

Biomedical Engineering Program Report Summary (Dated 10 March 2014)

The Biomedical Engineering (BME) Program was set up in May 2013 with an objective to facilitate teaching, research and entrepreneurship in the interdisciplinary areas encompassing engineering, medical sciences and natural sciences. With this objective, three undergraduate-level and eleven postgraduate-level Biomedical Engineering courses have been offered so far. For biomedical research, there are about twenty-three faculty members interested in biomedical areas, out of which fourteen faculty members are collaborating with medical specialists at PGIMER Chandigarh. There are nine funded research projects on Biomedical Engineering topics, out of which three are joint research projects with PGI faculty members. The doctors, engineers and scientists of the two institutes are working together, particularly with a focus on developing affordable healthcare in India. Collaboration with other national and international universities (such as Aston University) is underway.

An office of Biomedical Engineering Program and a common laboratory facility (including a fluorescent microscope and histopathology equipment) is being set up in Room 340. There is also a Cognitive/EEG Lab coming up in Room 340. An undergraduate teaching laboratory for Biomedical Engineering is underway. To inspire creativity, innovation and entrepreneurship in BME, a Biomechanical Creativity and Innovation Lab is also being set up.

The Biomedical Engineering Seminar Series has been started by the members of Biomedical Group. There have been around twenty-one journal publications and twenty-three conference publications in biomedical areas (including one awarded best technical session paper). In addition, there were several invited talks by the Biomedical Group members.

In short-term future, the BME program will be expanded further. A series of six undergraduate-level BME courses (e.g. Biology, Biochemistry, Anatomy & Physiology, and Introduction to BME as core plus two electives such as Biomechanics, Biomaterials etc.) equivalent to a minor in Biomedical Engineering is being planned. The courses will be designed soon. In long term, the BME Program will be slowly converted into a Bioengineering department so that it can recruit its own faculty members and has its own funding and academic programs such as B.Tech., M.Tech. and Ph.D.

Biomedical Engineering Program Report (Dated 10 March 2014)

1. Objective and Background:

Biomedical Engineering (BME) is a fast-developing engineering discipline, which focuses on solving biomedical-related problems using multidisciplinary subjects of sciences, engineering and humanities. BME is more important for India as most of the medical devices and equipments are imported and are not affordable for the general population of India. The motivation behind establishing the Biomedical Engineering Program at IIT Ropar is to encourage all the departments to work together towards an affordable healthcare in India. With this goal, the BME program facilitates research, teaching and innovation in Biomedical Engineering at IIT Ropar.

Although the BME Program was formally set up in May 2003, there were a plenty of groundwork done by a few people since August 2011. Several people have contributed later in developing the Biomedical Program at IIT Ropar. Informal historical background information in terms of the major events leading to setting up of the Biomedical Engineering Program is given in **Appendix1**.

Appendix 2 summarizes the relevant major events till date since the approval of the Biomedical Engineering Program at IIT Ropar.

2. Specific Aims:

An office of Biomedical Engineering Program has been set up in Room 340 with the following specific tasks:

- (i) To serve as an academic subunit for offering biomedical-related courses
- (ii) To identify a set of essential biomedical courses (which may later be developed into a minor or major program in biomedical engineering/bioengineering)
- (iii) To facilitate offering of the above courses/minor program
- (iv) To advise the students on taking the above courses
- (v) To liaise with the regional biomedical institutions for teaching, research, training and placement
- (vi) To facilitate interdisciplinary biomedical research by encouraging interaction within IIT Ropar, building contacts outside IIT Ropar, arranging a regular weekly seminar series, to facilitate interaction with doctors, etc.

- (vii) To facilitate collaboration with other institutions, especially PGIMER
- (viii) To keep/display information on the funding opportunities and upcoming conferences/events in biomedical areas
- (ix) To serve as a one-stop place for biomedical research/teaching related issues
- (x) To facilitate biomedical laboratory development and related purchases
- (xi) To develop UG/PG biomedical curriculum
- (xii) To look after the design/construction requirements of the building for Biosciences and Bioengineering at the new campus
- (xiii) To slowly evolve into a Department of Bioengineering (or School of Biosciences & Bioengineering or Center for Health Sciences & Engineering, etc.)
- (xiv) To organize student/faculty/expert seminars/journal-clubs
- (xv) To organize workshop/conference on Biomedical areas
- (xvi) To look after general interests of the Biomedical-Group including identification of laboratory spaces, transportation to collaborating institutes such as PGIMER, IISER, etc.
- (xvii) To liaise with NKN for biomedical related courses that our students can take.
- (xviii) To help with publishing yearly/biyearly newsletter on the Biomedical Engineering Program.

3. Faculty:

Biomedical Engineering Program is functioning effectively by the contributions of around twenty three faculty members from all the seven departments of IIT Ropar. At present, the Biomedical Group consists of the following faculty members:

Dr. Anshu Dhar Jayal
Dr. Debaprasad Mandal
Dr. Deepti R. Bathula
Dr. T. J. Dhilip Kumar
Dr. Harpreet Singh
Dr. Himanshu Tyagi
Dr. Jitendra Prasad
Dr. Jyotindra S.Sahambi
Dr. Kamal Kumar Choudhary
Dr. Manoranjan Mishra

Dr. Narinder Singh
Dr. Navin Kumar
Dr. Nitin Auluck
Dr. Partha Sharathi Dutta
Prof. P. K. Raina
Dr. Prabal Banerjee
Dr. Prabir Sarkar
Dr. Rajendra Srivastava
Dr. Rakesh Kumar
Dr. Ramjee Repaka
Dr. Rohit Y.Sharma
Dr. Subhendu Sarkar
Dr. Vishwajeet Mehandia
Dr. Yashveer Singh

4. Courses: The following Courses are offered by Biomedical Engineering Program:

Sem II of AY 2013-14

UG:

1. CYL456 Chemistry of Life – An Introduction (instructor: Dr. Yashveer Singh)
2. MEL415 Biomechanics (instructor: Dr. Jitendra Prasad)

PG:

1. MEL519: Biological Materials (instructor: Dr. Navin Kumar)
2. MEL617 Biology for Engineers (instructor: Dr. Yashveer Singh)
3. MEL618 Molecular, Cellular and Tissue Biomechanics (instructor: Dr. Jitendra Prasad)
4. CYL705 Bioconjugates: Techniques and Applications (instructor: Dr. Yashveer Singh)

Sem I of AY 2013-14

UG:

1. MEL426 / MEL465 Introduction to Biomedical Engineering (instructor: Dr. Navin Kumar)

PG:

1. MEL520 Advanced Topics In Biomedical Engineering (instructor: Dr. Navin Kumar)
2. CYL614 Principles of Biochemistry (instructor: Dr. Yashveer Singh)

Sem II of AY 2012-13

UG:

1. CYL240/CYL456 Chemistry of Life – An Introduction (instructor: Dr. Yashveer Singh)
2. MEL415 Biomechanics (instructor: Dr. Jitendra Prasad)

