

## Dr Samuel JK Abraham

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### **Educational Qualification:**

S.No	Degree	Institution	Year
1	primary medical degree	Tirunelveli Medical College	1992
2	post-graduate	Yamanashi Medical University	1999

### **Positions Held:**

S.No	Position	Organization	Year
1	Faculty of Medicine	Yamanashi University	Till date
2	Lecturer	Centre for advancing clinical research, Yamanashi University	2012 – Till date
3	Founder & Director	Nichi-In Centre for Regenerative Medicine	2005 – Till date
4	Distinguished Visiting Professor	University of Toronto	2012 & 2018
5	Adjunct Faculty	INDICASAT, Panama	2012
6	Member, Scientific Board	International Stem Cell Academy	Till date
7	Scientific Advisor	Edogawa Evolutionary Laboratory of Science	Till date
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### **Publications:**

1. Takizawa K, Osawa H, Kojima A, Abraham SJK, Hosaka S. Cystic Adventitial Disease of Popliteal Artery with Venous Aneurysm of Popliteal Vein: Two-Year Follow-Up after Surgery. Case Rep Vasc Med. 2017;2017:4873474.
2. Osawa H, Yoshii S, Abraham SJ, Okamoto Y, Hosaka S, Fukuda S, Tsuchiya K, Nakajima M, Honda Y, Takizawa K. Topical spraying of cefazolin and gentamicin reduces deep sternal wound infections after heart surgery: a multicenter, large volume, retrospective study. Gen Thorac Cardiovasc Surg. 2016 Apr;64(4):197-202.

3. Osawa H, Yoshii S, Abraham SJ, Hosaka S, Suzuki S, Ogata K, Akashi O, Higuchi H, Tada Y. Critical values of hematocrit and mixed venous oxygen saturation as parameters for a safe cardiopulmonary bypass. Jpn J ThoracCardiovasc Surg. 2004 Feb;52(2):49-56.
4. Yoshii S, Akashi O, Kobayashi M, Kojima A, Abraham SJ, Shindo S, Tada Y, Higuchi H. Preliminary results of intermittent retrograde cerebral perfusion during proximal aortic arch surgery. Jpn J ThoracCardiovasc Surg. 2003 Nov;51(11):588-93.
5. Osawa H, Yoshii S, Hosaka S, Suzuki S, Abraham SJ, Tada Y. Left atrial dissection after aortic valve replacement. J ThoracCardiovasc Surg. 2003 Aug;126(2):604-5.
6. Higuchi H, Yoshii S, Osawa H, Suzuki S, Abraham SJ, Hosaka S, Shindo S, Tada Y. A new formula to calculate perfusion rate in advanced hemodilution and tepid cardiopulmonary bypass. KyobuGeka. 2002 Nov;55(12):1021-5.
7. Yoshii S, Suzuki S, Hosaka S, Osawa H, Takahashi W, Abraham SJ, Tada Y, Sugiyama H, Tan T, Kanazawa H. Partial left ventriculectomy in pediatric end-stage dilated cardiomyopathy. Jpn J ThoracCardiovasc Surg. 2002 Jun;50(6):235-40.
8. Yoshii S, Suzuki S, Osawa H, Hosaka S, Honda Y, Abraham SJ, Tada Y, Sugiyama H, Tan T, Kadono T, Hoshiai M, Komai T. Accessory hepatic vein complicating extra-cardiac total cavopulmonary connection. Ann ThoracCardiovasc Surg. 2002 Apr;8(2):112-4.
9. Yoshii S, Suzuki S, Hosaka S, Osawa H, Takahashi W, Takizawa K, Abraham SJ, Tada Y, Sugiyama H, Tan T, Kadono T. A case of Uhl anomaly treated with one and a half ventricle repair combined with partial right ventriculectomy in infancy. J ThoracCardiovasc Surg. 2001 Nov;122(5):1026-8.
10. Yoshii S, Suzuki S, Hosaka S, Osawa H, Takahashi W, Takizawa K, Abraham SJ, Tada Y, Sugiyama H, Tan T, Kadono T. A case of Uhl anomaly treated with one and a half ventricle repair combined with partial right ventriculectomy in infancy. J ThoracCardiovasc Surg. 2001 Nov;122(5):1026-8.
11. Osawa H, Yoshii S, Takahashi W, Hosaka S, Ishikawa N, Mizutani E, Abraham SJ, Tada Y. Hemorrhagic shock due to intrathoracic rupture of an osteosarcoma of the rib. Ann ThoracCardiovasc Surg. 2001 Aug;7(4):232-4.
12. Yoshii S, Hosaka S, Suzuki S, Takahashi W, Okuwaki H, Osawa H, Abraham SJ, Tada Y. Prevention of surgical site infection by antibiotic spraying in the operative field during cardiac surgery. Jpn J ThoracCardiovasc Surg. 2001 May;49(5):279-81.
13. Higuchi H, Yoshii S, Osawa H, Suzuki S, Samuel A, Hosaka S, Shindou S, Tada Y. Whole-body oxygen consumption at different temperatures during cardiopulmonary bypass. KyobuGeka. 2000 Sep;53(10):841-6. Japanese.
14. Tada Y, Kamiya K, Shindo S, Kobayashi M, Iyori K, Ishimoto T, Abraham SJ, Takayama Y. Simultaneous repair of arch and abdominal aortic aneurysms. A simple new technique using a temporary bypass graft. Jpn J ThoracCardiovasc Surg. 1999 Sep;47(9):419-24.

