



Joint Institute for Regenerative Medicine

www.jirm.org

Joint Institute for Regenerative Medicine

Global Partnership
for Healthcare in the 21st Century



Institute for Regenerative Medicine



KYUNGPŌOK NATIONAL UNIVERSITY HOSPITAL



Mission

The Joint Institute for Regenerative Medicine (JIRM) was established on January 30th, 2009 by a long standing partnership between Kyungpook National University, School of Medicine in Korea and Wake Forest University, Institute for Regenerative Medicine (WFIRM) in the USA. JIRM is presently located in the Kyungpook National University Hospital (KNUH) and is focused on engineering a variety of tissues and organs by multidisciplinary teams with expertise in cell biology, molecular biology, genetics, materials science and engineering, imaging, biofabrication, sensor technology, drug delivery system, physiology, and surgery.

The goal of JIRM is to accelerate the clinical translation of regenerative medicine research and development for the benefit of patients who need organs and tissues through collaborative efforts and networking amongst institutions for regenerative medicine.

Regenerative Medicine

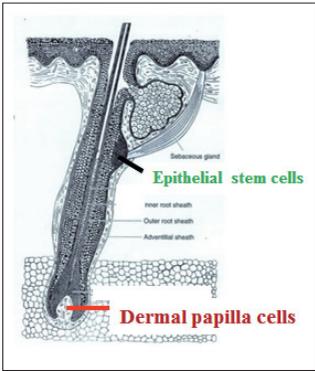
Regenerative Medicine has advanced through its initial roots of cell transplantation and subsequently tissue engineering to address the challenges of organ shortage. Regenerative medicine aims to develop tissues and organs to repair and replace damaged tissues with a goal of restoring normal anatomy and function.

Recent advances in technological innovations have brought hope to patients with diseases like cancer, diabetes, and those who suffer from tissue and organ loss and damage.

»» Engineering Various Functional Organs and Tissues at the Joint Institute for Regenerative Medicine



