KSUM 2023 Invited Speaker's CV

All fields marked with an asterisk (*) should be completed.

Name*	Wonhye Lee	
EDUCATIONAL BACKGROUND		
Country*	USA	
Current Affiliation*	Department of Radiology, Brigham and Women's Hospital, Harvard Medical School	
Specialty*	Focused ultrasound-mediated neuromodulation, Neuroscience 3D tissue engineering using bioprinting and soft lithography, Bioengineering	
Education* **(100 words)**	02/2006-08/2011 Ph.D., Bio and Brain Engineering, KAIST 02/2002-02/2006 B.S., BioSystems, KAIST	
Post-Graduate Education* **(100 words)**	04/2013-12/2014 Postdoctoral Research Fellow, Focused ultrasound-mediated neuromodulation, Brigham and Women's Hospital, Harvard Medical School 09/2011-07/2013 Postdoctoral Research Fellow, 3D tissue engineering, UNIST	
Academic Appointments* **(200 words)**	06/2021-Present Assistant Professor of Radiology, Harvard Medical School 12/2020-12/2021 Full, scientific member, Institutional Animal Care and Use Committee (IACUC), Brigham and Women's Hospital 01/2015-Present Research Associate of Radiology, Brigham and Women's Hospital 01/2015-05/2021 Instructor in Radiology, Harvard Medical School	

Scientific Publications* **(200 words)**	Xu L, **Lee W**, Rotenberg A, Böhlke M, Yoon K, Yoo SS. Localized disruption of blood albumin–phenytoin binding using transcranial focused ultrasound. Ultrasound Med Biol. 2020;46(8):1986-1997. PMID:32402673. https://doi.org/10.1016/j.ultrasmedbio.2020.04.011 **Lee W**, Croce P, Margolin RW, Cammalleri A, Yoon K, Yoo SS. Transcranial focused ultrasound stimulation of motor cortical areas in freely-moving awake rats. BMC Neurosci. 2018;19(1):57. PMID:30231861. https://doi.org/10.1186/s12868-018-0459-3 **Lee W**, Chung YA, Jung Y, Song IU, Yoo SS. Simultaneous acoustic stimulation of human primary and secondary somatosensory cortices using transcranial focused ultrasound. BMC Neurosci. 2016;17(1):68. PMID:27784293. https://doi.org/10.1186/s12868-016-0303-6 **Lee W**, Kim HC, Jung Y, Chung YA, Song IU, Lee JH, Yoo SS. Transcranial focused ultrasound stimulation of human primary visual cortex. Sci Rep. 2016;6:34026. PMID:27658372. https://doi.org/10.1038/srep34026 **Lee W**, Lee SD, Park MY, Foley L, Purcell-Estabrook E, Kim H, Fischer K, Maeng LS, Yoo SS. Image-guided focused ultrasound-mediated regional brain stimulation in sheep. Ultrasound Med Biol. 2016;42(2):459-470. PMID:26525652. https://doi.org/10.1016/j.ultrasmedbio.2015.10.001 **Lee W**, Kim H, Jung Y, Song IU, Chung YA, Yoo SS. Image-guided transcranial focused ultrasound stimulates human primary somatosensory cortex. Sci Rep. 2015;5:8743. PMID:25735418. https://doi.org/10.1038/srep08743

The Faculty of Medicine of Harvard University
Curriculum Vitae

Date Prepared:	March 22, 2023
Name:	Wonhye Lee
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Work Phone:	(617) 732-9174
Work Email:	wonhye@bwh.harvard.edu
Place of Birth:	Busan, South Korea

Education:

02/02-02/06	B.S.	BioSystems	Korea Advanced Institute of Science and Technology (KAIST)
02/06-08/11	Ph.D.	Bio and Brain Engineering (PI: Park JK)	KAIST

Postdoctoral Training:

09/11-07/13	Postdoctoral Research Fellow	3D tissue engineering (PI: Yoo SS)	Ulsan National Institute of Science and Technology (UNIST)
04/13-12/14	Postdoctoral Research Fellow	FUS-mediated neuromodulation (PI: Yoo SS)	Brigham and Women's Hospital

Faculty Academic Appointments:

01/15-05/21	Instructor	Radiology	Harvard Medical School
06/21-Present	Assistant Professor	Radiology	Harvard Medical School

Appointments at Hospitals/Affiliated Institutions:

04/13-12/14	Postdoctoral Research Fellow	Radiology	Brigham and Women's Hospital
01/15-Present	Research Associate	Radiology	Brigham and Women's Hospital

Other Professional Positions:

2007	Visiting Researcher	Korea Research Institute of Bioscience and Biotechnology (KRIBB)
2007-2009	Research Scholar	Harvard Medical School, Brigham and Women's Hospital
2009-2011	Professional Research Agent in Korean Military Service	KAIST
2011-2012	Professional Research Agent in Korean Military Service	UNIST
2012-2016	Visiting Researcher	Incheon St. Mary's Hospital, The Catholic University of Korea

