E-News Letter
Interdisciplinary Research Center in Biomedical Materials (IRCBM)
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Biomaterials – this key aspect of healthcare – is witnessing accelerating market growth in the World due to an unparalleled effort in multi-disciplinary research. An improved technological approach to current clinical needs has also reaped benefits, as new tailor-made materials have been developed in partnership with physicians and surgeons.

Diversity is imperative for broadening the scientific research base. My own career progression from a background in chemistry and materials sciences followed by specialisation in the area of biomaterials is an example of this. Only by adopting multi-disciplinary research of applied nature can the field of biomaterials be established in Pakistan.

An Interdisciplinary Research Centre in Biomedical Materials (IRCBM) has hence been established to carry out multi-disciplinary research, which will act as a hub for other research institutes to initiate collaboration on a number of research themes including bone replacement materials, dental materials, tissue engineering and cardio-vascular systems etc.

We would like to share our advances during the 2007-08 academic year by outlining our achievements. In addition, this report will provide you with a roadmap to the future directions of the IRCBM. May I also take the opportunity to invite other departments within the COMSATS and Institutions outside the COMSATS to come and collaborate with us. We will liaise with local industry and carry out application oriented research and development. Only by working together, we can achieve our Mission, which is to improve the quality of life of our people.

Prof. Dr. Ihtesham-ur-Rehman
Director & Founder IRCBM
“IRCBM is an essential part of the process to identify new opportunities for industry, government and academia. It stands as a signpost for future research and development in the field of Biomaterials.”

The field of material science has revolutionised the healthcare sector; increasing number of medical implants and devices are now being made available. This has only been possible due to an interdisciplinary approach to scientific problems. Ultimate aims of the centre are to produce tailor-made implants for the health sector; continuous improvement through research will be a major requirement for developing new generation of implants.

There is a need to identify experts from different fields (i.e., chemists, biologists, physicists, engineers, clinicians, etc.) in Pakistan who shall facilitate the application of innovative biomedical materials. This requires the transition of lab based concepts to patient-friendly solutions. IRCBM aims to achieve this by providing an effective interface between the IRC, Industry (& chambers of commerce), the Ministry of Health, the Ministry of Trade and Industry and appropriate academic and research institutions (national and international). This will form a network with complementary interdisciplinary laboratories and thereby help in establishing the field of biomaterials in Pakistan. The development and application of new materials has a significant effect on health, as materials play an increasingly important role in our everyday lives. It is clear that a manufacturing and innovation strategy which highlights advanced materials development is more likely to provide wealth creation and commercial success in addition to serving a national cause; improving the quality of life of our people.
**Synthesis**

- Bioceramics
- BioPolymers
- BioComposites

**Characterization**

- Structural Characterization (XRD, FTIR, Raman, NMR) to assess phase-purity
- Elemental Analysis to determine ultra high purity
- Biological Testing (Cell culture studies, animal testing etc.) to determine biological response prior to use in humans
- Mechanical Testing to ensure strength

**Applications**

- Interactions with surgeons, dentists etc.
- Implantation in humans (dental implants, orthopedic implants, maxillofacial surgery, bone augmentation/replacement etc.)

**Improvements**

- Improvements in biological, mechanical performance.
- Conformation to international standards

**Feedback**

- Feedback from doctors, patients, clinical studies – in order to continuously improve quality of product
The department submitted its second PC-1 to Ministry of Science and Technology (MoST) titled “Strengthening of the Department of Biomedical Material Sciences (IRC) at COMSATS Institute of Information Technology, Lahore”. The total cost of the project was estimated to be 38.669 million Pakistani Rupees and if approved will strengthen the ceramic, polymer, biological and characterization labs of IRCBM.

February 2008

The purpose built 10,000 sq. ft. picturesque premises of Department of Biomedical Materials Sciences (DBMS) were opened to the faculty.
March – April 2008

All the labs, offices and classrooms were made operational. Office and laboratory furniture was procured. Laptops and desktop computers for members of the department were obtained.
The department visited Pakistan Society for Rehabilitation of Disabled (PSRD). PSRD provides free treatment to the disabled. The doctors at PSRD use several kinds of implants and apprised the department about their quality, prices and availability in the local market. The department gained valuable insight into the problems faced by patients due to poor quality implants available in Pakistan. PSRD subsequently issued a letter of support for a project submitted by Dr. Rafaqat to Pakistan Science Foundation (PSF).
June 2008

DBMS visited the School of Biological Science (SBS) at University of The Punjab, Lahore. Dr. Javaid Iqbal, Acting Director General SBS offered open access to the specialized equipment at SBS. This was a major development as DBMS plans to biologically evaluate biomaterials prior to clinical testing.