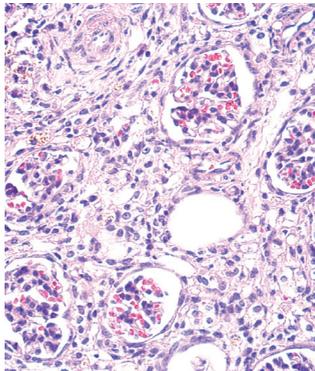
Bone



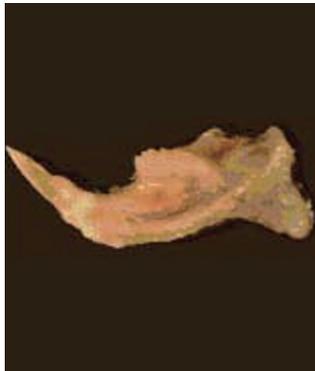
Skin & Hair



Muscle & Tendon



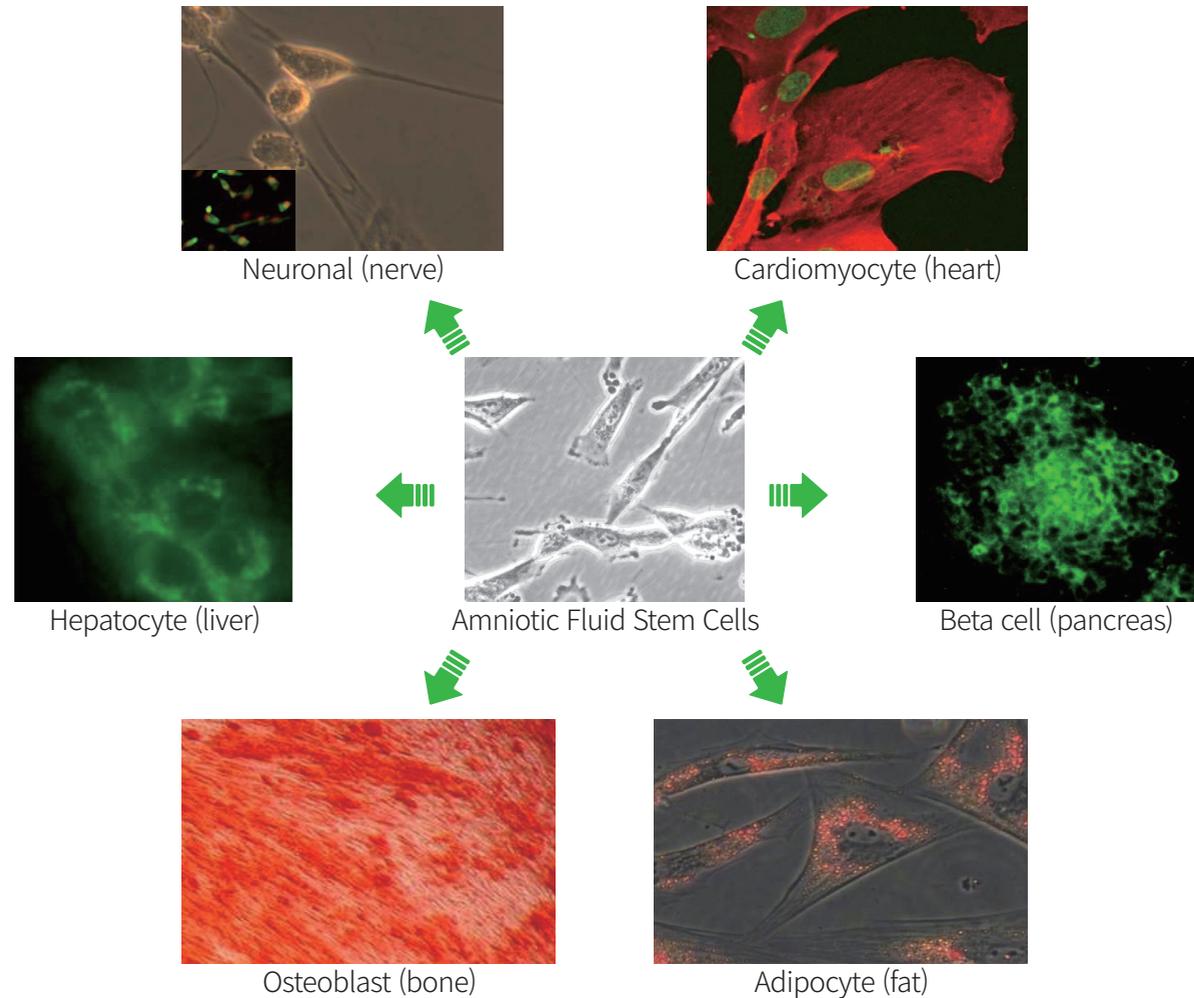
Kidney



Tooth

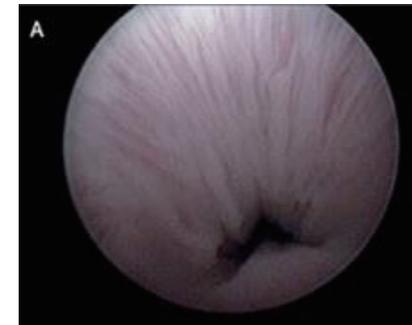
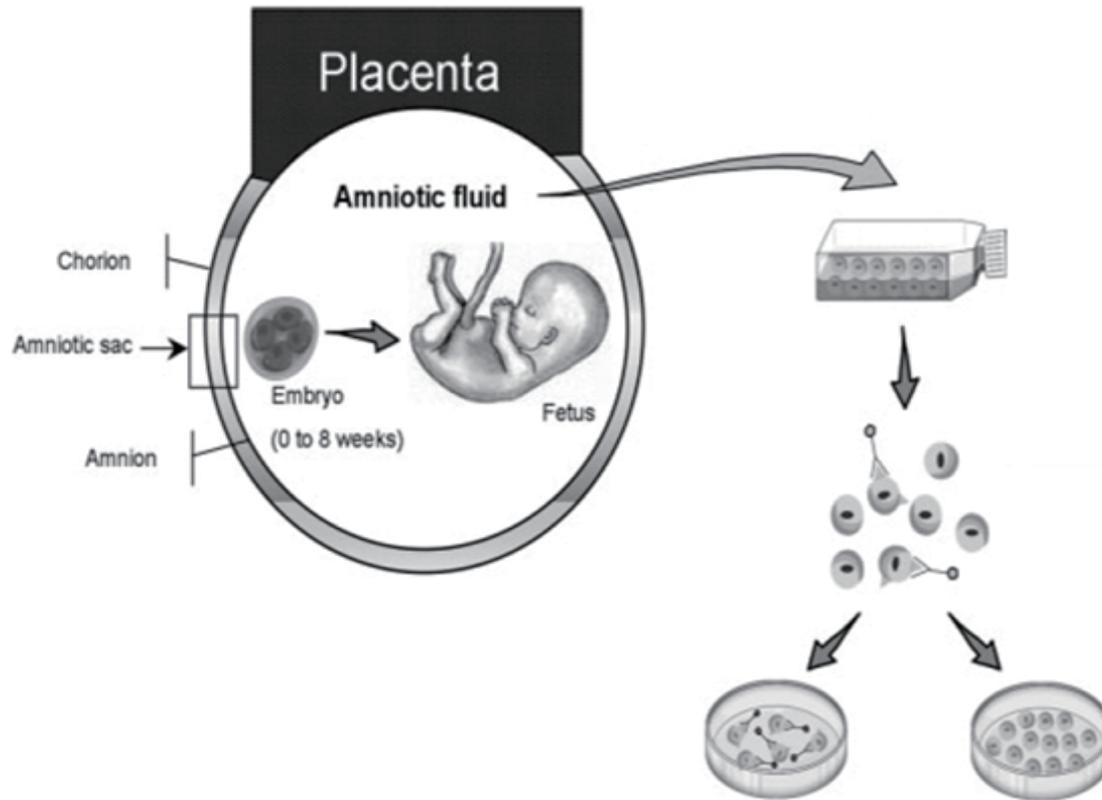
Stem Cell Sources

- Amniotic fluid stem cells
- Bone marrow stem cells
- Hair follicle stem cells
- Fat derived stem cells
- Tooth derived stem cells
- Urine derived stem cells