Committee Service:

Local

2020-2021	Institutional Animal Care and Use Committee (IACUC), Full, scientific member	Brigham and Women's Hospital

Professional Societies:

2009-	Society of Solid-State Sensors, Actuators and Microsystems (Transducers, TRF)	Member
2009-	Tissue Engineering & Regenerative Medicine International Society (TERMIS)	Member
2010-	Korea Society of Medical Biological Engineering (KOSOMBE)	Member
2010-	Korean Tissue Engineering and Regenerative Medicine Society (KTERMS)	Member
2011-	Society of Microtechnologies in Medicine and Biology (MMB)	Member
2011-	Focused Ultrasound Surgery Foundation (FUSF)	Member
2016-	International Society for Therapeutic Ultrasound (ISTU)	Member
2017-	Biomedical Engineering Society (BMES)	Member
2017-	Society of Neuroscience (SfN)	Member

2017-	Society for Brain Mapping and Therapeutics (SBMT)	Member

Grant Review Activities:

2016-	Focused Ultrasound Surgery Foundation (Extramural Research) 2016-present	Focused Ultrasound Surgery Foundation Ad hoc reviewer

Editorial Activities:

- **Ad hoc Reviewer**

Advanced Materials (Wiley-VCH)
International Journal of Molecular Sciences (MDPI)
Acta Biomaterialia (Elsevier)
Bioengineering (MDPI)
Brain Stimulation (Elsevier)
Journal of Functional Biomaterials (MDPI)
Psychoneuroendocrinology (Elsevier)
Materials (MDPI)
Applied Sciences (MDPI)
Scientific Reports (Springer Nature)
Pharmaceutics (MDPI)
Current Neuropharmacology (Bentham Science)
Chemistry (MDPI)

- **Other Editorial Roles**

2013-2017	Managing Editor	International Journal of Imaging Systems and Technology, Wiley

Honors and Prizes:

2006-2011	National scholarship	KAIST	Government-sponsored scholarship for competitively selected graduate students; tuition, living costs, special case on civic duty of military service
2007-2009	Scholarship for international joint research program	Department of Bio and Brain Engineering, KAIST	Three-dimensional tissue printing and its application
2007-2009	Research scholarship	Harvard Medical School, Brigham and Women's Hospital	Three-dimensional tissue engineering *via* direct tissue printing

2010	Best paper award	The 12th Annual Meeting of KTERMS	Facile fabrication of biomimetic hydrogel sheets for multi-layered cell-laden hydrogel scaffold
2012	Bronze prize	The 19th Samsung Human Tech Paper Competition	Microarchitectured free-standing cellular hydrogel sheets for 3D cell culture and tissue reconstruction
2014	The young investigator award	The 4th International Symposium on Focused Ultrasound	FUS-mediated functional neuromodulation in a large animal model of sheep
2018	The young investigator award	15th Annual Congress of The Society for Brain Mapping and Therapeutics (SBMT)	Significant achievement in neuromodulation—noninvasive regional stimulation of the human brain using FUS that elicits various somato-visual sensations
2018	Best poster award	The 6th Annual BWH Radiology Research Symposium	Biomimetic inflammatory dermatitis model by 3D bioprinting

Report of Funded and Unfunded Projects

Past

2008 Development of biomimetic microscale cell culture systems
Industrial Technology Development Program of the Korea Government (MKE), 10017755
Researcher (PI: Park JK)
Biomimetic microscale cell culture systems were developed to enable the miniaturized 3D cell culture within microfluidic channels using soft lithography technologies for multiplexed high-throughput cell-based assay and drug screening.

2008-2011 Multiplexed, ultrasensitive nanobiosensor using isomagnetophoresis
National Research Foundation of Korea, National Leading Research Laboratory Program, R0A-2008-000-20109-0 and 2011-0018607
Researcher (PI: Park JK)
Ultra-sensitive nanobiosensor platforms that can discriminate various kinds of attomolar (aM [10^{-18} mol/L]) molecules, based on microfluidic isomagnetophoretic immunoassay, were developed, enabling a multiplexed-analysis of the target molecules, such as breast cancer markers, to help select a proper strategy for a patient-specific breast cancer therapy.

2009 Development of multifunctional magnetic nanocomposite for disease diagnosis with high sensitivity
National Research Foundation of Korea, Nano/Bio Science and Technology Program, M10503000868-08M0300-86810
Researcher (PI: Park JK)
Multifunctional magnetic nanocomposites were developed for disease diagnosis with high sensitivity based on the synthesis of a complex having biocompatible DNA molecules and magnetic nanoparticles.