PG:

1. MEL519 Biological Materials (instructor: Dr. Navin Kumar)
2. HUL609 Cognitive Neuroscience of language
3. MEL617 Biology for Engineers (instructors: Dr. Yashveer Singh and Dr. Jitendra Prasad)
4. MEL618 Molecular, Cellular and Tissue Biomechanics (instructor: Dr. Jitendra Prasad)

Sem I of AY 2012-13**UG:** None**PG:** None**Sem II of AY 2011-12****UG:**

1. MEL415 Biomechanics (instructor: Dr. Jitendra Prasad)

PG:

1. MEL515 Bone Biology (instructor: Dr. Jitendra Prasad)

2. MEL517 Orthopedic Biomechanics (instructor: Dr. Jitendra Prasad)

3. HUL609 Cognitive Neuroscience of language (instructor: Dr. Kamal Kumar Choudhary)

4. CSL631 Physics of Medical Imaging (instructor: Dr. Deepti R. Bathula)

Sem I of AY 2011-12**UG:** None**PG:**

1. MEL617 Biology for Engineers (instructor: Dr. Jitendra Prasad)

2. MEL618 Molecular, Cellular and Tissue Biomechanics (instructor: Dr. Jitendra Prasad)

3. CSL711 Advanced Image Processing (instructor: Dr. Deepti R. Bathula)

5. Lab Equipments:

As Biomedical Engineering is an interdisciplinary program the faculty and students use the following equipments available in other departments for their research activity.

S.NO	Equipment
1	X- Ray Diffraction
2	Scanning Electron Microscopy/Energy Dispersive Spectroscopy
3	Nano Indentor
4	Deep freezer
5	CO ₂ Incubator
6	Scanning Probe Microscope
7	Nuclear Magnetic resonance
8	Gas Chromatography
9	Fluorescence Spectrometer
10	UV – Visible Spectro Photometer
11	FTIR
12	Sonicator
13	Anton Paar MCR102 Modular Compact Rheometer
14	Sorvall ST 16 R Refrigerated Centrifuge
15	Autoclave
16	Single Crystal XRD
17	COMSOL-Multiphysics software with CFD toolbox

The current biomedical equipment needs (such as Fluorescent Microscope, Microtome etc.) are also fulfilled by IIT Ropar's collaboration with various institutes around Chandigarh.

6. Seminars organized:

Sem II AY 2013-14

1. "Manipulation of Molecular Interactions in Protein Nanostructures: Implications in Drug Design and Bioengineering." by Dr. Sharmistha Sinha , RJ Carver Department of Biophysics, Biochemistry and Molecular Biology, Iowa State University, Ames, Iowa, USA-50011. On Thursday, 6 February 2014, 10:00AM in L-3.
2. "Investigation of neural cell fate processes on amorphous carbon structures and effect of vertical electric field using porous carbon electrodes" by Dr. Shilpee Jain, Department of Chemical Engineering, Indian Institute of Technology Kanpur on 11 February 2014, 4PM in L-3.
3. "Employing bioengineering for understanding complex human diseases" by Dr. Sonal Datta, DBT Bio-CARe Scientist, CSIR - Institute of Microbial Technology, Chandigarh. On Thursday, 13 February 2014, 10:00AM in L3 .
4. "Layer -by -Layer assembled nanostructured capsules as drug delivery systems" by Prof. Ashok M. Raichur, Department of Materials Engineering, Indian Institute of Science Bangalore. On Wednesday, 05 March, 2014, 11:00 am in L2
5. "Peptide aggregation: from materials to diseases" by Dr. Aseem Mishra, Wellcome Trust - DBT IA Early Career Fellow, Malaria Research Group, International Center for Genetic Engineering and Biotechnology (ICGEB), New Delhi. On Thursday, 13 March 2014, 10:00 am in L3.

Sem I AY 2013-14

1. "Nanoscale Surface Engineering for Biomedical Applications" by Dr. Sunil Kumar (Founder and Director, Coatings Mantra Science and Technology Consulting, Adelaide, Australia) on Wednesday, 13 November 2013, 11:30 AM.
- 2 "Role of histomorphometry in bone research" by Dr.D.Sudhakar Rao (Director, Bone & Mineral Research Laboratory, Henry Ford Hospital, USA) on Monday, 09 September 2013, 12.00 PM.
3. "Laparoscopic Bariatric Surgery" by Dr. B.P.S Parmar [MS (SURG), FMAS, FIAGES, DALS Laparoscopic Surgeon] on Wednesday, 14 August 2013, 1.00 PM.
4. "Viral therapy for brain tumor" Dr. Balveen Kaur (Associate Professor, Department of Neurological Surgery, Ohio State University) on Friday, 23 August 2013, 1.00 PM

7. Collaboration with PGI

1. Dr. Rakesh Kumar with Prof. Sunit Singhi, Pediatrics, PGI (Biosensor)
2. Dr.J.S.Sahambi with Dr. Rohit Manoj Kumar, Cardiology, PGI (Bio-devices / Bio-instrumentation); Status: DST project on cardiology instrumentation (Dr. Rohit Manoj Kumar is a consultant for the project)
3. Dr.Navin Kumar with Prof. G. D. Puri and Dr. Preeti Mathew, Anesthesia and Intensive Care, PGI (control system for drug delivery)
4. Dr. Navin Kumar with Dr Sanjay Bhadada and Dr. Naresh Sachdeva, Department of Endocrinology; Dr.Nirmal Raj, Department of Orthopedics (Effect of Diabetic and Osteogenesis Imperfecta on the structural and mechanical properties of bone).
5. Dr. Navin Kumar with Dr.Anand Mishra, Department of Cardiology, PGI Chandigarh (mechanical characterization of the vascular endothelium cell)
6. Dr. Navin Kumar with Prof. A. K. Gupta and Dr. Sandeep Bansal, Department of Otolaryngology and Head Neck Surgery (Development of indigenous and low cost Otoacoustic emissions (OAE) testing for early detection of the deafness)
7. Dr. Jitendra Prasad, SMME with Dr. Nirmal Raj / Prof. Mandeep Dhillon, Orthopaedics, PGI (Basic bone biology research; orthopaedic implant/device design); Status: Animal experiments are going on at PGI.
8. Dr.Narendra Singh, Chemistry with Dr. Samir Malhotra and Dr.Nusrat Shafiq, Pharmacology, PGI (Drug delivery). Status: IIT Ropar will synthesize new organic receptors and PGI will evaluate it for anti-cancer activity. At the moment, we are preparing the compounds.
9. Dr.Debprasad Mandal, Chemistry with Dr.Shalmoli Bhattacharyya, Biophysics, PGI (Synthetic scaffolds for tissue engineering).
10. Dr.Ramjee Repaka, SMME with Dr.Sunil Dogra, Dept.of Dermatology, PGI (Early detection of skin cancer) - Contact has been established.
11. Dr.Deepti R. Bathula, CSE with Dr.Akshay Saxena and Dr. Niranjana Khandelwal, Department of Radiodiagnosis, PGIMER, Chandigarh
12. Dr.Subhendu Sarkar, Physics with Dr.Shalmoli Bhattacharyya, Biophysics, PGI (tissue engineering).
13. Dr.Himanshu Tyagi, SMME with Dr.Kanchan Mukherjee, Neurosurgery, PGI (thermal

treatment of cancers - hyperthermia & cryosurgery)