15. Yoshii S, Hosaka S, Takahashi W, Amano H, Abraham SJ, Kaga S, Tada Y, Sugiyama H, Yanai J. Partial left ventriculectomy in an infant with dilated cardiomyopathy. J ThoracCardiovasc Surg. 1999 Mar;117(3):616-8.
16. Osawa H, Takahashi W, Yoshii S, Hosaka S, Kaga S, Fukuda N, Samuel A, Nagasaka S, Miyauchi Y, Tada Y. Surgical treatment of 2 cases of irradiation induced constrictive pericarditis. KyobuGeka. 1999 Nov;52(12):1048-51.
17. Yoshii S, Suzuki S, Hosaka S, Samuel A, Takahashi W, Okuwaki H, Matsubara H, Amashiro N, Tada Y. Fenestration of diaphragm for management of persistent postoperative pleural effusion: clinical experience and experiment in rabbits. KyobuGeka. 1998 Aug;51(9):760-4. Japanese.
18. Abraham S, Yoshioka H, Mori Y. Nanotechnology in Tissue Engineering and Regenerative Medicine. Book Chapter; Chapter 15, Nanomaterials and Hazard assessment; Ed: Mohanan PV; Educational Book Centre, Mumbai, India (2011); ISBN: 9788190362615 (NCRM Ref. No. 2013004920)
19. Abraham S, Terunuma H, Dedeepiya V, Premkumar S, Preethy S. An overview of treatment for cervical cancer with emphasis on Immune cell-based therapies. International Manual of Oncology Practice. (iMOP) - Principles of Medical Oncology. de Mello, Ramon Andrade, Tavares, Álvaro, Mountzios, Giannis (Eds.).Springer International Publishing. 2015. eBook ISBN: 978-3-319-21683-6. Hardcover ISBN 978-3-319-21682-9 (NCRM Ref. No. 2017005225)
20. Vaddi SP, Reddy VB, Abraham S. Buccal epithelium Expanded and Encapsulated in Scaffold-Hybrid Approach to Urethral Stricture (BEES-HAUS) procedure: A novel cell therapy-based pilot study. Int J Urol. 2018 Nov 22.
21. Parikumar P, Haraguchi K, Senthilkumar R, Abraham SJ. Human corneal endothelial cell transplantation using nanocomposite gel sheet in bullous keratopathy. Am J Stem Cells. 2018 Feb 1;7(1):18-24 (NCRM Ref. No. 2018005229)
22. Chidambaram R, Terunuma H, Balamurugan M, Dedeepiya V, Sumana P, Senthilkumar R, Rajmohan M, Karthick R, Preethy S, Abraham S. Cell based immunotherapy in a stage IIIA inflammatory breast cancer with declining innate immunity following successive chemotherapies; A case report. Molecular and Clinical Oncology. <https://doi.org/10.3892/mco.2017.1333> (NCRM Ref. No. 2017005228)
23. Preethy S, Dedeepiya V, Senthilkumar R, Rajmohan M, Karthick R, Terunuma H, Abraham S. Natural killer cells as a promising tool to tackle cancer—A review of sources, methodologies, and potentials. International Reviews of Immunology 2017. doi: <http://dx.doi.org/10.1080/08830185.2017.1284209> | PubMed (NCRM Ref. No. 2017005227)
24. Abraham SJ, Yoshioka H. Insights into in vitro environments for human cartilage tissue engineering. Indian J Med Res 2016;144:796-8 | PubMed (NCRM Ref. No. 2017005226)