2009-2011 Development of platform technology for nanobioelectronic chip
National Research Foundation of Korea, Nano/Bio Science and Technology Program, 2011-0002188
Researcher (PI: Park JK)
New bioprocessor chip platforms, based on the optoelectrofluidic manipulation technology, were developed for highly sensitive biomolecular detection, using a flat display with low-power consumption and simple structure.

2011-2013 Stem cell-based three-dimensional direct organ printing and focused ultrasound-mediated non-invasive neuromodulation
UNIST Institutional Grant, 1.110016.01 and 1.120016.01
Researcher (PI: Yoo SS)
Focused ultrasound-mediated non-invasive neuromodulation was applied to the development of brain-to-brain interface (BBI), which links the function of the human brain to a rat brain as a demonstration. Direct organ printing technology enabled the biological printing of 3D organ structures made up of hydrogel scaffold and various adult cells and stem cells.

2012-2018 Creation of human sensory perception mediated by non-invasive focused ultrasound neuromodulation
National Research Foundation of Korea, The Global Frontier R&D Program on Human-centered Interaction for Coexistence, 2013-056221
Researcher (PI: Chung YA)
We developed a noninvasive brain stimulation method using transcranial low-intensity focused ultrasound, enabling stimulation of a region-specific brain area, to induce various types of human perception without resorting on stimulating the peripheral sensory systems. We applied pulsed sonication to the somatosensory area of the human brain, which resulted in inducing tactile sensations in hand/arm areas.

2013-2014 FUS-mediated functional neuromodulation for neurophysiologic assessment in a large animal model
Focused Ultrasound Surgery Foundation (FUSF)
Researcher (PI: Yoo SS)
The goal of the research was to investigate the use of neuroimage-guided transcranial focused ultrasound to reversibly modulate the neural activity of a region-specific brain area in a large animal model of sheep. Electrophysiological signals of EEG/EMG elicited from the neuromodulation were assessed in terms of visual and sensorimotor functions, followed by post-sonication safety profiles examined through brain MRI, behavior and histology.

2013-2015 Planar electrical impedance tomography for the visualization of acupuncture meridians
Incheon St. Mary's Grant
Researcher (PI: Yoo SS)
We developed a system of electrical impedance tomography (EIT), an emerging noninvasive imaging modality of electrical properties in biological tissues, to visualize the anatomical distributions/locations of acupuncture meridians with electrical impedance characterization.

2014-2019 Robot and ultrasound-mediated novel therapeutic modalities
KIST Institutional Grant
Researcher (PI: Yoo SS)
The project entails the development of (1) multi-modal functional neurosurgical systems with surgical planning and neuronavigation capabilities, (2) miniature capsule robots that are wirelessly powered, controllable to be self-assembled (*via* docking/undocking) and applicable to the human body, and (3) noninvasive therapeutic systems using focused ultrasound that can stimulate the neural tissues and subsequent operational environment.

2015-2016 On-demand construction of biomimetic skin tissue using 3D bio-printing technology
AmorePacific Corp.
Co-I (PI: Yoo SS) – Investigator-initiated sponsored research
We developed a method to produce artificial skin by collaborative agreement with Amore-Pacific Research and Development (R&D) team. Our works on 3D bioprinting have been recognized with international reputations, where the detailed methods and applications can be found in the Report of Scholarship.

2015-2019 Development of portable transcranial FUS systems
Incheon St. Mary's Hospital Grant
Co-I (PI: Yoo SS)

A hardware/software environment that enables a new mode of noninvasive brain stimulation modality, which is compatible with mammalian species, was introduced. We also developed an image-guided environment that enables the delivery of focused ultrasound to the areas of interest, along with software that enables the estimation of acoustic intensities in 3D space using numerical simulation of acoustic propagation in biological media.

2016-2017 FUS-mediated neuromodulation from unanesthetized freely-moving animals
Focused Ultrasound Surgery Foundation (FUSF), FUS 461
PI ($100,000 - total direct costs)
The goal of this project was to examine the neuromodulatory outcome of non-thermal, transcranial focused ultrasound to the somatomotor area of unanesthetized, freely-moving awake small animals of Sprague-Dawley rats, based on motor behavioral responses along with its safety profile through immunohistological analysis and behavioral monitoring.

2017 Room temperature 3D bioprinting using chemically-modified salmon gelatin
Harvard Stem Cell Institute (HSCI), Presidents and Fellows of Harvard College
Co-I (PI: Lian CG)
In collaboration with the University of Andes, Chile, we developed a 3D printing technique using novel salmon-derived hydrogel materials to construct 3D tissue containing fibroblasts.