14. Dr.Tharamani.C.N, Chemistry with Dr.Navneet Singh, Pulmonary Medicine, PGI (electrochemical immune-sensor for Lung cancer diagnosis)

15. Dr.Anshu Dhar Jayal, SMME with Dr.Nirmal Raj Gopinathan, Orthopaedics, PGI (manufacturing of bone implants).

16. Dr.Prabir Sarkar, SMME with Dr. Devendra Kumar Chouhan, Orthopaedics, PGI (design of an orthopaedic device)

8. International Collaboration:

1.Dr.Navin Kumar with Prof. Greg Swadener (Aston University, UK) working on the collaborative project related to mechanical properties changes in atherosclerosis.

9. Research Publications:

a). Journals:

1. A. Bhowmik, R. Singh, Ramjee Repaka, S.C.Mishra, "Conventional and newly developed bioheat transport models in vascularized tissues - a review", J. Therm. Biology, 38, 2013, pp. 107-125.

2. A. Bhowmik, Ramjee Repaka, S. C. Mishra, K. Mitra, "Analysis of radiative signals from normal and malignant human skins subjected to a short-pulse laser", International Journal of Heat and Mass Transfer, 68, 2014, pp. 278-294.

3. A. Bhowmik, Ramjee Repaka S. C. Mishra, "Thermal analysis of increasing subcutaneous fat thickness within human skin – A numerical study", Numerical Heat Transfer, Part A (Accepted).

4. Soni, S., Tyagi, H., Taylor, R. A., and Kumar, A., "Role of Optical Coefficients and Healthy Tissue Sparing Characteristics in Gold Nanorod Assisted Thermal Therapy", International Journal of Hyperthermia, Vol. 29(1), pp. 87-97, Feb 2013.
(doi:<http://dx.doi.org/10.3109/02656736.2012.753162>)

5. Tiwari, A.K. and Prasad, J., 2013, "Investigating the Role of Shear Strain in Bone Adaptation," Indian Journal of Biomechanics, Vol. 4(1), pp. 26-34.

6.JiemingGao, Peiming Chen, Yashveer Singh, Xiaoping Zhang, Zoltan Szekely, Stanley Stein, and Patrick J. Sinko "Novel monodisperse PEG tidedendrons: design, fabrication, and evaluation of mannose receptor-mediated macrophage targeting", *Bioconjugate Chemistry* 24, 2013 (IF: 4.580)

7. Anu Prathap M.U., Rajendra Srivastava, and Biswarup Satpati Simultaneous detection of guanine, adenine, thymine, and cytosine at polyaniline/MnO₂ modified electrode *Electrochimica Acta* 114 (2013) 285-295.
8. Anu Prathap M.U., Carlos Alberto Huerta Aguilar, Thangarasu Pandiyan, and Rajendra Srivastava Synthesis of imidazole based NHC-Au(I) complexes and their application in non-enzymatic glucose sensing *Journal of Applied Electrochemistry* 43 (2013) 939-951.
9. Balwinder Kaur, Thangarasu Pandiyan, Biswarup Satpati, Rajendra Srivastava Simultaneous and sensitive determination of ascorbic acid, dopamine, uric acid, and tryptophan with silver nanoparticles-decorated reduced graphene oxide modified electrode *Colloids and Surfaces B: Biointerfaces* 111 (2013) 97– 106.
10. Balwinder Kaur, Rajendra Srivastava Simultaneous determination of ascorbic acid, dopamine, uric acid, and tryptophan by nanocrystalline ZSM-5 modified electrodes *Journal of Nanoscience and Nanotechnology* (Accepted 11th April 2013).
11. M.U. Anu Prathap, Rajendra Srivastava Tailoring properties of polyaniline for simultaneous determination of a quaternary mixture of ascorbic acid, dopamine, uric acid, and tryptophan *Sensors & Actuators: B. Chemical* 177 (2013) 239-250.
12. M.U. Anu Prathap, B. Kaur, Rajendra Srivastava Direct synthesis of metal Oxide incorporated mesoporous SBA-15 and their applications in non-enzymatic sensing of glucose *Journal Colloid and Interface Science* 370 (2012) 144–154
13. Balwinder Kaur, M.U. Anu Prathap, Rajendra Srivastava Synthesis of transition metal exchanged nanocrystalline ZSM-5 and their application in electrochemical oxidation of glucose and methanol *Chem Plus Chem* 77 (2012) 1119-1127.
14. M.U. Anu Prathap, Balwinder Kaur, Rajendra Srivastava Hydrothermal synthesis of CuO micro-/nanostructures and their applications in the oxidative degradation of methylene blue and non-enzymatic sensing of glucose/H₂O₂ *Journal Colloid and Interface Science* 381 (2012) 143-151.
15. M.U. Anu Prathap, Bhawana Thakur, Shilpa N. Sawant, Rajendra Srivastava, Synthesis of mesostructured polyaniline using mixed surfactants, anionic sodium dodecylsulfate and non-ionic polymers and their applications in H₂O₂ and glucose sensing *Colloids and Surfaces B: Biointerfaces* 89 (2012) 108–116.
16. D.A. Fair, D.R. Bathula, M. A. Nikolas and J. T. Nigg, "Distinct neuropsychological subgroups in typically developing youth inform heterogeneity in children with ADHD," *Proceedings of the National Academy of Sciences*, April 2012.
17. K.L.Mills, D.R.Bathula, T.G.Dias, S.P.Iyer, M.C.Fenesy, E.D.Musser, C.A. Stevens,

B.L.Thurlow, S.D.Carpenter, B.J.Nagel, J.T.Nigg, D.A.Fair, "Altered Cortico-Striatal-Thalamic Connectivity in relation to Spatial Working Memory Capacity in Children with ADHD," *Frontiers in Psychiatry*, January 2012.

18. Singh, T. P., Singh, H. and Singh, H., (2012), "Characterization, Corrosion Resistance and Cell Response of High Velocity Flame Sprayed HA and HA/TiO₂ Coatings on 316L SS", *J. Thermal Spray Technol.*, Vol. 21, pp. 917–927.

19. Singh, T. P., Singh, H. and Singh, H., (2012), "Characterization and In-Vitro Corrosion Investigations of Thermal Sprayed Hydroxyapatite and Hydroxyapatite-Titania Coatings on Ti-Alloy", *Metall. Mater. Trans. A*, Vol. 43, pp. 4365-4376.