The department was officially notified as the Interdisciplinary Research Centre in Biomedical Materials (IRCBM) on the 21st June 2008
The department hosted its first 1-Day International Symposium on “Biomedical Material Sciences in Pakistan: Prospects and Potentials”. Professor N. M. Butt (Chairman, Pakistan Science Foundation) graced the occasion with his presence as a chief guest. Many distinguished researchers from Pakistan and United Kingdom presented their cutting edge research in the field of Biomedical Materials.
August 2008

IRCBM faculty visited Pakistan Institute of Technology for Minerals and Advanced Engineering Materials (PITMAEM) at PCSIR Laboratories in Lahore. The IRCBM faculty was briefed by PITMAEM Project Director, Dr. Shahzad Alam which was followed by a lab tour. In a major development Dr. Shahzad Alam offered open access to the labs at PITMAEM. Several collaborative projects were proposed some of which have already been initiated.
All the faculty members of IRCBM held a meeting with Dr. Shahzad Leghari, owner of Pro-Health, a company offering biomedical engineering solutions. Ideas were exchanged and IRCBM benefitted from the knowledge provided by Dr. Shahzad Leghari related to obtaining medical grade 316L, costs and other issues related to orthopaedic implants.

IRCBM was officially inaugurated on 21st October 2008 by His Excellency Chief Minister of Punjab Mian Muhammad Shahbaz Sharif.
Research work was initiated in the Ceramics Lab on the synthesis of hydroxyapatite. Hydroxyapatite is similar to biological apatite, the mineral component of bone. This very first project of IRCBM focuses on optimization of synthesis parameters and scaleup. This will pave the way for subsequent commercialization in the near future. The Centre also initiated collaborations with national universities for the characterization of these samples.

Prof. Dr. Shahzad A. Mufti (Advisor) bid farewell to IRCBM, to move to Islamabad. IRCBM learnt a lot from his enigmatic personality, kindness, professionalism and sense of humor. He advised everyone to work with a smile and encouraged everyone to take a stand for a right cause. The whole IRCBM team vows to remain a reflection of his teachings.
The department organized a 3-Day international Workshop on Proposal Writing. Dr. Jawwad Darr (Reader, University College London) and Dr. Ihtesham-ur-Rehman (Reader, Queen Mary University, London) conducted the workshop and gave professional insight into writing techniques and reviewing research proposals. Young researchers from all the campuses of CIIT attended the workshop and came up with several interdisciplinary innovative research ideas which are currently being translated into research proposals.
The Ceramics Lab of IRCBM started research in November 2008. Research has been initiated with the in-house capability of syntheses and heat-treatment of bioceramics. These materials are then fully characterized with support from IRCBMs international and national collaborators.

Project
- Dr. Aqif Anwar, Nanomechanical properties of spark plasma sintered hydroxyapatite and its comparison to human teeth – **Collaborators: IRCBM, QMUL, UCL, PITMAEM**
- Dr. Aqif Anwar, Effect of ionic substitutions on the nanomechanical properties of spark plasma sintered hydroxyapatite – **Collaborators: QMUL, UCL, PITMAEM**
- Dr. Aqif Anwar, Synthesis and Characterisation of IRCBM Hydroxyapatite for potential commercialization – **Collaborators: IRCBM, QMUL, UCL, PU.**

Projects Submitted to funding agencies
- Rafaqat Hussain “Synthesis of Novel Biological Hydroxyapatite” submitted to HEC
- Rafaqat Hussain, “National Database for Implants” submitted to Information and Communication Technology
- Rafaqat Hussain “Synthesis of Carbon Nanotubes and Carbonated Hydroxyapatite Composites,” submitted to Pakistan Science Foundation
- Rafaqat Hussain “Preparation and Characterization of Hydroxyapatite Scaffolds” submitted to COMSATS Research and Development Fund
- Anila Asif “Novel bioactive dental composite materials” submitted to HEC, Islamabad
Dr. Rafaqat is developing bioceramics with tailorable resorbability at the IRCBM. Optimum resorbability of an implant surface is essential for bonding to human tissue and being able to bear load. This work is being carried out in collaboration with Queen Mary University of London and Punjab University.

Dr. Aqif is currently developing bioactive nano-bioceramics at the IRCBM in collaboration with Queen Mary University of London and Punjab University. Once implanted in patients of bone trauma (or cosmetic surgery) these materials have the ability to bond to human bone and thereby reduce patients bed-rest time after surgery.

Dr Anila is working on Polyvinyl Alcohol-Hydroxyapatite (PVA-HA) composites these materials can be used for repairing damaged articular cartilage. HA is used in composite form (HA-polymer) to retain useful bone-bonding properties with nature tissue through osteo-conduction as well as enhancement in mechanical properties.

Dr Rafaqat and Dr Aqif are presently working on project “Synthesis and characterization of hydroxyapatite scaffolds.

Publications

International Advisory Board

**Prof. Paul Hogg**
Professor of Composite Materials  
School of Materials, University of Manchester  
**Current Activities**  
- Professor of Composite Materials, School of Materials, University of Manchester  
- Executive Director of the Northwest Composites Centre  
- Chairman of the British Composites Society  
- Research Director of the trade association, Composites-UK  
- Board member of the National Composites Network

**Prof. Elizabeth Tanner**
Professor of Mechanics of Materials and Structures  
Department of Mechanical Engineering, University of Glasgow  
**Current Activities**  
- Fellow of the Royal Academy of Engineering since 2006  
- Professor of Mechanics of Materials and Structures, University of Glasgow

**Dr. Jawwad A. Darr**
Reader in Materials Chemistry  
Department of Chemistry, University College London (UCL)  
**Current Activities**  
- Reader in Materials Chemistry, UCL Chemistry [since 2007]