2018-2021 Additive bio-manufacturing for the creation of hybrid tissue units
CleCell Inc.
Co-PI (with Yoo SS, $500,000 - total direct costs) – Investigator-initiated sponsored research
The main objective of this research is to develop modular and reconfigurable 3D additive bio-manufacturing techniques that can selectively (1) produce 3D multi-cellular biomimetic structures, (2) embed cytokine-releasing matrix in the structure, and (3) create fluidic channels with/without endothelial lumens.

2016-2021 Wearable transcranial focused ultrasound system for region-specific functional neuromodulation
NIH/NIMH R01 MH111763
Co-I (PI: Yoo SS)
The overall objective of the project is to develop a wearable transcranial focused ultrasound environment that reversibly modulates (either elicits or suppresses) region-specific neural activities of the brain in a large animal model of sheep.

2016-2022 Acoustic measurement and characterization for biological applications
NSN Inc.
Co-I (PI: Yoo SS) – Investigator initiated sponsored research
The aims of this research are to develop a characterization system of ultrasound transducers, including acoustic field mapping and power calibration hardware/software for biological applications such as acoustic acupuncture, in compliance with American Institute of Ultrasound in Medicine (AIUM)-standards.

2019-2021 Wearable modular focused ultrasound systems for non-invasive stimulation of the human brain during deep space exploration
NASA Translational Research Institute for Space Health (TRISH) #T0415
Co-I (PI: Yoo SS)
The proposed ground-based study is intended to advance our knowledge on neuromodulatory potentials of transcranial focused ultrasound while addressing crucial technical innovations necessary to achieve the accurate delivery of the acoustic focus to specific brain areas (both cortical and subcortical), with specifications suitable for its routine use during deep space exploration.

2019-2021 3D bio-printing of the blood-brain barrier
BWH Brigham Research Institute (BRI) NextGen Award
Consultant (PI: Cho CF)

3D bioprinting technology will enable us to construct brain microvascular structures for studying blood-brain barrier mechanisms in a setting that closely mimics an *in vivo* environment, as well as investigating drug delivery across the blood-brain barrier.

Current

2020-2023 Focused ultrasound-mediated disruption of blood plasma protein binding with pharmacological molecules
NIH/NINDS R21 EY031807
PI ($300,000 - total direct costs)
The objective of this research is to examine the effects of transcranial focused ultrasound on region-specific disruption of plasma protein binding with antiepileptic drug phenytoin and to evaluate if the regional increase of parenchymal phenytoin uptake results in the suppression of chronic temporal lobe epilepsy in rodents.

Training Grants and Mentored Trainee Grants

2010-2011 Modular biofabrication of biomimetic 3D artificial liver tissue using microarchitectured cell-laden hydrogels
KAIST Institutional Grant, N01100609, Senior Undergraduate Research Program
Co-I (PI: Park JK), Mentoring of Jaejung Son
The goal of this project was to develop a novel lamination-based fabrication and assembly method of freestanding cellular hydrogel biopaper containing controlled 3D cellular microenvironment and to demonstrate its application of hepatic organoid reconstruction.

Unfunded Current Projects

2019- Development of T cell-mediated immunocompetent skin model using 3D bioprinting
PI
The goal of this research is to develop 3D bioprinting methods and bioreactor-based culture protocols for creating an immunocompetent full-thickness skin model that can exhibit T cell-mediated immunological responses, which are prevalent in many inflammatory skin diseases.
NIH/NIAMS R21 AR076011 (Impact Score: 58, Percentile: 52 +, as of 03/15/2019)

2019- On-demand high-throughput manufacturing of individualized cancer models—Pilot demonstration in melanoma and breast cancer
Co-I (PI: Yoo SS)
The objective is to develop modular and reconfigurable 3D bioprinter hardware and printing protocols for creating individualized tumor models in on-demand high-throughput fashion.

2019- Modulation of motor skill learning using non-invasive transcranial focused ultrasound
Co-I (PI: Fregni F)
The objective is to implement image-guided focused ultrasound protocols for stimulating cortical areas (M1 and PreM) that are known to play a critical role in motor skill learning and to examine the degree of performance enhancement and subsequent neuronal manifestation in functional connectivity in the human brain.