20. Singh, T. P., Singh, H. and Singh, H., (2012), "Characterization of Thermal Sprayed Hydroxyapatite Coatings on Some Biomedical Implant Materials", *J. Appl. Biomater. Biomech.*, DOI: 10.5301/JABFM.2012.9267.

b). Conferences:

1. Soni, S., Tyagi, H., Taylor, R. A., and Kumar, A., "Spatiotemporal Temperature in a Tumor During Nanorod Assisted Thermal Therapy", Paper No. NEMB2013-93053, ASME 2013 2nd Global Congress on Nano Engineering for Medicine and Biology, Boston, Massachusetts, USA, Feb. 4-6, 2013. (doi:<http://dx.doi.org/10.1115/NEMB2013-93053>).

2. Soni, S., Tyagi, H., and Kumar, A., "Numerical Computation of Spatiotemporal Temperature Field in a Cancerous Tissue During Plasmonic Photothermal Therapy", Paper No. ISHMT-IND-00-003, 21st National and 10th ISHMT-ASME Heat and Mass Transfer Conference, IIT Madras, Chennai, India, Dec. 27-30, 2011.

3. Soni, S., Tyagi, H., and Kumar, A., "Light Interaction of a Nanoparticle Embedded Tissue towards a Novel Hyperthermia Treatment", OPTICS:PHENOMENA, MATERIALS, DEVICES, AND CHARACTERIZATION: OPTICS 2011: International Conference on Light, held at NIT Calicut, Calicut, India, May 23-25, 2011. Published in AIP Conference Proceedings, Vol.1391(1), pp.724-727, Oct 2011.
(doi:<http://dx.doi.org/10.1063/1.3643661>)

4. Soni, S., Tyagi, H., and Kumar, A., "Role of Blood Flow and Thermal Response of a Cancerous Tissue During Hyperthermia", Paper No. FMFP2010-153, 37th National and 4th International Conference on Fluid Mechanics and Fluid Power, IIT Madras, Chennai, India, Dec. 16-18, 2010.

5. A. Bhowmik, Ramjee Repaka, S.C. Mishra, K. Mitra, Thermal assessment of ablation limit of subsurface tumor during focused ultrasound and laser heating, Proceedings of the 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference 2013, 28-31 December 2013, IIT Kharagpur, INDIA.

6. A. Bhowmik, Ramjee Repaka, R. Mulaveesala, S.C. Mishra, Thermal characterization of varying subcutaneous fat thickness using thermal wave imaging technique, Proceedings of the 22nd National and 11th International ISHMT-ASME Heat and Mass Transfer Conference 2013, 28-31 December 2013, IIT Kharagpur, INDIA.
7. Arka Bhowmik, Ramjee Repaka, S.C. Mishra, Thermal Imaging and Screening of Subsurface Cancer during Thermal Recovery after Cold Stress, The 10th International Conference on Flow Dynamics ICFD 2013, 25-27 November 2013, Sendai, Japan.
8. Arka Bhowmik, Ramjee Repaka, S.C. Mishra, Ravibabu Mulaveesala, Detection of Subsurface Skin Lesion Using Frequency Modulated Thermal Wave Imaging: A Numerical Study, ASME 2013 International Mechanical Engineering Congress and Exposition, 15-21 November 2013, San Diego, CA, USA.
9. Arka Bhowmik, Ramjee Repaka, S.C. Mishra, Ultra-short Pulse Laser: A Potential Tool for Breast Cancer Detection, The 9th International Conference on Flow Dynamics ICFD 2012, 19-21 September 2012, Sendai, Japan.
10. Arka Bhowmik, Ramjee Repaka, S.C. Mishra, Short-pulse Laser Transport in Biological Tissue with and without Malignant Lesion, 2nd International Conference on Biomedical Engineering and Assistive Technologies, 6-7 December 2012, Jalandhar, India.
11. Arka Bhowmik, Ramjee Repaka, S.C. Mishra, Diagnosis of Malignances in Human Tissues: A Review of Non-Invasive Thermal Techniques, the 8th International Conference on Flow Dynamics ICFD 2011, Sendai, Japan, 9-11 November 2011.
12. Grover, K., Thakuria, J., Wasudeo, N.S., Gopinathan, N.R., and Prasad, J., 2014, "A Biomimetic Implant for Osteogenesis Imperfecta," 2nd International Conference on Medical Materials, Devices & Regenerative Medicine (MMDRM-2014), January 11-13, 2014, Kathmandu, Nepal (invited talk by J. Prasad)
13. Badhyal S., Saini K., Dhiman V., Kumar A., Bhadada S. K., Kumar, N., "Pilot study for evaluating the micromechanical properties of bone in Osteogenesis Imperfecta (OI) and Osteoporosis patients", 9th Annual Meeting of the Indian Society for Bone and Mineral Research (ISMBR), 7th -8th Sep., 2013, Sher-e-Kashmir Institute of Medical Sciences (SKIMS), Jammu & Kashmir, India.
14. Saini K. and Kumar N., "Intrinsic compressibility and volume compression in Collagen proteins by Molecular Dynamics Simulation at high pressures", International Conference on Design of Biomaterials (BIND-12), 09-11 December, 2012, IISc Bangalore, Bangalore, India.
15. Saini K. and Kumar N., "Structural changes in Collagen protein molecules under high hydrostatic pressures", Mechanical Manipulations (MM-2013) 15th-26th April, 2013, National

Centre for Biological Sciences (NCBS) Bangalore, India.

16. Tiwari, A.K., and Prasad, J., 2012, "Investigating the Role of Shear Strain in Bone Adaptation," International Conference on Design of Biomaterials (BIND-12), December 9-11, 2012, Indian Institute of Science (IISc), Bangalore.

17. Soni, S., Tyagi, H., and Kumar, A., "Optical Coefficients of Gold Nanorod Embedded Tissue – Variant Parameters", Photonics 2012 - International Conference on Fiber Optics and Photonics, IIT Madras, Chennai, India, Dec. 9-12, 2012.

18. Soni, S., Kumar, A., and Tyagi, H., "Plasmonics Instrumentation – A New Era for the Cancer Therapeutics", National Symposium on Instrumentation (NSI-37), CSIO, Chandigarh, India, Oct. 30 - Nov. 01, 2012.

19. Soni, S., Tyagi, H., Taylor, R. A., and Kumar, A., "Numerical Analysis of Nanoparticle Distribution in a Tumor following Intramuscular Injection of Nanofluid", International Conference on Frontiers of Nanoscience, Nanotechnology and Their Applications (NanoSciTech-2012), Punjab University, Chandigarh, India, Feb. 16-18, 2012.

20. Soni, S., Kumar, A., and Tyagi, H., "Numerical Analysis of Nanoparticle Distribution in a Tumor and its Effect on Enhanced Hyperthermia", Poster No. P-63, International Conference on Nano Sensors and Technology, CSIO, Chandigarh, India, Oct. 28-30, 2010.