25. Arumugam S, BhupeshKarthik B, Rajeswar C, Mori Y, Yoshioka H, Senthilkumar R, Rajmohan M, Karthick R, Preethy S, Abraham S. Transplantation of autologous chondrocytes ex-vivo expanded using Thermoreversible Gelation Polymer in a rabbit model of articular cartilage defect. *Journal of Orthopedics* 2017: 14(2);223–25. (NCRM Ref. No. 2017005224) | [PubMed](#)
26. Baskar S, Dedeepiya V D, Terunuma H, Manjunath S R, Senthilkumar R, Sivaraman G, Pandian A, Abraham S. Prolonged survival of a patient with inoperable, locally advanced adenocarcinoma of pancreas after autologous immune enhancement therapy with chemotherapy. *Indian J Cancer* 2015;52:395-6. (NCRM Ref. No. 2017005223) | [PubMed](#)
27. Rajalakshmy AR, Malathi J, Madhavan HN, Samuel J. Mebiolgel, a thermoreversible polymer as a scaffold for three dimensional culture of Huh7 cell line with improved hepatocyte differentiation marker expression and HCV replication. *Indian J Med Microbiol.* 2015 Oct-Dec;33(4):554-9. (NCRM Ref. No. 20160005212) | [PubMed](#)
28. Levy GA, Reena HC, Dedeepiya VD, William JB, Rajmohan M, Karthick R, Preethy S, Abraham SJ. A comparative analysis of the participation and knowledge gained by clinicians and researchers in a web based learning program on regenerative medicine. *J Contemp Med Edu.* Online First: 14 Oct, 2015. doi:10.5455/jcme.20150713024140 (NCRM Ref. No. 2017005222)
29. Osawa H, Orii K, Terunuma H, Abraham SJ. Combining autologous peripheral blood mononuclear cells with fibroblast growth factor therapy along with stringent infection control leading to successful limb salvage in diabetic patient with chronic renal failure and severe toe gangrene. *Int J Stem Cells.* 2014 Nov;7(2):158-61. (NCRM Ref. No. 2015005204) | [PubMed](#)
30. Bhamare S, PrabhakarP,Dharmadhikari A, Dedeepiya V, Terunuma H, Senthilkumar R, Srinivasan T, Reena HC, Preethy S, Abraham S. Autologous Immune Enhancement Therapy (AIET) in a case of Gall bladder cancer stage IV after surgical resection and chemotherapy yielding a stable non-progressive disease. *J Cancer Res Ther.* 2014 Jul-Sep;10(3):752-4. (NCRM Ref. No.2014005172) | [PubMed](#)
31. Dedeepiya VD, William JB, Parthiban JKBC, Yoshioka H, Mori Y, Kuroda S, Iwasaki M, Preethy S, Abraham SJK. Scaffolds for Cell Transplantation in Neurology: The Suitability of a Thermoreversible Gelation Polymer—Our Perspectives. *Journal of Spinal Surgery* 2014;1(1). (NCRM Ref. No. 2014005177)
32. Sankaranarayanan S, Jetty N, Gadagi JS, Preethy S, Abraham SJ. Periodontal regeneration by autologous bone marrow mononuclear cells embedded in a novel thermo reversible gelation polymer. *J Stem Cells.* 2013;8(2):99-103. (NCRM Ref. No. 2015005205) | [PubMed](#)