Report of Local Teaching and Training

Teaching of Students in Courses:

2006-2007, 2009	Introduction to Bioelectronics and Bioinformation Undergraduate course	KAIST, Daejeon, South Korea Teaching Assistant 6 hrs/wk for 16 wks/year
2006	Regenerative Medicine and Engineering Graduate course	KAIST, Daejeon, South Korea Teaching Assistant 6 hrs/wk for 8 wks
2007, 2010	Biological Instrumentation Laboratory Undergraduate course	KAIST, Daejeon, South Korea Lecturer and Technical Advisor 12 hrs/wk for 16 wks/year
2007-2009	Boston University Senior Project Design Undergraduate course (2-3 students per year)	Brigham and Women's Hospital Technical Advisor 100 hrs/year per trainee for 1 year
2009	Neural Information Processing Algorithm Undergraduate course	KAIST, Daejeon, South Korea Lecturer and Teaching Assistant 6 hrs/wk for 16 wks/year
2010-2011	BioElectroMechanics | Computational Fluid Dynamics (CFD) Simulation Graduate course	KAIST, Daejeon, South Korea Lecturer and Teaching Assistant 6 hrs/wk for 16 wks/year
2010-2011	Nano/Micro-Machining Process Laboratory Graduate course	KAIST, Daejeon, South Korea Technical Advisor 15 hrs/wk for 8 wks
2012	Tissue Engineering Undergraduate course	UNIST, Ulsan, South Korea Lecturer and Teaching Assistant 10 hrs/wk for 5 wks
2014-2017	Boston University Senior Project Design Undergraduate course (1-3 students per year)	Brigham and Women's Hospital Technical Advisor 100 hrs/year per trainee for 1 year
2017-2019, 2021	Harvard Mind Brain Behavior (MBB) 3D Bioprinting of Neural Tissues Graduate/Undergraduate course (~10 students per year)	Brigham and Women's Hospital Lab Instructor and Technical Advisor 15 hrs/wk for 2 wks

Research Supervisory and Training Responsibilities:

2010-2011	Research training and supervision Undergraduate senior research trainee (1 trainee)	KAIST, Daejeon, South Korea 100 hrs/year per trainee
2012-2015	Research training and collaboration Research assistances/nurses (1-2 assistances per year)	Incheon St. Mary's Hospital, South Korea 150 hrs/year per assistance

2013-Present	Research training and supervision Graduate research trainees/assistances (1-3 assistances per year)	Brigham and Women's Hospital 200 hrs/year per assistance
2015-2017	Research training and supervision Undergraduate senior research trainees (1-3 trainees per year)	Brigham and Women's Hospital 100 hrs/year per trainee
2018-Present	Research training and supervision Postdoctoral research fellows (average of 1-2 fellows per year)	Brigham and Women's Hospital 200 hrs/year per fellow

Mentored Trainees and Faculty:

2010-2011 Jaejung Son, B.S. / Ph.D., KAIST, Senior Scientist, Samsung Biologics, Korea
Career stage: research trainee. Mentoring role: research mentor. Accomplishments: multiple scholarships of mentored research including facile and biocompatible fabrication of chemically sol−gel transitional hydrogel free-standing microarchitectures. [articles 9, 12]

2012-2015 Yujin Jung, M.S. / Researcher, Incheon St. Mary's Hospital, the Catholic University of Korea, Incheon, South Korea
Career stage: researcher. Mentoring role: research mentor. Accomplishments: multiple scholarships of mentored research including image-guided transcranial focused ultrasound stimulates human primary somatosensory cortex. [articles 18, 21–23]

2013-2016 Stephanie D. Lee, B.A. / D.O., Touro College of Osteopathic Medicine, New York, NY
Career stage: research trainee. Mentoring role: research mentor. Accomplishments: multiple scholarships of mentored research of noninvasive low-intensity focused ultrasound-mediated neuromodulation of the brain.

2013-2016 Michael Y. Park, M.S. / D.M.D., Boston University Henry M. Goldman School of Dental Medicine, Boston, MA
Career stage: researcher. Mentoring role: research mentor. Accomplishments: multiple scholarships of mentored research of functional neuromodulation of the brain using focused ultrasound in small and large animal models. [articles 15, 17, 19, 20]

2015-2016 Emily Misnick, B.S. / Ph.D. candidate in Biomedical Engineering, UC Davis, Davis, CA
Career stage: research trainee. Mentoring role: research mentor. Accomplishments: Boston University senior project, mentored research of modular 3D bioprinter for individualized acellular rib implant.

2015-2016 Tomas Jordan, B.S. / Ph.D. candidate in Thayer School of Engineering, Dartmouth College, Hanover, NH
Career stage: research trainee. Mentoring role: research mentor. Accomplishments: Boston University senior project, mentored research of modular 3D bioprinter for cellular hydrogel-based tissue fabrication.

2015-2016 Steven Santora, B.S. / Boston University, Biomedical Engineering
Career stage: research trainee. Mentoring role: research mentor. Accomplishments: Boston University senior project, mentored research of design of modular multi-head printer nozzle for the 3D bioprinter.

2016 Natasha Joglekar / B.S. candidate, Massachusetts Institute of Technology (MIT), Cambridge, MA

Career stage: research trainee. Mentoring role: research mentor. Accomplishments: mentored research of 3D bioprinting of full-thickness skin model.