21. Yashveer Singh, Polymeric vaginal hydrogels and gp120 surface binding inhibitors to prevent HIV-1 infection, Asian Polymer Association International Conference on Polymers: Visions and Innovations, India Habitat Center, New Delhi, 19-21 February 2014 (accepted for oral presentation)

22. Kumar, S., Kumar, D., Tiwari, A. K., and Prasad, J., 2014, "Investigating Bone's Adaptation to Mechanical Environment Using Neural Networks," 2nd International Conference on Medical Materials, Devices & Regenerative Medicine (MMDRM-2014), January 11-13, 2014, Kathmandu, Nepal (Oral Presentation).

23. Tiwari, A.K., and Prasad, J., 2014, "Bone's Adaptation to Mechanical Loading: Fluid Flow Versus Shear Strain," 2nd International Conference on Medical Materials, Devices & Regenerative Medicine (MMDRM-2014), January 11-13, 2014, Kathmandu, Nepal (poster presentation).

c). Editorial:

1. Yashveer Singh, Systemic delivery remains a major challenge for oligonucleotide-based therapeutics? Journal of Nanomedicine and Biotherapeutic Discovery 2013, 3(2), e124

d). Invited Talks Delivered:

1. Dr. Yashveer Singh: *Design, development, and evaluation of PEG-based biomaterials for targeted drug delivery*, 50 Annual Convention of Chemists, Indian Chemical Society, Department of Chemistry, Panjab University, Chandigarh, 6 December 2013.

2. Dr. Yashveer Singh: *Emerging trends in biomedical nanotechnology*, Department of Applied Sciences, RIMT - Institute of Engineering and Technology, Mandi Gobindgarh, 20 August 2013.

3. Dr. Deepti R. Bathula: *NeuroImaging with MRI: An Insight into Brain Structure & Function*, Speaker, Symposium on Image Processing & Pattern Recognition, SAU, New Delhi, India (Nov 2013).

4. Dr. Deepti R. Bathula: *Brain Connectivity Analysis Using Resting State Functional MRI*, Expert Lecture, Panjab University, Chandigarh, India (Oct 2013).

10. Research Projects:

S.NO	Title of the Project	Sponsored Agency	Duration	Amount	Role of Investigator
1	Assessment of thermally induced damage of healthy cell volume during radiofrequency ablation of breast malignant tissue.	DST, India	3 Years (expected from Apr, May'14)	24 Lakhs	Dr. Ramjee Repaka (Principal investigator)
2	Design and development of Schiff base- based pH sensitive hydrogels for vaginal microbicidal deliver.	ISIRD IIT Ropar	2 Years (Jun'13 – Jun'15)	4 Lakhs 40 thousand	Dr. Yashveer Singh
3	Biomechanical Regulation of Bone Repair	ISIRD IIT Ropar	3 years (Sep'11 – Jun'14)	16 Lakhs	Dr. Jitendra Prasad (Principal investigator) (Collaborator: Dr. Nirmal Raj Gopinathan, Orthopaedics, PGI)
4	To design closed loop automated blood pressure control system	DST,India	3 Years	57.2 Lakhs (IITRopar's share 26.56 Lakhs)	Dr. Navin Kumar (Co-PI) (collaboration with PGI)

5	Neuroimage processing and analysis techniques	ISIRD IIT Ropar	3 Years (Sep'11 – Jul'14)	10 Lakhs	Dr. Deepti R. Bathula
6	Neuroimaging – towards integrated analysis of multi- site functional MRI Data,	DST – FAST-SERB	3 Years (expected from Apr, May'14)	24 Lakhs	Dr. Deepti R. Bathula
7	Smart Phone Based Real-Time Remote Monitoring of Cardiac Patients From Hospital Coronary Care Units (CCU's)	DST, India	3 Years (Jan'13 – Jan'16)	32 Lakhs	Dr. J. S. Sahambi (PI) (Consultant: Dr. Rohit Manoj Kumar, Cardiology, PGI)
8	Human Language Processing	ISIRD, IIT Ropar	3 Years (Aug'12 - Jul'15)	59 Lakhs	Dr. Kamal Kumar Choudhary
9	Neurocognition of Ergative Language	DST (Cognitive science research Initiative)	3 years (Aug'13 – Jul'16)	40 Lakh 60 thousand	Dr. Kamal Kumar Choudhary

11. Awards/Recognitions:

1. Received best technical session paper award for the paper titled: "Short-pulse Laser Transport in Biological Tissue with and without Malignant Lesion", A. Bhowmik, Ramjee Repaka and S.C. Mishra, in 2nd International Conference on Biomedical Engineering and Assistive Technologies 2012, NIT Jalandhar, Punjab, India.

12. Future Plans:

(a) Short Term:

1. A series of six undergraduate-level BME courses (e.g. Biology, Biochemistry, Anatomy & Physiology, and Introduction to BME as core plus two electives such as Biomechanics, Biomaterials etc.) equivalent to a minor in Biomedical Engineering is being planned. The courses will be designed soon.

2. The following laboratories are under construction and expected to be ready soon:

- Biomechanical Creativity and Innovation Lab (new shed)
- BME Program Office & Common Lab Facility (Room 340)
- Biomedical Engineering Lab (L 8)
- Cognitive/EEG Lab (Room 340)

3. The inaugural BME News letter and the Brochure are expected to be published this semester.

4. Institutional Ethical Committee (IEC) and Institutional Animal Ethics Committee (IAEC) are expected to be formed. A committee has been formed to look into this.

(b) Long Term:

1. The BME Program is to be slowly converted into a Bioengineering department to accelerate the Biomedical Engineering program at IIT Ropar by recruiting its own faculty members and running its own academic programs such as B.Tech., M.Tech. and Ph.D. Independent budgeting and a status equivalent to a department will be a big advantage.

2. MoU with medical colleges such as PGIMER will be very helpful in the long term, which will enable a joint UG/PG program and faculty/student exchange.

Appendix 1: Historical Background of the BME Program

The foundation of Biomedical Engineering Program at IIT Ropar traces back to August 2011, when three BME-related courses (“CSL711 Advanced Image Processing”, “MEL617 Biology for Engineers” and “MEL618 Molecular, Cellular and Tissue Biomechanics”) were started being taught to PhD students. In the following semester, the first undergraduate-level BME course “MEL415 Biomechanics” was offered along with four postgraduate-level BME courses – “CSL631 Physics of Medical Imaging”, “HUL609 Cognitive Neuroscience of Language”, “MEL515 Bone Biology” and “MEL517 Orthopedic Biomechanics”. Since then, three undergraduate-level and ten postgraduate-level Biomedical Engineering courses in total have been being offered to the students.

