FAST BREAKING PAPERS - 2009

August 2009

PDF

Peter X. Ma talks with *ScienceWatch.com* and answers a few questions about this month's Fast Breaking Paper in the field of Pharmacology & Toxicology.

Article Title: Biomimetic materials for tissue engineering
Authors: Ma, PX
Journal: ADVAN DRUG DELIVERY REV
Volume: 60
Issue: 2
Page: 184-198
Year: JAN 14 2008
* Univ Michigan, Dept Biol & Mat Sci, 1011 N Univ Ave, Ann Arbor, MI 48109 USA.
* Univ Michigan, Dept Biol & Mat Sci, Ann Arbor, MI 48109 USA.
* Univ Michigan, Dept Biomed Engn, Ann Arbor, MI 48109 USA.
(addresses have been truncated)

SW: Why do you think your paper is highly cited?

This paper reviews an important new direction in the fields of biomaterials, drug delivery, and tissue engineering/regenerative medicine. The paper systematically discussed a biomaterial (scaffold) design strategy that mimics extracellular matrix (ECM) structures and biological activities in the body to facilitate and optimize the regenerative outcome.

Our laboratory is one of a few early laboratories that have explored this new research direction. The significance and effectiveness of this new approach have been recognized by our peers. The high citation number is a reflection of the agreement by peer researchers with the opinions expressed in the article.

SW: Does it describe a new discovery, methodology, or synthesis of knowledge?

The paper reviews new technologies developed by our group as well as others that demonstrate the effectiveness of the biomimetic approach in designing a temporary artificial ECM (scaffold) for tissue regeneration. These new findings have been analyzed and summarized, leading to a now generally accepted strategy.

SW: Would you summarize the significance of your paper in layman's terms?

Tissue loss and organ failure are devastating to patients. Due to the severe shortage of donor organs, a scientific field called tissue engineering and regenerative medicine has emerged, aiming at regenerating the needed tissues and organs.

Porous materials are designed as templates (scaffolds) to support cell growth and function to regenerate the needed new tissues. The porous materials are biodegradable, so that after fulfilling the template function they degrade and

disappear, leaving behind the regenerated living tissues.

The scaffold plays crucial roles in not only serving as a template, but also providing the microenvironment for cell growth and function. This paper, using our research results as well as those of others, demonstrates the benefits for the scaffolds to mimic the structural features, chemical composition, and biological molecular activities in the natural tissues. Both the methods and possible mechanisms of these biomimetic approaches are discussed, which provide important resources for fellow researchers in the field.

"The initial success further enhanced my enthusiasm for developing more advanced scaffolds using the biomimetic approach."

SW: How did you become involved in this research, and were there any problems along the way?

Many years ago, I obtained my Ph.D. degree in polymer science and engineering from Rutgers University. I was attracted to the explosively growing life sciences field and wanted to personally contribute to the biological and biomedical sciences using my polymer science background. I luckily obtained a joint postdoctoral fellow position in two leading labs in the emerging field of tissue engineering at MIT and Harvard Medical School. My luck further led me to become the coordinator of these two collaborating labs for a period of two years.

My own research was to focus on the development of scaffolding materials and to collaborate with many young surgeons to help generate new tissues. These projects have proved the principle of tissue engineering by establishing successfully engineered various tissues for the first time. However, we soon realized that those regenerated tissues were far from being clinically useful and the scaffolds developed at that time were seriously limited.

Around that time, I took a faculty position at the University of Michigan in Ann Arbor. I remained excited about tissue engineering and tried to develop better scaffolds. At the same time I wanted to demonstrate my independence from the research groups in Boston.

I started to think that the natural ECM might be an important model for us to mimic in developing advanced scaffolds.

Since then, we have developed various biomimetic nanostructured materials (nanofibrous scaffolds, nanocomposites, and nanospheres for biomolecule delivery in scaffolds) and demonstrated their advantages over more traditional scaffolds. The initial success further enhanced my enthusiasm for developing more advanced scaffolds using the biomimetic approach.

SW: Where do you see your research leading in the future?

Although the biomimetic approach has been successful in improving scaffold structure and biological performance, the mechanisms are not well understood. Driven by curiosity, we have started to address the underlying mechanisms. These understandings will facilitate the more rational design of advanced scaffolds.

SW: Do you foresee any social or political implications for your research?

The biomaterials and tissue engineering research aims to develop advanced therapies for patients who suffer from tissue loss and organ failure. Although I do not see any particular issues associated with the goal of the research, some specific approaches that involve certain types of cells—such as embryonic stem cells—may continue to be somewhat controversial.

The lack of an established regulation system for the technologies and products in the field may likely limit the growth rate of the field and the clinical utilization of the technologies. However, regulations will likely improve overtime. I continue to remain excited about the biomimetic approach in tissue engineering and regenerative medicine.

Peter X. Ma, Ph.D., Professor
Department of Biologic and Materials Sciences
Department of Biomedical Engineering
Macromolecular Science and Engineering
University of Michigan
Ann Arbor, MI, USA
Web

KEYWORDS: BIOMIMETIC; TISSUE ENGINEERING; REGENERATION; POLYMER SCAFFOLD; MATRIX; BIOMATERIAL; NANO; CONTROLLED RELEASE.

PDF

back to top