Human amniotic fluid stem cells for urethral sphincter muscle regeneration

➤➤ Sphincter muscle regeneration



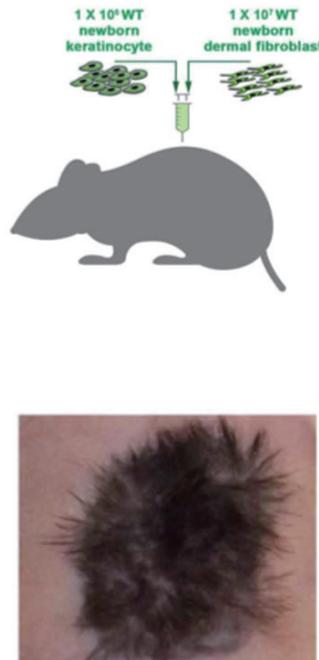
Before injection



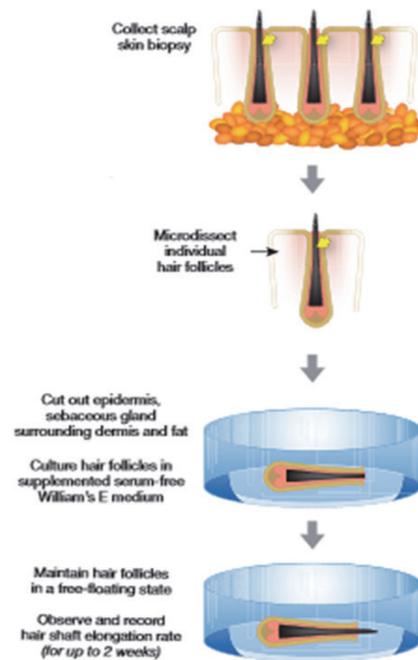
3 months after treatment

Hair follicle Stem cells for hair regeneration

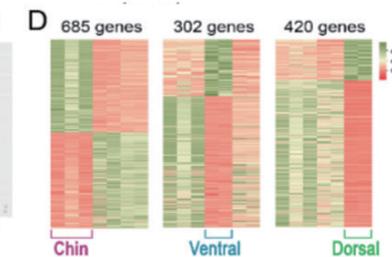
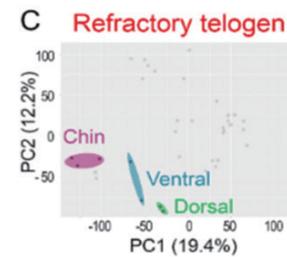
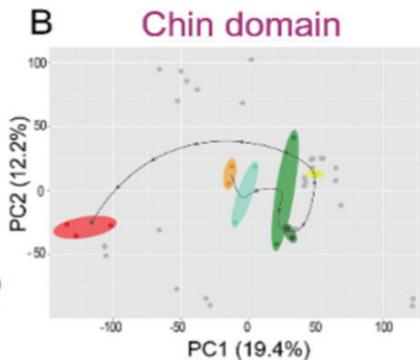
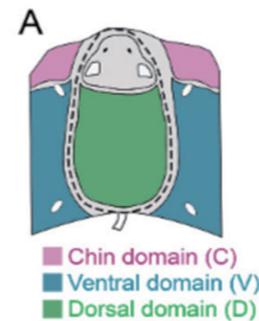
1) Xenograft assay:
Human hair transplantation onto SCID or Nude



2) In vivo assay:
Cell-based hair follicle neogenesis



3) Ex vivo assay:
Human hair organotypic culture



Bioreactor Systems

»» Smart Skin Bioreactor

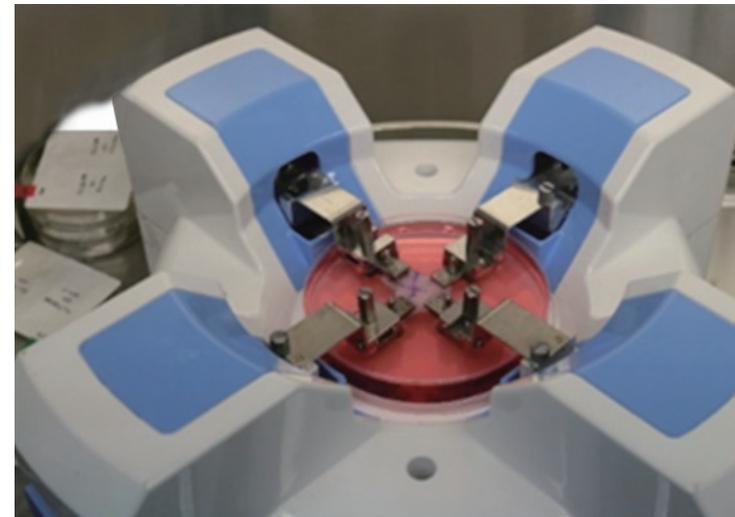
Expansion of full skin using the smart bioreactor technology for skin grafting

»» Key Features

- Portable System
- Removable Culture Chamber
- Sensor-based Alarm System
- Automatic Remote control
- Flexible Clamp Arms

»» Expected Effects

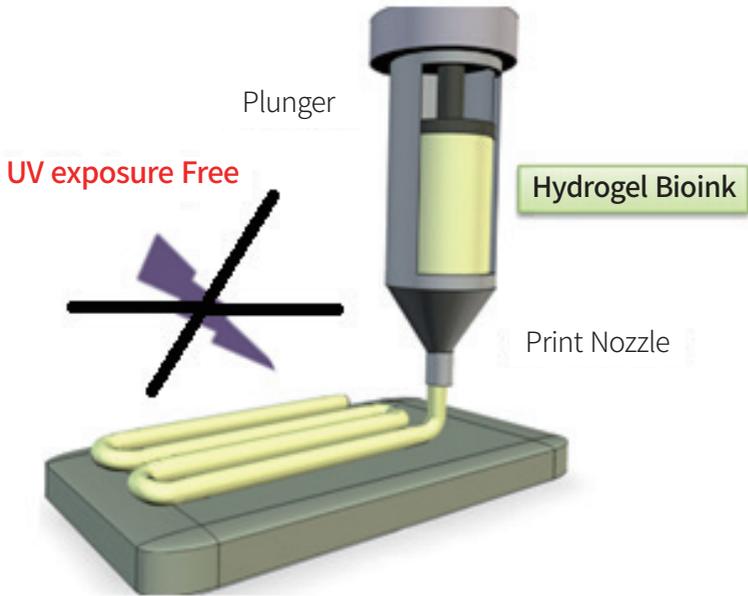
- Effective ex-vivo autologous skin expansion
- Immune compliant compliance
- Color match with surrounding skin
- High engraftment rate
- Minimize damage and scarring of engrafted skin
- Expansion > 200%