The PGIMER-IIT Ropar collaborative BME research program at IIT Ropar started with the efforts of Dr. Jitendra Prasad to establish his collaboration with Dr. Mandeep Dhillon, then HOD of Orthopaedics at Post Graduate Institute of Medical Education & Research (PGIMER). A meeting was held on 23 September 2011 between Dr. Dhillon and Dr. Prasad to work on a research project to study biomechanical regulation of bone fracture healing. As the project involved experiments with mice and IIT Ropar did not have animal facilities, Dr. Dhillon promised to help with the experiments. Based on this promise, Dr. Jitendra Prasad wrote a proposal for ISIRD grant, which was approved by IIT Ropar. In the meantime, Dr. Dhillon got Dr. Prasad in touch with Dr. Deepak Kaul, HOD of Experimental Medicine & Biotechnology, PGIMER.

It was visit of two faculty members (Prof. Vipin Kumar and Prof. Per Reinhall) from University of Washington (UW) at Seattle to IIT Ropar on 4th November 2011 that started bringing people interested in BME together. As the primary focus of the possible UW-IIT Ropar collaboration was health and energy research, Dean (Academic & Research), Prof. P. K. Raina accordingly asked Dr. Jitendra Prasad to give presentation to the visitors on the biomedical topics that IIT Ropar faculty members (namely, Dr. Anshu dhar Jayal, Dr. Deepti Bathula, Dr. Harpreet Singh, Dr. Jitendra Prasad, Dr. J. S. Sahambi, Dr. Manoranjan Mishra, Dr. Narinder Singh, Dr. Rajendra Srivastava) had been working. Collaboration between UW and IIT Ropar never took off; however, faculty members from different departments interested in BME started coming together as a group, which later came to be known as the BioGroup.

On 5 December 2011, PhD admission written test and interview were conducted in the School of Mechanical, Materials and Energy Engineering (SMMEE). It was the first time in IIT Ropar’s history that some written tests were designed to evaluate candidates’ knowledge and aptitude in Biology.

In January 2012, a meeting was held at PGI Chandigarh where a group of PGI doctors and faculty members led by PGI Director Prof. Yogesh Chawla and a group of IIT Ropar faculty members (namely, Dr. Deepti Bathula, Dr. Jitendra Prasad and Dr. J.S. Sahambi) led by IIT Ropar Director Prof. M. K. Surappa discussed possible collaboration between IIT Ropar and

PGIMER Chandigarh. This meeting was followed up by an informal lunch meeting following IIT Kanpur's Dr. Ashok Kumar's presentation on tissue engineering at PGI on 14 March 2012.

On Feb 2012, Dr. Navin Kumar visited IMTech and talked with Dr. R.Surifor a possible collaboration in Biomedical areas. Dr. N. Sachdeva (Endocrinology, PGI) was also present in the meeting.

On March 2012, Dr. Navin Kumar visited PGI and interacted with Dr.N.Sachdeva for possible research collaboration.

On May 2012, there was a brainstorming session to discuss about a possible research area. The session was attended by Dr. Sanjay Bhadada (Endocrinology, PGI), Dr. N. Sachdeva (Endocrinology, PGI), Dr. Navin Kumar and two students.

Around mid-March 2012, Dr. Jitendra Prasad in consultation with Dr. Deepti Bathula wrote an application proposing a new UG course titled "Introduction to Biomedical Engineering". This course was later taught to the students by Dr. Navin Kumar in the First Semester of the academic year 2013-14.

On 2 May 2012, Dr. Jitendra Prasad (as Coordinator of Curriculum Development) gave a seminar on "Overhauling of UG Curriculum". It was proposed that a compulsory biology-related course be the part of the new curriculum. A minor program in Bioengineering was also proposed.

On 4th June 2012, Dr. Jitendra Prasad visited Biological Sciences department of Indian Institute of Science Education and Research (IISER), Mohali to explore collaboration.

By May 2012, Dr. Jitendra Prasad realized that senior doctors, especially HODs are too busy to easily meet with and therefore requested Dr. Dhillon to get him in touch with a junior faculty member. Accordingly, in a meeting at PGI on 12 June 2012, Prof. Dhillon introduced Dr. Nirmal Raj Gopinathan, Assistant Professor, Orthopaedics to Dr. Prasad.

PGI's Golden Jubilee Research Day was held on 11 August 2012. PGI Director had invited faculty members of IIT Ropar. Dr. Jitendra Prasad organized a trip to PGI on this day. A few faculty members (namely, Dr. Ramjee Repaka, Dr. Rakesh Kumar, Dr. Prabir Sarkar, Dr. Kamal Kumar Choudhary, Prof. P. K. Raina, Dr. Navin Kumar, and Dr. Jitendra Prasad) and research scholars (Mr. AbhishekTiwari and Mr. Arka Bhowmik) attended the event. This conference was very useful for the IIT faculty members as a few of them got connected with PGI doctors for research collaboration. For example, Dr. Navin Kumar got introduced to PGI's Dr. G. D. Puri's anesthesia machine on that day and they later started working together.

Dr. Jitendra Prasad also met with Dr. Nirmal Raj on that same day and discussed about the details of the project. Dr. Nirmal Raj also showed interest in working on implants for Osteogenesis Imperfecta. Based on the discussion, three Mechanical Engineering B.Tech. Students (namely, Kartikey Grower, Sridhar Narkhede and Jyotiraj Thakuria) started working on

a novel biomimetic telescopic implant for Osteogenesis Imperfecta. This work was later presented in an international conference in January 2014.

Dr. Navin Kumar interacted with Dr. Sandeep Bansal (Otolaryngology, PGI) on 11th Aug 2012 and talked about development of low cost Otoacoustic devices. Dr. Navin Kumar developed an idea, based on which two B.Tech. students have worked on the project.

On 30 August 2012, Prof. M. K. Surappa called a meeting with the BioGroup members to discuss about the collaboration with PGI and asked Dr. Jitendra Prasad to formally lead the BioGroup. Dr. Prasad was also asked to compile research interests of the faculty members, so that Prof. Surappa could forward that list to PGI Director Prof. Yogesh Chawla. On 6 September 2012, a meeting of BioGroup members held and Dr. Prasad forwarded the final compiled list of the research interests to Prof. Surappa. Then onwards the BioGroup started meeting weekly, although only for a couple of months.

In the meantime, some efforts were on by all the institutes in Chandigarh region to join hands to form a Bio-Cluster. In this context, there was a meeting of the institutional heads of this region scheduled on 2 October 2012 at PGIMER. Dr. Jitendra Prasad attended the meeting on Prof. Surappa's behalf. After the meeting, Prof. Chawla introduced Dr. Prasad to Dr. Ritesh Agarwal, an Associate Professor in the Dept of Pulmonary Medicine, who was going to coordinate the IIT-PGI collaboration from PGI side. Dr. Shalmoli Bhattacharyya (Dept of Biophysics, PGI) who works with stem cells invited Dr. Prasad to see her lab at PGI. As she had been working with stem cell application in orthopaedics, there was a potential for a good collaboration in the area of bone tissue engineering.