2016-2017 Kevin Huang, B.S. / Research Assistant at Qurgen Inc., Detroit, MI
Career stage: research trainee. Mentoring role: research mentor. Accomplishments: Boston University senior project, mentored research of 3D bioprinting for tumor engineering.

2016-2017 Ryan W. Margolin, B.S. / D.O. candidate at Touro College of Osteopathic Medicine, New York, NY
Career stage: research technician. Mentoring role: research mentor. Accomplishments: multiple scholarships of mentored research including focused ultrasound-mediated neuromodulation in freely-moving awake rat models. [articles 26, 29]

2017 Phammela Noemi Abarzua, M.S. / Research Technician in Pathology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA
Career stage: visiting research scholar. Mentoring role: research mentor. Accomplishments: writing a grant application and mentored research including 3D bioprinting of fish-gelatin for tissue engineering.

2018-2020 Niklas von Spreckelsen, M.D. / Resident in Neurosurgery, Germany
Career stage: postdoctoral research fellow in Neurosurgery, BWH. Mentoring role: research mentor (Co-mentor, Cho CF in Neurosurgery, BWH). Accomplishments: mentored research of 3D bioprinting of blood-brain barrier.

2020-2021 Hyunchul Kim, Ph.D. / Assistant Professor, Department of Artificial Intelligence, Kyungpook National University, Daegu, Korea
Career stage: postdoctoral research fellow. Mentoring role: research mentor. Accomplishments: mentored research of focused ultrasound-mediated brain stimulation in animal models of sheep and rats.

2021-2023 Evgenii Kim, Ph.D. / Postdoctoral Research Fellow in Radiology, BWH and HMS, Boston, MA

Career stage: postdoctoral research fellow. Mentoring role: research mentor. Accomplishments: mentored research of focused ultrasound-mediated unbinding of antiepileptic drug phenytoin from plasma protein for suppression of chronic temporal lobe epilepsy in a rodent model.

2021-2022 Jared Van Reet, B.S. / Research Technician in Radiology, Brigham and Women's Hospital, Harvard Medical School, Boston, MA

Career stage: research technician. Mentoring role: research mentor. Accomplishments: Mentored research including focused ultrasound-mediated disruption of the binding between plasma proteins and antiepileptic drug phenytoin.

Local Invited Presentations:

☒ *No presentations below were sponsored by 3rd parties/outside entities*

☐ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

2010 Bioprinting of multilayered cell-hydrogel scaffolds through on-demand three dimensional freeform fabrication / Invited presentation

Biofusion Seminar, Department of Bio and Brain Engineering, KAIST; Sept 13, 2010; Daejeon, South Korea

2011 Mesoscopic cellular hydrogel scaffolds for bioartificial 3D tissue structures / Invited presentation

Department of Bio and Brain Engineering, KAIST; April 4, 2011; Daejeon, South Korea

2012 Bioprinting of multilayered cell-hydrogel scaffolds through on-demand 3D freeform fabrication: bioprinting for 3D tissue fabrication / Invited presentation

Department of Nano-Bioscience and Chemical Engineering, UNIST; July 19, 2012; Ulsan, South Korea

2012 Cellular hydrogel biopaper for patterned 3D cell culture and modular tissue reconstruction / Invited presentation

Department of Nano-Bioscience and Chemical Engineering, UNIST; July 19, 2012; Ulsan, South Korea

2020 New phases and new faces of 3D bioprinting / Invited presentation

Neuromodulation and Tissue Engineering Laboratory, Department of Radiology, Brigham and Women's Hospital, Harvard Medical School; Jan 6, 2020; Boston, MA

Report of Regional, National and International Invited Teaching and Presentations

☒ *No presentations below were sponsored by 3rd parties/outside entities*

☐ *Those presentations below sponsored by outside entities are so noted and the sponsor(s) is (are) identified.*

National

2012 Micro-architectured free-standing cellular hydrogel sheets for 3D cell culture and modular tissue reconstruction / Invited presentation

Bio Engineering and Life Science, Humantech, Samsung; January 31, 2012; Seoul, South Korea

2014 FUS-mediated functional neuromodulation for neurophysiologic assessment in a large animal model (selected oral and poster abstract)

Focused Ultrasound 2014–4th International Symposium; Oct 12-16, 2014; Washington, DC

2016 Simultaneous stimulation of the human primary and secondary somatosensory cortices using transcranial focused ultrasound (selected oral abstract)

Focused Ultrasound 2016–5th International Symposium; Aug 28-Sept 1, 2016; Washington, DC

2016 Transcranial focused ultrasound stimulation of the primary visual cortex in humans (selected oral abstract)

Focused Ultrasound 2016–5th International Symposium; Aug 28-Sept 1, 2016; Washington, DC