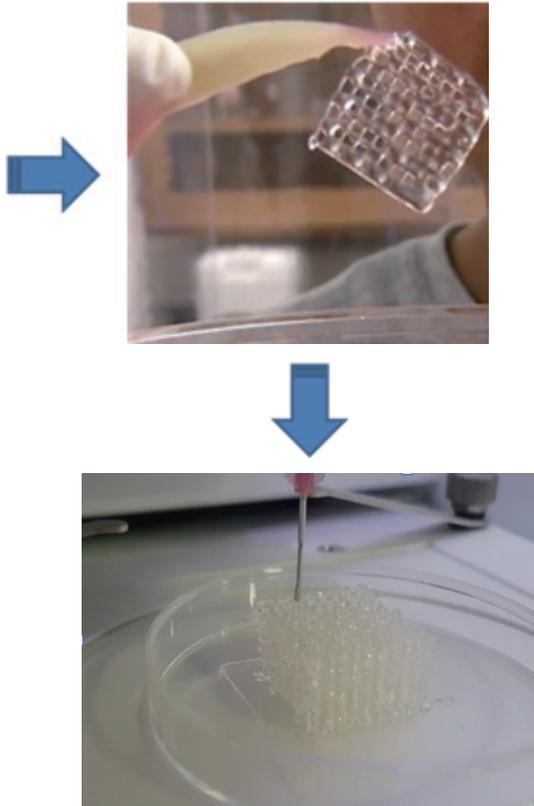
Automated Skin Bioreactor

Biofabrication and Bioink Development

Development of Photoinitiator free hydrogel based bioink for tissue construction



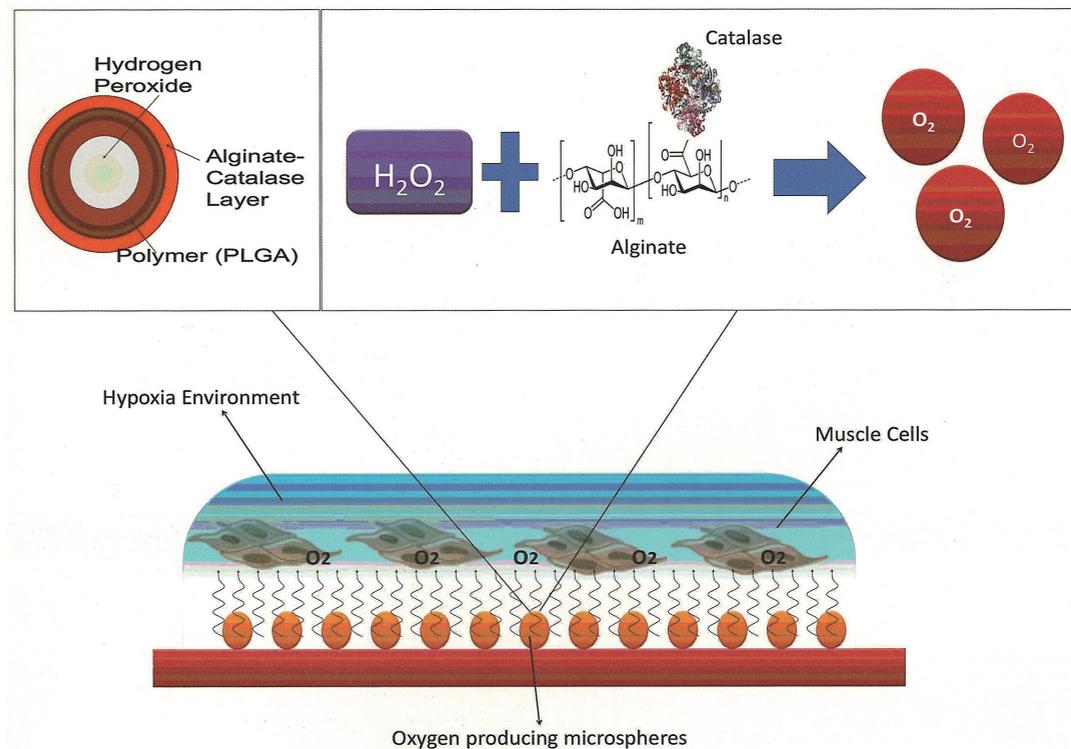
Peptide bioink for functional Skin Patch Development



Controlled Drug Delivery Systems

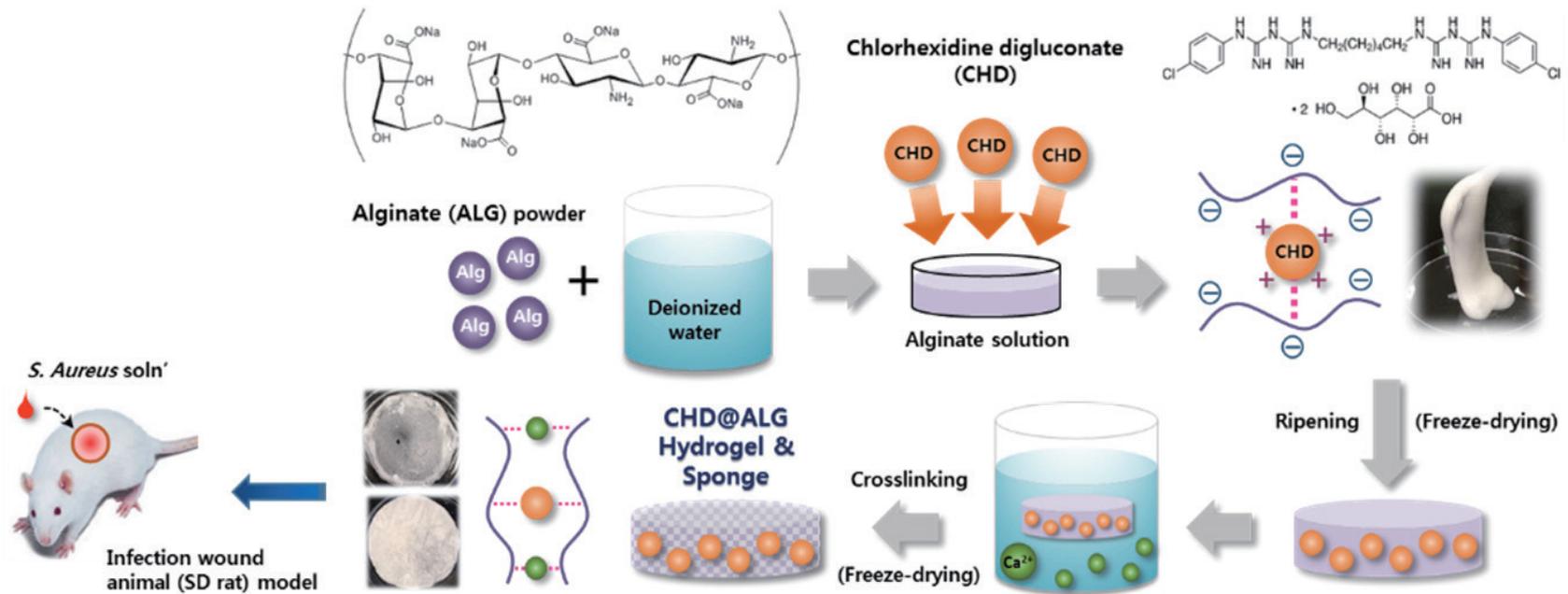
➤ Delivering pharmaceuticals to target tissue or organ site is important to achieve successful regenerative medicine therapies. Drug delivery vehicles have been developed as injectable microspheres, topical liposomes, implantable hydrogels and cell capsule devices.