33. Dedeepiya V, William JB, Parthiban JKBC, Ranaganathan C, Balamurugan M, Kuroda S, Iwasaki M, Preethy S, Abraham S. The known-unknowns in spinal cord injury, with emphasis on cell based therapies – A review with suggestive arenas for research. Expert OpinBiolTher. 2014 May;14(5):617-34. doi: 10.1517/14712598.2014.889676.(NCRM Ref. No. 2015005203) | [PubMed](#)
34. Revathi Raj, Deenadayalan M, Vimal Kumar G, Khandelwal V, Karuna Sri, Senthilkumar R, Abraham S, Hiroshi T. Autologous Immune Enhancement Therapy in Philadelphia Chromosome Positive Acute Lymphoblastic Leukemia. Indian J Hematol Blood Transfus. 2014;30(Suppl 1):202-4. (NCRM Ref. No. 2014005157) | [PubMed](#)
35. Ganesh JS, Rao YY, Ravikumar R, Jayakrishnan AG, Iwasaki M, Preethy S, Abraham S. Beneficial effects of Black yeast derived 1-3, 1-6 beta glucan- NichiGlucan in a dyslipidemic individual of Indian origin - A case report. J Diet Suppl. 2014;11(1):1-6. doi:10.3109/19390211.2013.859211. (NCRM Ref. No. 2014005102) | [PubMed](#)
36. Parikumar P, Haraguchi K, Ohbayashi A, Senthilkumar R, Abraham S. Successful transplantation of in vitro expanded human cadaver corneal endothelial precursor cells on to a cadaver Bovine's eye using a Nanocomposite gel sheet. Curr Eye Res. 2014;39(5):522-6. doi:10.3109/02713683.2013.838633. (NCRM Ref. No. 2014005130) | [PubMed](#)
37. Krishnamohan J, Senthilnathan VS, Vaikundaraman TM, Srinivasan T, Balamurugan M, Iwasaki M, Preethy S, Abraham S. In vitro culture and characterization of enteric neural precursor cells from human gut biopsy specimens using polymer scaffold. Intractable Rare Dis Res. 2013 ;2(3):98-102. (NCRM Ref. No. 2013005054) | [PubMed](#)
38. Rao S, Sudhakar J, Parikumar P, Natarajan S, Insaan A, Yoshioka H, Mori Y, Tsukahara S, Baskar S, Manjunath S, Senthilkumar R, ThamaraiKannan P, Srinivasan T, Preethy S, Abraham S. Successful Transportation of Human Corneal Endothelial Tissues without Cool preservation in varying Indian Tropical climatic Conditions and in vitro Cell Expansion using a novel Polymer. Indian J Ophthalmol. 2014;62(2):130-5. (NCRM Ref. No. 2014005129) | [PubMed](#)
39. Srinivasan T, Dedeepiya V, John S, Senthilkumar R, Reena HC, Rajendran P, Balamurugan M, Kurosawa G, Iwasaki M, Preethy S, Abraham S. Smallpox still haunts scientists: Results of a questionnaire based inquiry on the views of health care and life science experts and students on preserving the remaining variola virus stocks. ScientificWorldJournal. 2013 Jul 22;2013:672813. <http://dx.doi.org/10.1155/2013/672813>. (NCRM Ref. No. 2013005034) | [PubMed](#)

40. Manikandan R, Muthu MS, Sunil PM, Shalini R, Kannan TA, Manjunath S, ThamaraiKannan P, Srinivasan T, Preethy SP, Abraham S. Isolation, *in vitro* expansion and characterization of stem cells from human exfoliated deciduous teeth. International Journal of Clinical Dentistry. 2012; 5(3):211-15. (NCRM Ref. No. 2013005033)
41. Sumana P, Dedeepiya V, Terunuma H, Senthilkumar R, Srinivasan T, Reena HC, Preethy S, Abraham S. Cell based Autologous Immune Enhancement Therapy (AIET) after radiotherapy in a locally advanced carcinoma of the cervix. Case Rep Oncol Med. 2013;2013:903094. <http://dx.doi.org/10.1155/2013/903094> (NCRM Ref. No. 2013005028) | [PubMed](#)
42. VelusamyVenkatesa K, Rejendran V, Senthilkumar R, Srinivasan T, Kubota S, Yamaji N, Abraham S. Efficacy of an Alcohol - Free, Citrate based Agent 'Clinister' as a Surface Disinfectant against Common Bacterial and Fungal Contaminants. Current trends in Biotechnology and Pharmacy. 2013; 7(2) :592-96 (NCRM Ref. No. 2013005011)
43. Preethy S, John S, Saravana Ganesh J, Srinivasan T, Terunuma H, Iwasaki M, Abraham S. Age old wisdom of Cell-based therapies with added knowledge in the stem cell era - Our perspectives. Stem Cells and Cloning: Advances and Applications. 2013; 2013(6): 13 - 18.(NCRM Ref. No. 2013005005) | [PubMed](#)
44. Takayama F, Amikura Y, John S, Dedeepiya V, Senthilkumar R, Venkataramani G, Cherian KM, Madhavan HN, Green DW, Matsumoto M, Suzuki S, Iwasaki M, Preethy S, Abraham S. Five-year trend of competitiveness and knowledge-gaining attitude of university students; Evaluation based on an event of continuing health sciences education. Journal of Contemporary Medical Education 2013; 1(2): 92-99. (NCRM Ref. No. 2013004954)
45. John S, Natarajan S, Parikumar P, Shanmugam M, Senthilkumar R, Green DW, Abraham S. Choice of cell source in cell based therapies for retinal damage due to age related macular degeneration (AMD): A review. Journal of Ophthalmology 2013 (2013), Article ID 465169, <http://dx.doi.org/10.1155/2013/465169>. (NCRM Ref. No. 2013004953) | [PubMed](#)
46. Dedeepiya V, SivaramanG,Venkatesh A, Preethy S, Abraham S. Potential Effects of NichiGlucan as a Food Supplement for Diabetes Mellitus and Hyperlipidemia; Preliminary Findings from the Study on Three Patients from India. Case Reports in Medicine 2012 (2012), Article ID 895370; doi:10.1155/2012/895370 (NCRM Ref. No. 2013004923) | [PubMed](#)
47. Abraham S. Reservations in Accepting That There Is "Depletion of Bone Marrow Progenitor Cells With Aging." Generalization Should Be Avoided. J Gerontol A