2017 Development of wearable focused ultrasound transducer for the stimulation of rat brain (selected oral abstract)

2017 Biomedical Engineering Society (BMES) Annual Meeting; Oct 11-14, 2017; Phoenix, AZ

2018 Development of wearable focused ultrasound transducer for the stimulation of rat brain / Invited presentation

The 15th Annual Congress of Society for Brain Mapping and Therapeutics (SBMT); April 13-15, 2018; Los Angeles, CA

2018 Transcranial FUS-mediated motor cortical stimulation in freely-moving awake rats using wearable headgear system (selected oral abstract)

Focused Ultrasound 2018 – 6th International Symposium; Oct 21-25, 2018; Reston, VA

2019 Effects of sonication parameters on transcranial FUS-mediated neuromodulation in an ovine model / Invited presentation

The 16th Annual Congress of Society for Brain Mapping and Therapeutics (SBMT); March 15-17, 2019; Los Angeles, CA

2022 Focused ultrasound mediated unbinding of phenytoin from plasma proteins for seizure suppression of rodent model of chronic temporal lobe epilepsy / Invited presentation

The 19th Annual Congress of Society for Brain Mapping and Therapeutics (SBMT). March 10-13, 2022; Virtual & In-person Hybrid, Los Angeles, CA, USA

International

2008 3-dimensional bio-printer for tissue engineering / invited presentation

NanoBiotech Laboratory, Department of Bio and Brain Engineering, KAIST; Sept 27, 2008; Daejeon, South Korea

2009 Three-dimensional cell-hydrogel printer using electromechanical microvalve for tissue engineering (selected oral abstract)

The 15th International Conference on Solid-state Sensors, Actuators and Microsystems (Transducers'09); June 21-25, 2009; Denver, CO

2011 Mesoscopic free-standing cellular hydrogel microarchitectures for bioartificial 3D tissue geometry (selected oral and poster abstract)

The 6th International Conference on Microtechnologies in Medicine and Biology; May 4-6, 2011; Lucerne, Switzerland

2022 Focused ultrasound neuroengineering – Neuromodulation & CNS drug enhancing / invited presentation

Center for Bionics, Korea Institute of Science and Technology (KIST); December 21, 2022; Seoul, South Korea

Report of Technological and Other Scientific Innovations

Patent (2007 July 03) KR100734584B1. Han YM, Cho YS, Kim J, Park JK, Kim MS, **Lee W**; Korea Research Institute of Bioscience and Biotechnology (KRIBB).
https://patents.google.com/patent/KR100734584B1/en

Stamp for dissociation of human and animal cells into cell units having certain cell number at one time, method for cell dissociation by pressing with same, and apparatus for manual/automatic cell dissociation by using the same.

Patent (2007 Oct 30)	KR100771522B1. Park JK, Lee SS, Han MH, **Lee W**; Korea Advanced Institute of Science and Technology (KAIST). https://patents.google.com/patent/KR100771522B1/en Conducting polymer-based microneedle electrode sheet and the manufacturing method thereof.
Patent (2008 Jan 31)	WO2008013331A1. Han YM, Cho YS, Kim J, Park JK, Kim MS, **Lee W**; Korea Research Institute of Bioscience and Biotechnology (KRIBB). https://patents.google.com/patent/WO2008013331A1/en Stamp for cell dissociation, method for cell dissociation using the same, and apparatus for manual/automatic cell dissociation using the same.
Patent (2013 Jun 18)	US8465987B2. Park JK, Kang JH, Choi S, **Lee W**; Korea Advanced Institute of Science and Technology (KAIST). https://patents.google.com/patent/US8465987B2/en Apparatus, microfluidic chip and method for separating particles using isomagnetophoresis.

Report of Scholarship

Harvard Catalyst: https://connects.catalyst.harvard.edu/Profiles/display/Person/82156
NIH Bibliography: https://www.ncbi.nlm.nih.gov/myncbi/wonhye.lee.1/bibliography/public/
Google Scholar: https://scholar.google.com/citations?user=KSbP9hUAAAAJ
ORCID iD: https://orcid.org/0000-0002-4203-2209
(Scopus Author ID: 35755741800, ResearcherID: GYA-4052-2022)

Peer-Reviewed Scholarship in print or other media:

Research Investigations

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Narrative Report

My current research focuses on the development of a non-invasive functional neuromodulation technique using low-intensity transcranial focused ultrasound (FUS) in the context of neuroscience and the creation of biomimetic tissues using 3D bioprinting technique and soft lithography.