➤ Polymenc H₂O₂ Capsule delivers oxygen to target tissues and organs



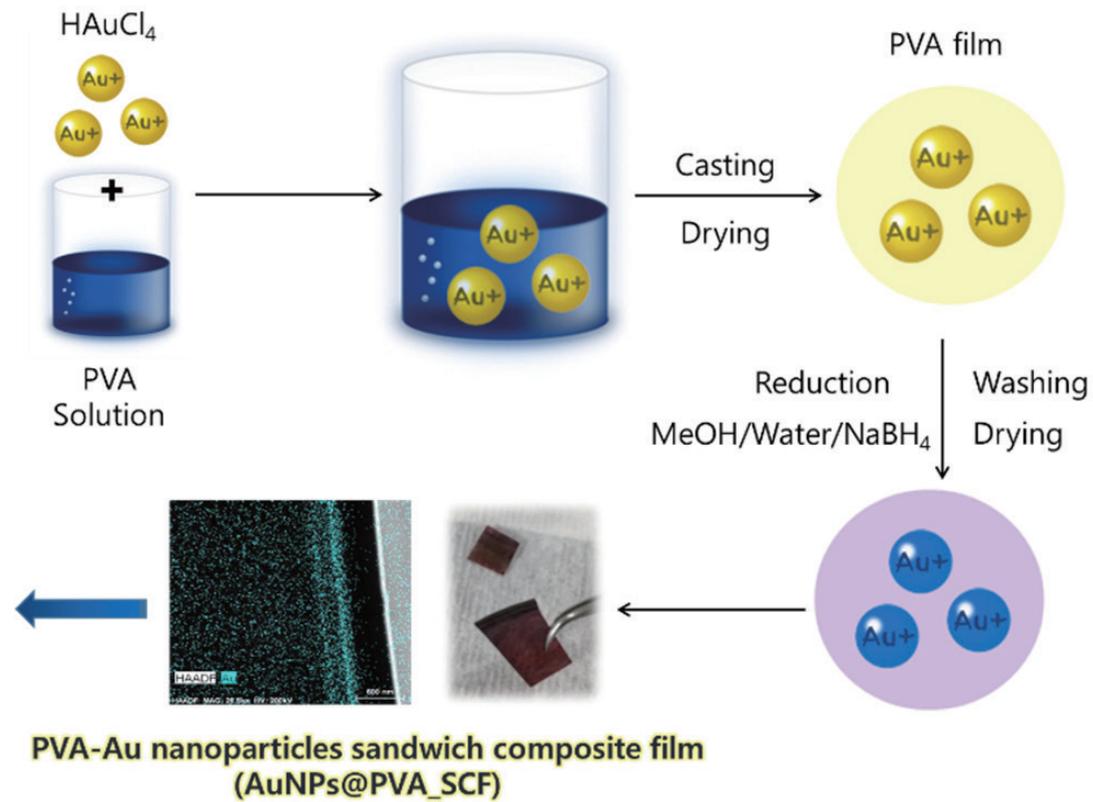
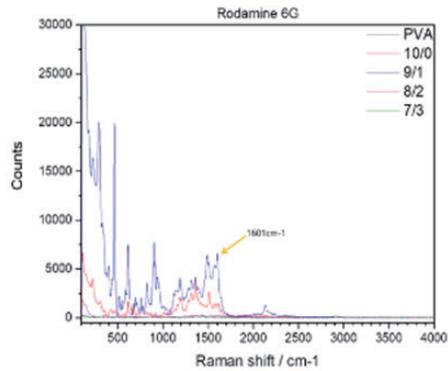
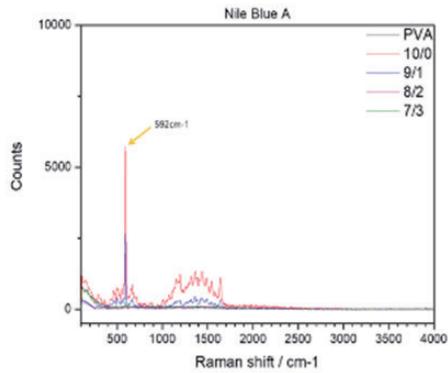
Wound Dressing

➤➤ Moisturized wound dressings in combination with drug delivery systems



Imaging

➤➤ Molecular imaging and biosensing using metal nanoparticles



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James J. Yoo, MD, PhD.