- BiolSci Med Sci. 2013 Apr;68(4):404-5. doi: 10.1093/gerona/gls189.(NCRM Ref. No. 2012004896) | [PubMed](#)
48. Dedeepiya VD, Rao YY, Jayakrishnan GA, Parthiban JK, Baskar S, Manjunath SR, Senthilkumar R, Abraham SJ. Index of CD34+ Cells and Mononuclear Cells in the Bone Marrow of Spinal Cord Injury Patients of Different Age Groups: A Comparative Analysis. Bone Marrow Res. 2012;2012:787414. (NCRM Ref. No. 2013004924) | [PubMed](#)
49. Manjunath S, Ramanan G, Dedeepiya V, Terunuma H, Deng X, Baskar S, Senthilkumar R, Thamaraikannan P, Srinivasan T, Preethy S, Abraham S. Autologous immune enhancement therapy in recurrent ovarian cancer with metastases; 18 months follow-up- A case report. Case Rep Oncol 2012;5:114-118; posted online on Mar 2012 (NCRM Ref. No. 2013004772) | [PubMed](#)
50. Green DW, Watson GS, Watson J, Abraham S. New Biomimetic Directions in Regenerative Ophthalmology. Adv. Healthcare Mater . 2012, DOI: 10.1002/adhm.201100039. (NCRM Ref. No. 2012004758) | [PubMed](#)
51. Sunil PM, Manikandhan R, Muthu MS, Abraham S. Stem cell therapy in oral and maxillofacial region: An overview. J Oral MaxillofacPathol 2012;16:58-63 (NCRM Ref. No. 2012004759) | [PubMed](#)
52. Senthilkumar R, Manjunath S, Baskar S, Dedeepiya DV, Natarajan S, John S, Parikumar P, Aditya I, Mori Y, Yoshioka H, Green DW, Balamurugan M, Tsukahara S, Abraham S. Successful Transportation and in vitro Expansion of Human Retinal Pigment Epithelium and its Characterization; a step towards Cell-based Therapy for Age related Macular Degeneration. Current Trends in Biotechnology and Pharmacy Jan 2012; Volume 6 (1): 44-54 (NCRM Ref. No. 2013004927)
53. Dedeepiya V, Terunuma H, Deng X, Baskar S, Manjunath S, Senthilkumar R, Murugan P, Thamaraikannan P, Srinivasan T, Preethy S, Abraham S. A comparative analysis of in vitro expansion of natural killer cells of a patient with autoimmune haemolyticanaemia and ovarian cancer with patients with other solid tumours. Oncology Letters. 2011;3(2). Doi: 10.3892/ol.2011.498; Posted online on Nov 29, 2011. (NCRM Ref. No. 2011004564) | [PubMed](#)
54. William JB, Prabakaran R, Ayyappan S Puskinraj H, Rao D, Manjunath S , Thamaraikannan P, Dedeepiya V, Kuroda S, Yoshioka H, Mori Y, Preethy S, Abraham S. Functional Recovery of Spinal Cord Injury Following Application of Intralesional Bone Marrow Mononuclear Cells Embedded in Polymer Scaffold - Two Year Follow-up in a Canine. J Stem Cell Res Ther.2011; 1:110. doi:10.4172/2157-7633.1000110; Posted online on Nov 21, 2011. (NCRM Ref. No. 2011004565)
55. Arumugam S, Manjunath S, Senthilkumar R, Srinivasan V, Rajendiran S, Yoshioka H, Mori Y, Samuel Abraham S. In vitro expansion and characterization of human