My first experience in neuroscience was linear/non-linear analysis of electroencephalography (EEG) measured from adolescents with attention-deficit/hyperactivity disorder (ADHD) [article 8]. Using this prior experience as a background, I have started to participate in research involving neuromodulation using low-intensity transcranial FUS [article 11]. As a non-invasive modality, FUS has been gaining momentum in neuroscientific research due to its ability to reversibly modulate regional neural activities from both the central/peripheral nervous systems (CNS/PNS) [articles 11, 13–15, 17, 18, 20, 22–27, 29–31, 33, 35, 37, 38]. Over the past decade, I have been heavily involved in the translation of these techniques to various neurotherapeutic applications. I used functional MRI (fMRI) and diffusion tensor MRI (DTI) data [article 19] to give FUS transcranially to stimulate the region-specific cortical and thalamic areas of visual and sensorimotor neural circuits in a large animal model of sheep [articles 20, 27, 30, 31, 35, 38]. Furthermore, guided by individual-specific neuroimage data of fMRI and skull CT, I delivered transcranial FUS to human somatosensory cortices (S1/S2) to elicit tactile sensations and accompanying evoked EEG potentials [articles 18, 21, 23]. Upon the basis of these somatosensory cortical stimulation studies, I demonstrated non-invasive transmission of sensorimotor information in humans using an EEG/FUS brain-to-brain interface [article 25]. After that, I reported for the first time that FUS given to human visual cortex (V1) resulted in elicited activations of the sonicated brain area (as revealed by fMRI neuroimage data), accompanied by phosphene perception and EEG responses [article 22]. I also investigated the PNS-FUS stimulation to elicit various sensations in the fingertip [articles 13, 14], which has potential to be a novel non-invasive acupuncture modality that does not require the use of needles.

Subsequently, as a Principal Investigator, I led a foundation-funded study to develop a wearable miniature FUS headgear for rat brain stimulation and demonstrated its ability to stimulate the motor cortex in unanesthetized freely moving small animals [articles 26, 29]. This line of study was extended to NIH-funded R01 investigations that I participated as a Co-I, using an awake large animal model of sheep [article 35]. I also worked to develop wearable FUS systems for non-invasive stimulation of human brain during deep space exploration through a NASA grant as a Co-I [article 38]. I am also interested in studying the effects of FUS-neuromodulation on invertebrate species to discover the physiological mechanisms behind the scene [article 24]. Recently, I headed an independent research project that further expands the spectrum of FUS applications to increase the parenchymal uptake of pharmacological agents through unbinding from plasma proteins [articles 32, 34], which led to my NIH grant (R21) as a Principal Investigator [article 39].

Another active area of research for me is in tissue engineering and the development of novel 3D cellular hydrogel fabrication methods to construct biomimetic tissues/organoids. I played an instrumental role in developing the cell-hydrogel printer that is capable of on-demand 3D freeform fabrication of tissue scaffolds with computer control [articles 4–7, 28, 36]. These research topics were part of my Ph.D. thesis research and partial postdoctoral training. With further development and testing, I expect that this bioprinting technology will be utilized in various applications such as 3D tumor engineering, drug screenings, and clinical studies [proceedings 26–28, 35, 42, 46, 51]. This technology can be further combined with soft lithography and microfluidic techniques to mimic vascularized tissue composites, in which cells can be grown without diffusion depth limitation allowing the creation of thick bioartificial 3D tissues [articles 3, 6, 9, 12]. I am actively engaged in further research to develop novel (1) stem cell growth/bioreactor platforms, (2) *in vitro* vascularized tissue reconstruction methods, (3) patient-specific *ex vivo* tumor engineering techniques and (4) T cell-mediated immunocompetent organoid models. Several research grant applications are anticipated. I have recently led an Industry-funded research project on developing biomimetic tissue units using state-of-the-art additive biomanufacturing techniques, which enable up to 15 multi-channel/multi-material bioprinting with multiplexed operation to meet the growing needs in the scientific communities for versatile tissue creations.

Along with my research activities, I have been actively contributing to training and teaching of students, research trainees/assistances and postdoctoral research fellows. This has been accomplished through various research projects/training programs within my active research areas as demonstrated in multiple scholarships with the mentored trainees, for 3D tissue bio-printing/fabrication [articles 4–6, 9, 12] as well as for FUS-mediated neuromodulation [articles 15, 17–24, 26, 29, 35, 38]. Based on one of my scholarships [article 4], I have also been participating as a lab instructor/technical advisor in the course entitled ‘3D bioprinting of neural tissues’, at Harvard University’s Mind Brain Behavior (MBB) Interfaculty Initiative.

Overall, my long-term research goals include (1) the development of FUS-based non-invasive functional neuromodulation techniques for excitatory or suppressive brain stimulation as a basis for novel neurotherapeutic methods and (2) the development of 3D tissue biofabrication techniques, including (but not limited to) 3D cell-hydrogel printing, soft lithography, and microfluidics, whereby biological organ/tissue can be substituted by part/whole bioartificial 3D tissue composites to support or replace essential physiological functions. I will also continue contributing to teaching/training and committee (such as IACUC)/community services as an important future endeavor.