Co-Director(Overseas)

Dr. Yoo is a surgeon and researcher. In addition to his role at the Joint Institute for Regenerative Medicine (JIRM) at the Kyungpook National University Hospital, Dr. Yoo is a Professor, Associate Director and Chief Scientific Officer at the Wake Forest Institute for Regenerative Medicine (WFIRM), and is cross-appointed to the Departments of Urology, Physiology and Pharmacology and Biomedical Engineering. Dr. Yoo's research efforts have been directed toward the clinical translation of tissue engineering technologies and cell-based therapies. Dr. Yoo's background in cell biology and medicine has facilitated the transfer of several cell-based technologies from the bench-top to the bedside. A few notable examples of successful clinical translation include the bladder, urethra, vagina, and muscle cell therapy for incontinence. Dr. Yoo has been a lead scientist in the bioprinting program at WFIRM, and has been instrumental in developing skin bioprinting and integrated tissue and organ printing (ITOP) systems for preclinical and clinical applications. Dr. Yoo has authored more than 250 scientific publications, 50 patents, 800 scientific presentations, 220 invited lectures and mentored over 250 trainees, ranging from undergraduate students to practicing physicians.

Research Interests:

- Clinical translation of tissue engineering and regenerative medicine
- Progenitor and stem cells for engineering functional tissues and organs
- Development of enabling technologies for regenerative medicine
- Biofabrication
- In Situ Tissue Regeneration



Jeong Ok Lim, PhD.

Director of JIRM

Professor Lim is a scientist and researcher in medical polymers for regenerative medicine and drug delivery. Dr. Lim received her B.S in Korea, M.S. at Cornell University, Ph.D. in Polymer Science and Plastics Engineering at University of Massachusetts in 1993. She had postdoctoral training at Dr. Langer's lab at MIT, and Harvard Medical School in the field of drug formulation and evaluation in vivo for pain management. She was an Assistant Professor at the Wake Forest Institute for Regenerative Medicine (WFIRM) from 2004 through 2006. She was an affiliated faculty member of the Virginia Tech – Wake Forest University School of Biomedical Engineering and Sciences. Currently she is a Professor at Kyungpook National University School of Medicine in Korea and adjunct Professor at WFIRM, and Director of Joint Institute for Regenerative Medicine www.jirm.org.

Research Interests:

- Biomedical applications of biomaterials
- Controlled drug delivery systems of growth factor
- Liposome for Topical Anesthetics
- Cell carrier
- Regenerative medicine enabling technology
- Diagnose system using cell chip technology
- Functional Bioink Development
- Hydrogel for Wound healing



Jang Soo Suh, MD, PhD.

Founding Director of JIRM

Prof. Jang Soo Suh graduated from Kyungpook National University, School of Medicine (BS, MD, 1981), Graduate School (MS, Lab Medicine, 1987) Chungnam National University, Graduate School (PhD, Physiology, 1993). He served as the director of Kyungpook National University Hospital, Biomedical Research Institute and Joint Institute for Regenerative Medicine (2009-12). And Prof. Suh served as Dean of Kyungpook National University, School of Medicine (2012-14), President of Korean Society of Blood Transfusion (2008-11), President, Korean Society of Diagnostic Hematology (2015) and President elect, Korean Society for Laboratory Medicine (2019). He published 60 SCI articles, 6 Patents, Tech Transfer and Commodification, and developed Medical devices and kits such as RBC deformability device, G6PD deficiency screening POCT kit, STD immunoassay kit. Currently he is CEO of Bioink Solution, Ltd.

Research Interests:

- Diagnostic Hematology and Transfusion Medicine: hematologic neoplasm diagnosis, immunology of blood cells, hematopoietic stem cell transplantation
- Hemorheology study: RBC deformability, aggregation, platelet function tests
- Medical device and Kits R&D: G6PD deficiency screening POCT kit, HbA1c QC, leukocyte removal filter R&D and verification
- Regenerative Medicine: hematopoietic stem cell differentiation, 3D bioprinting
- Cardiovascular disease prediction using with RBC physical characteristics
- New medical devices and kits R&D and verification
- Artificial bone marrow system build using 3D bioprinting and bioink



Tae Gyun Kwon, MD, PhD.

Vice Director of JIRM

Dr. Tae Gyun Kwon is a surgeon in the Urological Cancer Center, Kyungpook University Chilgok Hospital and Professor in the department of Urology, School of Medicine, Kyungpook National University. He graduated from Kyungpook National University Medical School and acquired doctoral degree in urology from Kyungpook National University Medical School in 1993. Major publications include Regenerative medicine (3rd) - genitourinary system, and following papers :
Impact of preoperative thrombocytosis on prognosis after surgical treatment in pathological T1 and T2 renal cell carcinoma: Results of a multi-institutional comprehensive study. [2017]
Human Urine-derived Stem Cells Seeded Surface Modified Composite Scaffold Grafts for Bladder Reconstruction in a Rat Model [2016]
Development of porcine renal extracellular matrix scaffold as a platform for kidney regeneration [2015]
Nontransected Ventral Onlay-augmented Urethroplasty Using Autologous Saphenous Vein Graft in a Rabbit Model of Urethral Stricture [2014]
Surgical smoke may be a biohazard to surgeons performing laparoscopic surgery [2014]
Characterization of a novel composite scaffold consisting of acellular bladder submucosa matrix, polycaprolactone and Pluronic F127 as a substance for bladder reconstruction. [2014]

Research Interests:

- Urology tumor, prostate, robot surgery, laparoscopic surgery
- Biomimic-antiinflammatory scaffold development for kidney regeneration
- Stem cell treatment for interstitial cystitis treatment
- Development of human-derived biomaterials

