Biomaterials for Tissue Engineering

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Biomaterials are materials that are deliberately designed to be used in contact with biological systems. They have applications either in artificial medical devices or in replacing some tissue, organ or some function in the living organism. Biomaterials engineering is the physical and biological study of such materials and their interaction with biological environments. This is a vastly exciting interdisciplinary field of science. At the one hand it uses the ideas of medicine and biology and on the other hand it draws heavily upon physics, chemistry and engineering in order to synthesize new devices and implants. Law, ethics and health care have important roles to play too.

In Pakistan, research on biomaterials has seen a spurring growth in the previous decade or so. To enhance this research in a more far-reaching and productive manner, active researchers from different fields need to sit together and share knowledge in their respective fields; this knowledge-sharing is a pre-requisite for biomaterials technology.

With this background in mind, the Khwarizmi Science Society, Pakistan (KSS; www.khwarizmi.org) decided to organize a seminar on Biomaterials and their applications in tissue engineering. It was hosted on 24 January 2008 in the Seminar Room of the School of Biological Sciences, Punjab University, Lahore, a growing Institute for research in Biological Sciences at the national level. The school collaborated with KSS in organizing the seminar. The Chair of the session was Dr. Muhammad Akhtar, Director of same institute and a veteran biologist and Fellow of the prestigious Royal Society. The Founding President KSS, Dr. S. A. Siddiqi was

also present. The speaker was Dr. Hassna Ramay, Assistant Professor of Bioengineering at the LUMS School of Science and Engineering, Lahore.

Speaker Dr. Hassna Ramay

The Chair of the session, Prof. Dr. M. Akhtar

Dr. Saadat. A. Siddiqi (left), Dr. Khalid Rasheed and Sajjad (author).

The seminar started at sharp 11 o’clock with recitation from the Book.

Dr. Ramay then deliberated on various aspects of biomaterials engineering. Her presentation contained attention-grabbing and colourful animations. The lecture was had sufficient matter of technical interest for working researchers and was also tuned at the right level for students of biology.

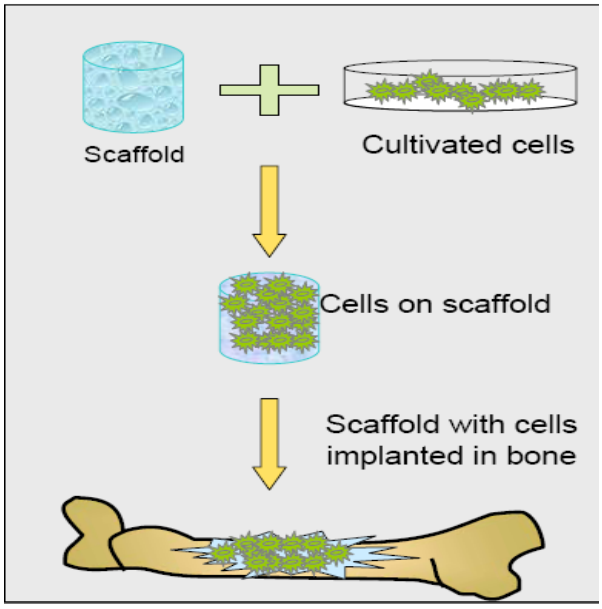
First of all she elucidated the significance of biomaterials in human life. She said that the use of biomaterials ranges from neuron regeneration to cardiac valve replacement, from bone implants to skin synthesis and from cartilage replacement to tissue engineering.

Dr. Ramay also emphasized that the specific choice of a biomaterial depends upon its application and place where it is to be used. For example, in case of skeletal implantation, titanium and its alloys are competitive candidates as compared to other materials because of their hardness and smaller susceptibility to corrosion. Whereas in the case of cardiovascular systems Teflon or carbon fibres fulfil the merit.

The speaker described that for a material to be used in a medical device it has to pass through certain vital steps. The first of these is the identification of need. Then the design of the device and material synthesis are carried out. In the next phase, the material is tested out. If material does not fulfil the highly specific preconceived needs, the above-mentioned steps are repeated until the material has acquired the required features. After this the device is finally fabricated and put to use.

The central focus of the lecture was on ‘tissue engineering’. Dr. Ramaay presented a way to cultivate new tissues in which, patient derived cells are grown on a macroporous artificial scaffold that promises to grow into a new tissue. That scaffold is then implanted into the body of patient where scaffold is gradually degraded and

eventually eliminated out of body. The cells that have grown around this scaffold remains inside the body and forms the engineered tissue.



Dr. Ramay described that mechanical, chemical, biological, environmental, and surface properties of the scaffold material are crucial. She discussed two ceramic scaffolds: Hydroxyapatite (HA) and tricalcium phosphate (TCP), both having increased biocompatibility and suitable mechanical properties, mimicking the skeletal tissue.

She also explained the contribution of nanotechnology in Bioengineering, showing that nanocomposite porous scaffolds comprising of TCP and HA nanofibres had more controllable degradation, possessed better mechanical and biological properties and were better suited for bone generation as well.

Many Phd. Scholars from the School of Biological Sciences took part in the ensuing discussion after the lecture and shared their own interests with the worthy speaker. that the lecture was attended by participants from departments of Physics, Chemistry, Biochemistry, Solid State Physics and Engineering at the Punjab University, and the COMSATS Biomaterials Department.


The question and answer session was moderated by the presiding chair Prof. Dr. Muhammad Akhtar himself.

Prof. Dr. M. Akhtar, moderating the Question and Answer Session

At the end he concluded the session with memorable remarks and presented the Khwarizmi Science Society with his good wishes for organizing another high-class event. The seminar has given a flourishing new start in the year 2008 to the KSS.