaborative Innovation Center for Advanced Organic Chemical Materials, Ministry-of-Education Key Laboratory for the Green Preparation and Application of Functional Materials, Hubei Province Key Laboratory of Industrial Biotechnology, Faculty of Materials Science & Engineering, Hubei University, Wuhan, China

<sup>b</sup>Department of Orthopaedics and Traumatology, The University of Hong Kong, Pokfulam, Hong Kong, China

<sup>c</sup>Shenzhen Key Laboratory for Innovative Technology in Orthopaedic Trauma, The University of Hong Kong Shenzhen Hospital, 1 Haiyuan 1st Road, Futian District, Shenzhen, China

<sup>d</sup>Key Laboratory for Ultrafine Materials of Ministry of Education, East China University of Science and Technology, Shanghai, China

<sup>e</sup>School of Materials Science and Engineering, Tianjin University, Tianjin, China

## Contents

1. Introduction .....	2
1.1. The demand for musculoskeletal tissue engineering materials .....	2
1.2. Characteristics of natural bone .....	3
1.2.1. Composition .....	3
1.2.2. Natural bone architecture.....	3
1.2.3. Biomechanics of bone .....	4
1.3. The evolution of bone scaffolds.....	5
1.3.1. Autograft bone scaffold.....	5
1.3.2. Allograft-based bone scaffold .....	5
1.3.3. Artificial and engineered bone scaffold .....	5
2. Biomimetic biomechanics .....	6
2.1. Structural design .....	6
2.1.1. Porosity .....	6
2.1.2. Pore shape, size and orientation.....	7
2.1.3. Hierarchical structure .....	7
2.2. Choice of materials .....	9
2.2.1. Metals .....	9
2.2.2. Bioglasses .....	11
2.2.3. Biopolymer and its derived composites.....	12

\* Corresponding author.

E-mail addresses: [wkkyeung@hku.hk](mailto:wkkyeung@hku.hk) (Kelvin W.K. Yeung).

---

3.	Biomimetic surface design .....	16
3.1.	Surface functionalized chemistry .....	17
3.1.1.	Coatings/film .....	17
3.1.2.	Biomineralization .....	21
3.1.3.	Surface polymerization .....	22
3.2.	Surface functionalized structure .....	25
3.2.1.	Chemical treatment .....	25
3.2.2.	Physical methods .....	26
3.3.	Synergistic regulation of surface structure and chemistry .....	26
4.	Biodegradability design .....	28
4.1.	Scaffold resorption/biodegradability .....	28
4.2.	Biodegradation rate control .....	30
5.	Clinical applications of engineered tissue scaffolds .....	32
6.	Conclusions .....	33
	Acknowledgements .....	33
	References .....	33