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Shin Yoon Kim, MD, PhD

Shin-Yoon Kim, MD, Ph.D., is currently Professor in the Department of Orthopaedic Surgery at Kyungpook National University, Daegu, Korea(south). He graduated Kyungpook National University School of Medicine in 1983 and obtained his PhD in the Department of Orthopedic Surgery, Yeungnam University School of Medicine, Korea. He had his clinical and research fellowship at department of Orthopedic Surgery, University of Pittsburgh Medical Center(UPMC) and Musculo-Skeletal Research Center(MSRC) from 1996-1998. He is a member of the International Hip Society, SICOT, ISTA, AAHKS, ARCO, ASBMR and ORS, and the National Academy of Medicine of Korea. He was past-president of Korea Orthopedic Research Society, Korean Tissue Engineering and Regenerative Medicine, and editor-in-chief of CiOS which is an official English journal of Korean Orthopedic Society indexed in Medline, Scopus, and Pubmed, and ESCI(E). Currently he is president of Korean Hip Society and vice president of Korean CAOS and Korean Sarcopenia Society. He is an Asian vice president of ARCO. He published as an author and co-author more than 290 articles in various journals, having a significant number of total citations. He wrote several book chapters including the Adult Hip, and more mainly in the areas of Hip arthroplasty, Genetics and Hip preservation procedure of osteonecrosis, and Bone Biology.

Research Interests:

- Bone regeneration for osteonecrosis
- 3D printing imaging
- Genetics on skeletal disease



Young Kwan Sung, PhD.

Young K. Sung completed his undergraduate studies in Genetic Engineering at Kyungpook National University and obtained his PhD in Biology at Imperial College, UK. He carried out post-doctoral research at Cambridge University and Johns Hopkins University Medical School. He was then appointed as research professor in Biomolecular Engineering Center, Kyungpook National University in 2001 and as assistant professor in Bio-Medical Research Institute, Kyungpook National University Hospital in 2004. He has been professor of the Department of Immunology, School of Medicine, Kyungpook National University since 2013.

Research Interests:

Elucidation of the mechanisms of hair loss and providing effective medical treatment strategies for hair loss.

Work in progress in several areas including:

- Investigating the molecular pathogenic mechanisms of various types of hair loss
- Investigating the molecular mechanisms of hair growth and regression
- Identifying genes involved in hair follicle induction
- Developing hair follicle bioengineering system
- Developing drugs for hair loss



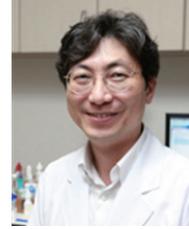
Eui Kyun Park, PhD.

Dr. Park received his B.A. and completed his Ph.D. at Kyungpook National University. Dr. Park undertook his postdoctoral training in the laboratory of Dr. Ira Daar at National Cancer Institute in USA. Both his Ph.D. and postdoctoral research focused on the signaling pathways regulating cell differentiation and embryonic development. He Joined Kyungpook National University in 2002. Dr. Park has authored more than 150 scientific publications, 10 patents, and 200 scientific presentations.

Research Interests:

Transcriptional regulation of mesenchymal stem cells and cellular reprogramming of somatic cells, and their applications in bone and tooth regeneration. Small chemical molecules capable of inducing osteoblast differentiation and suppressing osteoclast formation, and therapeutic intervention of skeletal diseases such as osteoporosis, periodontitis, and wear debris-induced osteolysis.

- Bone and tooth regeneration
- Stem cell and progenitor biology
- Small molecules for bone regeneration
- Osteoporosis and osteolytic disease



Hong Kyun Kim, MD, PhD.

Dr. Kim is an ophthalmic surgeon and researcher. He received his Ph.D. in ophthalmology at Kyungpook National University, Daegu, Korea in 2008. He was a visiting professor from 2011 to 2013 at Wake Forest Institute for Regenerative Medicine (WFIRM). He was awarded Innovative First Prize in European society of cataract & refractive surgeons (ESCRS) at 2009 and 2011. He has been professor of the Department of Ophthalmology, School of Medicine, Kyungpook National University since 2005.

Research Interests:

- Developing corneal substitute based on a biomaterial for eye surface disease
- Developing new drug for dry eye disease
- Developing bio-mimetic system for high-throughput drug screening
- Developing diagnostic device using tear fluid

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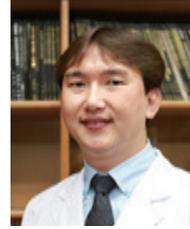


Tae Geon Kwon, DDS, PhD

Prof. Kwon completed his undergraduate studies in Dentistry at Kyungpook National University and trained at Dept. of Oral & Maxillofacial Surgery in Kyungpook National University Hospital. After the clinical training, he was a visiting scholar of Freiburg University, Germany and Osaka University, Japan. After returning from Japan, he became to be the assistant professor at the Dept. of Oral surgery in College of Medicine in Keimyung University, Korea. In 2003, he became to be the associate professor at the Dept. Oral & Maxillofacial Surgery, School of Dentistry in Kyungpook National University. He carried out post-doctoral research at University of Michigan, Ann Arbor, focused on craniofacial bone regeneration. He has been full professor since 2011 and currently serving as a head of the same department.

Research Interests:

- Developing bone regeneration strategy for refractory bone defect by using the hematopoietic stem cell mobilization
- Investigation of pathophysiological mechanism of Bisphosphonate related osteonecrosis of the jaw
- Investigating the Influence of Stromal cell-derived factor 1/CXC chemokine receptor 4 modulation on osteoblastic differentiation and osteogenesis
- Developing diagnostic device using tear fluid



Jong Pil Yoon, MD, PhD.

Dr. Yoon is a surgeon at the Kyungpook National University Hospital, is a associate professor at College of Medicine.

Dr. Yoon have been studing appropriate surgical techniques for the treatment and surgery of joints and tendon injuries caused by aging or trauma and are studying development of various drugs and scaffolds to help regenerate injured tissues.