- chondrocytes using a novel Thermoreversible Gelation Polymer (TGP). J.Orthopaedics 2011;8(3)e5. (NCRM Ref. No. 2011004407) | [PubMed](#)
56. Subramaniyan R, Amalorpavanathan J, Shankar R, Rajkumar M, Baskar S, Manjunath SR, Senthilkumar R, Murugan P, Srinivasan VR, Abraham S. Application of autologous bone marrow mononuclear cells in six patients with advanced chronic critical limb ischemia as a result of diabetes: our experience. Cytotherapy. 2011 Sep;13(8):993-9. Epub 2011 Jun 15. (NCRM Ref. No. 2011004300) | [PubMed](#)
57. Sitalakshmi G, Sudha B, Madhavan HN, Vinay S, Krishnakumar S, Mori Y, Yoshioka H, Abraham S. Ex Vivo Cultivation of Corneal Limbal Epithelial Cells in a Thermoreversible Polymer (Mebiol Gel) and Their Transplantation in Rabbits: An Animal Model. Tissue Eng Part A. 2009 Feb;15(2):407-15. (NCRM Ref. No. 2008001483) | [PubMed](#)
58. Parveen N, Khan AA, Baskar S, Habeeb MA, Babu R, Abraham S, Yoshioka H, Mori Y, Mohammed HC. Intraoperative Transplantation of Hepatocytes Embedded in Thermoreversible Gelation Polymer (Mebiol Gel) in Acute Liver Failure Rat Model. Hepatitis Monthly 2008; 8(4): 275-280. (NCRM Ref. No. 2008001823)
59. Sudha B, Madhavan HN, Sitalakshmi G, Malathi J, Krishnakumar S, Mori Y, Yoshioka H, Abraham S. Cultivation of human corneal limbal stem cells in Mebiol gel - A thermo-reversible gelation polymer. 1. Indian J Med Res. 2006;124(6):655-64.(NCRM Ref. No. 2007000578) | [PubMed](#)
60. Madhavan HN, Malathi J, Joseph PR, Mori Y, Abraham S, Yoshioka H. A study on the growth of continuous culture cell lines embedded in Mebiol Gel. Current Science, 87(9), 1275 - 1277 (2004) (NCRM Ref. No. 2005000015)

### **Interests:**

1. Translation of bench-side technologies for in vitro cell culture and tissue engineering using nanomaterials and polymers to the bed-side.
2. Studying the complexity of physico-chemical-biological interactions by way of reproducing in vitro biomimicking systems with nanomaterials and environments.
3. Immortalization and arrest of the process of aging of cells by subjecting them to various physico-chemical-biological environments and influences including zero-gravity of the outer space.
4. Development and evolution of immune system through the ladder of phylogeny.



## **Projects:**

Areas of research in regenerative medicine include:

- (i) Corneal limbal stem cells, endothelial progenitors, ([cesbank.org](http://cesbank.org))
- (ii) Hybrid Artificial Corneal Prosthesis ([hybridcornea.org](http://hybridcornea.org))
- (iii) Hepatic progenitors for drug toxicology screening,
- (iv) Natural killer cell based immunotherapy for cancer & viral infections, ([www.aieforcancer.org](http://www.aieforcancer.org))
- (v) Human monoclonal antibodies for cancer,
- (vi) Cell based therapies for anti-aging,
- (vii) *In vitro* expansion of human hematopoietic stem cells,
- (viii) Tissue engineering of human chondrocytes,
- (ix) Nanomaterial based scaffolds for cell culture and tissue engineering,
- (x) Dental stem cells.