On 9 October 2012, Dr. Jitendra Prasad followed up with Dr. Ritesh Agarwal and forwarded him the compiled list of research interests of IIT Ropar's faculty members. Dr. Agarwal forwarded that list to PGI's faculty members.

On 17 October 2012, there was a meeting held at PGI Director's office where Dr. Jitendra Kumar Sharma (from World Health Organization) talked on affordable healthcare. The attendees included Prof. Yogesh Chawla, Prof. M. K. Surappa, Prof. Mandeep Dhillon (Orthopaedics), Dr. Malhotra (Pharmacology), Dr. Ajay Bahl (Cardiology) and Dr. Jitendra Prasad. There was a discussion on how PGI and IIT Ropar can collaborate on affordable healthcare. In discussion with Dr. Jitendra Prasad; Dr. Samir Malhotra and Dr. Ajay Bahl showed interest in working with IIT Ropar. Dr. Jitendra Prasad followed up later and requested the interested IIT faculty members to get in touch with them. Dr. Narinder Singh has been collaborating with Dr. Samir Malhotra since then.

On 18 October 2012, Dr. Jitendra Kumar Sharma visited IIT Ropar on request of Dr. Surappa and discussed with the BioGroup about innovation in clinical engineering.

On 21 October 2012, Bioscience's Cluster meeting was held IIT Ropar. Dr. Jitendra Prasad gave presentation introducing IIT Ropar's activities in biomedical areas and about the role IIT

Ropar would like to play in the upcoming Bio-Cluster.

On 3 November 2012, Dr. Ritesh Agarwal forwarded the compiled list of the research interests of the IIT faculty members to PGI faculty members for collaboration, and there were a few responses from the PGI faculty members. In particular, Dr. Ashish Sharma (Dept. of Transplant Surgery), Prof S K Gupta (Department of Neurosurgery), and Sunit Singhi, (Head, Department of Pediatrics) responded with an interest to collaborate and IIT Ropar faculty members (Dr. Ekta Singla, Dr. Kamal Kumar Choudhary, Dr. Rakesh Kumar and Dr. Rajendra Srivastava) followed up with them.

On 10 November 2012, a biological science cluster meeting was held at CSIO, Chandigarh. Prof. P. K. Raina and Dr. Jitendra Prasad went to attend the meeting. Dr. Prasad personally talked to CSIO Director, Dr. Kapur for using their biomechanics (GAIT) lab as part of the Biomechanics course that Dr. Prasad was going to teach the following semester. Dr. Kapur agreed for that. As the focus of the proposed BioCluster moving towards Biomass (rice straw, in particular), Dr. Prasad suggested that Dr. Harpreet Singh, Dr. Himanshu Tyagi or Dr. Navin Kumar should attend the meeting then onwards. Dr. Harpreet Singh, Dr. Navin Kumar and Dr. Sagi Sudhakar went to attend the next meeting at Punjab University, Chandigarh.

On 19 November 2012, a news article entitled "PGI to collaborate with IIT Ropar for Research Work" published in Hindustan Times Chandigarh.

On 17 January 2013, Dr. Jitendra Prasad visited Dr. Shalmoli Bhattacharyya's laboratory in the Biophysics department at PGI. She needed a scaffold for the use in tissue engineering. Dr. Prasad later introduced her to Dr. Debprasad Mandal (Chemistry), who has been collaborating since then with her for research. Later, Dr. Shubhendu Sarkar has also visited her lab along with Dr. Mandal and has collaboration there since then.

On 28 January 2013, Dr. Prasad visited CSIO Gait Lab with his fourteen Biomechanics students. Dr. Neelesh Kumar showed the Gait Lab to the students and introduced Dr. Prasad to Mr. Vijay Kumar Meena, who works on bone implants. Mr. Meena wanted to be connected with a faculty member at IIT Ropar with the similar research interests. Dr. Prasad accordingly got him in touch with Dr. Anshu Dhar Jayal. Since then, Mr. Meena has visited IIT Ropar several times as a part of the collaboration with Dr. Anshu Dhar Jayal. Dr. Nilesh Kumar and his students later visited IIT Ropar to learn the basics of the gait-analysis software "OpenSim".

Dr. Nirmal Raj wanted to introduce Dr. Jitendra Prasad to Dr. Sanjay Badada (Department of Endocrinology, PGI) for a long time; however, it was not until around mid-February 2013 that Dr. Nirmal Raj drove Dr. Prasad to Dr. Badada's place for a meeting, after which, Dr. Badada and his student Mrs. Vandana Dhiman became the part of the bone fracture healing project. Dr. Jitendra also came to know that Dr. Navin Kumar had earlier met Dr. Badada and both of them had already started collaborating on the effect of Diabetes on bone material properties.

In Mid March 2013, Dr. Sanjay Bhadada (Endocrinology, PGI) added Dr. Nirmal Raj

(Orthopaedics, PGI) in his collaborative work with Dr. Navin Kumar on mechanical properties of biological materials.

On 23 March 2013, Dr. Jitendra Prasad took initiatives to set up a Biomedical Engineering Program and wrote a proposal for that. The members of Biomedical Group supported the idea and a few of them (especially Dr. Yashveer Singh, Dr. Anshu Dhar Jayal and Dr. Navin Kumar) helped with the editing of the proposal.

On 5 April 2013, Dr. Nirmal Raj Gopinathan, Assistant Professor, Orthopaedics, PGI visited IIT Ropar and gave a talk on bone implants. This led to collaboration between him and Dr. Navin Kumar.

The proposal for the BME Program was finally approved in May 2013. On 17 May 2013, Dr. Jitendra Prasad was made the Coordinator of the Biomedical Engineering Program. An email-group (biogroup@iitrprac.in) started on the same day.

Appendix 2: Major Events Since the Inception of BME Program

The proposal for the BME Program was finally approved in May 2013. On 17 May 2013, Dr. Jitendra Prasad was made the Coordinator of the Biomedical Engineering Program. An email-group (biogroup@iitrprac.in) started on the same day.

Dr. Yashveer Singh and Dr. Jitendra Prasad worked on the space requirements for the Biomedical Engineering building planned on the new campus. The space requirements were sent to relevant committee on 31 May 2013.

On 12 June 2013, Dr. Akshay Anand, Department of Neurosurgery, PGI visited IIT Ropar. Professor Surappa introduced him to Dr. Kamal Kumar Choudhary and Dr. Jitendra Prasad. A meeting followed where Dr. Anand, Dr. Kamal Kumar Choudhary, Dr. Yashveer Singh and Dr. Jitendra Prasad discussed about the collaboration between PGI and IIT Ropar. Among others, Dr. Akshay Anand offered to share high-profile speakers. It was decided that the next meeting be held on 24 June 2013, at PGI at Dr. Anand's Neuroscience Research Lab.