In the rotator cuff rupture part, he is working on various development studies such as finding drugs and materials that have an effect on tissue regeneration and applying them to experimental animals.

Research Interests :

- Sustained delivery of growth factor enhances tendon-to-bone healing in massive tendon defect
- Is selective serotonin reuptake inhibitor(SSRI) effective to tendon - bone healing mechanism in the rotator cuff tear rat model?
- The effect of PTH(parathyroid hormone) for tendon to bone healing
- Correlation between rotator cuff disease and hypercholesterolemia
- Effect of mechanical augmentation with absorbable alginate scaffold in a rat rotator cuff model



Kyoung-Tae Kim, MD, PhD.

Dr. Kim is a surgeon-scientist with advanced training in spine surgery and also a PhD in neuroscience. He is a Professor in the KNU Department of Neurosurgery. As an attending neurosurgery spine surgeon at KNU hospital his practice is focused on the management of adult degenerative spine and spinal cord injuries. As a neuroscientist and Principal Investigator at JIRM, Dr. Kim runs an active basic/translational research laboratory.

Research Interests:

- Spinal cord injury. During his residency, he met many young patients on the spinal cord unit whose lives had been devastated by SCI; this motivated him to pursue a career in spine surgery and a PhD in neuroscience. Now, as a surgeon-scientist, his research interests in SCI focus on the regenerative medicine.



Bum Soo Kim, MD, PhD.

Bum Soo Kim graduated and achieved degree of doctor in the Department of Urology, School of Medicine, Kyungpook National University. He started to perform experiments and basic research of regenerative medicine from 2010. More than 60 articles, including 33 articles listed in SCI(E), were published until 2017.

Research Interests:

- Urology tumor, prostate, laparoscopic surgery
- Biomimic-antiinflammatory scaffold development for kidney regeneration
- Stem cell treatment for interstitial cystitis treatment
- Development of human-derived biomaterials

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Jin Hyun Choi, PhD.

Jin Hyun Choi received B.S in 1992, M.S. in 1994 and PhD in 1999 at the Department of Fiber and Polymer Science, Seoul National University, Korea. Dr. Choi worked as a postdoctoral fellow in the Department of Biomedical Engineering/Department of Orthopedic Surgery, Johns Hopkins University School of Medicine in USA from 2000 to 2001 and started working as faculty in the Department of Bio-fibers and Materials Science, Kyungpook National University in 2001. Currently Dr. Choi is a full Professor in the Department of Advanced Organic Materials Science and Engineering, Kyungpook National University.

Research Interests:

- Biomedical Application of Natural and Synthetic Polymers
- Synthesis of Polymeric Biomaterials
- Polymeric Hydrogels and Nanofibers
- Tissue Engineering using Polymer Scaffolds
- Drug, Cell, Protein, and Gene Delivery using Polymeric Vehicles
- Synthesis of Nanoprobes for Molecular Imaging



Ji Won Oh, MD, PhD.

Dr. Oh is a hair transplantation surgeon and bio-medical scientist. Dr. Oh is an Assistant professor at the Department of Anatomy in Kyungpook National University School of Medicine and is also cross-affiliated at the Hair Transplantation Center as well as at the Bio-medical Research institute in the Kyungpook National University Hospital. His medical background as M.D. has brightened the field of hair biology including human hair cycle and stochastic behavior of adult stem cells while his biological background as Ph.D. has advanced the field of the developmental somatic mosaicism using post-mortem genetic tools. His recent papers including eLife, Journal of Investigative Dermatology, Development and Science, are focusing on how individual cells within our body behave differently under specific biological stimulus and physiologic conditions. He is currently devoting all his effort to elucidate how the heterogeneity of each cell of our body can be achieved, why there are such a heterogenetic diversity and how we can modulate the heterogeneity for the therapy of specific pathological conditions.

Research Interests:

- Stem cell biology: Stem cell behaviors, Stochastic stem cell fates.
- Development and Regeneration: Developmental biology, Cyclic organ regeneration.
- Genetics: Post-mortem genetics, Post-zygotic variants, Pharmacogenetics.



So Young Chun, PhD.

So Young Chun completed her BS, MS and PhD in Molecular Biology Lab at Hyosung Women's University and major is Cell-biology. She carried out post-doctoral research in Regenerative medicine Institute at Wake Forest University Medical School as a research fellow. From 2003, she worked at Kyungpook National University Hospital as a research professor.

Research Interests:

- Amniotic fluid stem cell application for tissue regeneration
- Renal tissue regeneration using urine stem cell
- Urethral reconstruction using decellularized ECM scaffold
- Human tissue derived decellularized ECM scaffold development
- Development of human derived mesenchymal stem cell therapy
- Scaffold surface modification for stimulate tissue regeneration
- Bladder tissue regeneration using stem cell and scaffold combination
- In vivo safety, duration, stability, biocompatibility test for stem cell and scaffold



Tae Ho Kim, PhD.

Tae-Ho Kim is research professor in Bio-Medical Research Institute, Kyungpook National University Hospital, Daegu, Korea. Dr. Kim is a graduate of the Kyungpook National University where he studied microbiology and gained his PhD. He has been studying genetic epidemiology of osteonecrosis of the femoral head for a long time and has conducted many studies on inhibitors of osteoclast differentiation. Nowadays, he is also interested in stem cell-derived exosomes as a new therapeutic strategy and drug delivery systems. He focuses on the functional study of exosomes isolated from human amniotic membrane epithelial cell culture

Research Interests:

- Amniotic membrane stem cell-derived exosomes as a therapeutic strategy for diseases
- Exosomes as drug delivery system
- Studies on substances that ameliorate the cardiotoxicity of anticancer drugs.
- Studies on substances that inhibit osteoclast differentiation and function.



For additional information, please contact

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