On 24 June 2013, eight IIT Ropar faculty members (namely, Dr. Anshu Dhar Jayal, Dr. Jitendra Prasad, Dr. Kamal Kumar Choudhary, Dr. Manoranjan Mishra, Dr. Navin Kumar, Dr. Rakesh Kumar, Dr. Vishwajeet Mehandia, and Dr. Yashveer Singh) visited PGI. They were received by Dr. Akshay Anand who escorted them to the office of Prof. Arunaloke Chakravorty, Head, Department of Medical Microbiology who welcomed the visiting team. They later visited the Neuroscience Research Laboratory and had luncheon discussions with research scholars. The team from IIT met the Director, Prof. Yogesh Chawla who greeted the team individually and discussed a range of issues for building collaborations for enhanced educational, research and innovative activities. Dr. Akshay Anand was asked by Prof. Chawla to form a team of young faculty members from PGI in consultation with Prof. Arunaloke Chakravorty such that it could continue to drive this multidisciplinary initiative by engagement of other departments and stakeholders.

On 3 Jul 2013, Dr. Himanshu Tyagi contacted Dr. Akshay Anand (through BME Program) for collaboration at PGI on thermal treatment of cancers. Dr. Anand introduced him to Dr. Kanchan Mukherjee from Neurosurgery department.

On 12 July 2013, an application for the recruitment of a staff (Junior Lab Assistant –cum- Office Assistant) for the BME Program was approved by the Director.

On 24 July 2013, Dr. Ramjee Repaka needed a collaborator at PGI's Radiology department. He was directed to contact Dr. Akshay Anand, who connected him to Dr. Sunil Dogra, Dermatology, PGI for research.

On 26 July 2013, construction work for the BME Program Office, common laboratory facility and Cognitive/EEG lab in Room 340 was approved by the Director. A tender for the construction work was floated the same day. An advertisement was also published on that day on IIT

Ropar's website inviting applications for the position of a Junior Lab Assistant-cum-Office Assistant.

On 5 August 2013, Dr. Akshay Anand introduced Dr. Balveen Kaur (Associate Professor, and Vice Chair of Neuro-Oncology Research, Department of Neurological surgery, Ohio State University) to Dr. Jitendra Prasad over email. As a part of Dr. Anand's initiative to share high-profile speakers, Dr. Balveen Kaur was invited by Dr. Jitendra Prasad to deliver a talk on 20 August 2013. Dr. Navin Kumar organized her visit to IIT Ropar. Her visit to IIT Ropar led to research collaboration between her and Dr. Yashveer Singh.

On 8 August 2013, Dr. Devendra Kumar Chouhan, Asst. Professor, Orthopaedics, PGI talked on phone with Dr. Jitendra Prasad as he needed some help on an instrument he had made for taking some orthopaedic measurements during surgery. Dr. Prasad sent this information to the IIT faculty members with some initial tips to Dr. Chouhan to solve the problem. Dr. Prasad also offered to meet with him in person to discuss this further.

Around mid-August 2013, Dr. Jitendra Prasad's B.Tech. Project student, Mr. Kartikey Grover (2009 batch, ME), who worked on a biomimetic implant for Osteogenesis Imperfecta, headed to Stony Brook University (The State University of New York) to do his MS in Biomedical Engineering.

Dr. Jitendra Prasad attended the meeting held on 3 September 2013 at the office of Mrs. Vini Mahajan, Principal Secretary, Health & Family Welfare, Govt. of Punjab. There were discussions on how to increase private investment in the state in health and pharmaceutical sector, and how can the various educational institutions in the state can collaborate with the Punjab Govt. and help in this regard. The Principal Secretary conveyed that the state medical colleges (such as Govt. Medical Colleges at Patiala and Amritsar) would like to collaborate with IIT Ropar and would write a letter to IIT Ropar later requesting for such collaboration.

While returning from the Principal Secretary's office, Dr. Jitendra Prasad met with Dr. Devendra Kumar Chouhan at PGI's Orthopaedics department. Dr. Prasad came to know that Dr. Navin Kumar and Dr. Prabir Sarkar had already visited him earlier. Dr. Prabir Sarkar and Dr. Navin Kumar have been since then collaborating with Dr. Chouhan.

On 5 September 2013, Dr. C.N. Tharamani requested Dr. Jitendra Prasad to find a collaborator at PGI. Dr. Akshay Anand forwarded my request to Dr. Ritesh Agarwal, who introduced Dr. Tharamani to Dr. Navneet Singh, Pulmonary Medicine, PGI. Although Dr. Anand was travelling abroad, Dr. Tharamani had contact of Dr. Navneet Singh within 35 minutes of her email to Dr. Jitendra Prasad.

On 6 September 2013, a committee to complete the recruitment process for the BME program staff was formed. The committee comprised of Dr. Deepti R. Bathula, Dr. Jitendra Prasad and Dr. Yashveer Singh.

Accepting an invitation by Dr. Navin Kumar, Dr. D.Sudhakar Rao (Director, Bone & Mineral Research Laboratory, Henry Ford Hospital, USA) gave a talk on “the role of histomorphometry in bone research” on 9th September 2013.

On 9 September 2013, Dr. Anshu Dhar Jayal needed a collaborator at PGI. Dr. Jayal has been connected with Dr. Nirmal Raj Gopinathan.

Around the first week of October 2013, animal experiments started at PGI for the ISIRD project of Dr. Jitendra Prasad (in collaboration with Dr. Nirmal Raj Gopinathan and a few of his colleagues at PGI) after approval from PGI’s Institutional Animal Ethics Committee. This is the first animal experiment ever for IIT Ropar.

Dr. Yashveer Singh coordinated the recruitment process on behalf of Biomedical Engineering Program. On 10 October 2013, a written test followed by an interview was conducted for the Junior Lab Assistant –cum- Office Assistant post. On 22 November 2013, Mrs. Sowjanya Dinesh N.B. was given an offer of employment. Mrs. Sowjanya joined BME Program as Lab Assistant –cum- Office Assistant on 29 November 2013.

On 8 January 2014, a Purchase Committee for the BME Program (consisting of Dr. Jitendra Prasad, Dr. Kamal Kumar Choudhary, Dr. Navin Kumar, and Dr. Yashveer Singh) was formed.

On 16 January 2014, a website for the Biomedical Engineering Program (<http://www.iitrpr.ac.in/bme>) was created.

On 31 January 2014, order placed for the purchase of furniture for the common lab facility in Room 340.

On 7 February 2014, a tender has been floated on IIT Ropar’s website for the purchase of an upright epi-fluorescent microscope with color, cooled CCD camera. This microscope will be the part of the common lab facility in Room 340.

On 11 February 2014, the Director met with the BioGroup members and discussed on various issues concerning the BME program. It was decided that a Center for Biomedical Engineering will be formed.

A proposal for a Center for Biomedical Engineering Program was drafted by Dr. Jitendra Prasad in consultation with the BioGroup members. With endorsement of the BioGroup members, the proposal was submitted for further processing on 18 February 2014.