2019 POSTECH Summer Program

List of Participating Professors & Research Topics

1. Department of Creative IT Engineering (CiTE)
2. Division of Environmental Science and Engineering
3. Department of Chemistry
4. Department of Electrical Engineering
5. Department of Life Sciences
6. Division of Integrative Biosciences and Biotechnology (IBB)

International Relations
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※ List of Participating Professors: 2019 POSTECH Summer Program

Dept	Name	Email	Laboratory	Research Topic	Capacity	Remarks
CiTE	Ju Hong PARK	juhpark@postech.ac.kr	Design Intelligence Lab.	Virtual Twin City Robotic Tensegrity System Robotic Construction Robotic Kitchen Smart Farm Autonomous Vehicle/Drone IoT Fashion Design	10	
CiTE	Jinah JANG	jinahjang@postech.ac.kr	Biofabrication and Translational Medicine	Bioprinting system for Tissue Engineering	1	
CiTE	Hyung Ham KIM	davidkim@postech.ac.kr	Kim Lab – Ultrasound Research Group	High-frequency ultrasound transducer design and fabrication	1	Lab safety training required
DESE	Seokhwan HWANG	shwang@postech.ac.kr	Environmental Bioprocess Lab	Biological Wastewater Treatment	1~2	
DESE	Wonyong CHOI	wchoi@postech.ac.kr	Eco-friendly Photoenergy Applications Lab	Solar energy utilization for energy and environmental applications, Photocatalysis, Environmental chemistry	1	
Chemistry	Kyo Han AHN	ahn@postech.ac.kr	Organic and Bioorganic Chemistry Lab	organic fluorescent materials and molecular probes for biomedical imaging, basic chemical laboratory courses	1	
Chemistry	Young-Tae CHANG	ytchang@postech.ac.kr	Sensor & Molecular Bioimaging Lab	Bioimaging Fluorescent sensor Chemical Biology Artificial Cell	3	
EE	Byungsub KIM	byungsub@postech.ac.kr	Bevil Lab.	Biosensor Driving Module	2	- Prerequisite: electronics, basic circuit t heory, verilog skill, etc.
Life	Joung-Hun KIM	joungkim@postech.ac.kr	Lab of Molecular Neuroscience	Neural circuits for emotional memory	2	
Life	Kunyoo SHIN	kunyoos@postech.ac.kr	Stem cell and cancer biology	Stem cells, organoid, miniature tissue	1~2	Undergraduate 3~4 year students only
Life	Jin-Kwan HAN	jkh@postech.ac.kr	Developmental Biology	Signaling control vertebrate development	1	
IBB	Kyong Tai KIM	ktk@postech.ac.kr	Molecular Neurophysiology	Regulation of Synaptic mRNA translation	1~2	
IBB	G-One AHN	goneahn@postech.ac.kr	Tumor microenvionment lab	Investigating the interplay between tumor microenvironmental factors influencing tumor progression	1	
IBB	Inhwan HWANG	ihhwang@postech.ac.kr	Cellular Systems Biology	Plant Biotech	2	
6 Departments 14 Professors					31	

1-1. Dept. of Creative IT Engineering: Prof. Ju Hong PARK

RESEARCH INTERESTS
- IoT, Smart Cities
- Healthcare Architecture
- Robotic Fabrication, 3D Printing
- Machine Learning, Computer Vision

MAJOR RESEARCH ACHIEVEMENTS
- IoT Assistive Furniture/Building
- Building Constructional 3D Printers
- Machine Learning- and Computer Vision-based Intelligent Education System

RESEARCH KEYWORDS
IoT, Smart Cities, Healthcare Architecture, 3D Printing, Robotic Fabrication, Machine Learning, Data Mining, Computer Vision

과학기술 관련 연구분야 분류
건축계획및설계(G31001), 인공지능(G30308), 의공학기술(G31401)

Prof. **PARK, JU HONG**
박 주 홍

Education
2015: Ph.D., Massachusetts Institute of Technology
2005: M.Arch., Harvard University
1998: B.Eng., Hong-ik University

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Advisor	**Prof. Ju Hong PARK**
Laboratory	**Design Intelligence Lab.**
Web	**http://www.juhongpark.com/**
Email	**juhpark@postech.ac.kr**
Research Topic	**Virtual Twin City** **Robotic Tensegrity System** **Robotic Construction** **Robotic Kitchen** **Smart Farm** **Autonomous Vehicle/Drone** **IoT Fashion Design**
Capacity	**10**
Remarks	

1-2. Dept. of Creative IT Engineering: Prof. Jinah JANG

RESEARCH INTERESTS

- 3D bioprinting systems and tissue specific printable bioinks
- Tissue modeling and printing for regenerative medicine
- Convergence on ICT and 3D bioprinting technologies for future healthcare system
- Image-guided diagnosis and treatment using 3D printed constructs
- In vitro testing platform for personalized medicine

MAJOR RESEARCH ACHIEVEMENTS

- Advanced 3D bioprinting techniques/Advanced bioink system for biomedical applications/3D printing of engineered tissue constructs for stem cell delivery and regenerative medicine

RESEARCH KEYWORDS

Bioprinting, Bioinks, Regenerative medicine, Delivery platform for stem cell therapy, Personalized medicine, Real-time tissue monitoring device, In vitro tissue model for drug testing

과학기술 관련 연구분야 분류

의공학기술(G31401), 의공학재료(G31402)

Prof. **JANG, JINAH**

장 진 아

Education

2015: Ph.D., POSTECH

2010: B.S., Seoul National University of Science & Technology

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Homepage

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Advisor	**Prof. Jinah JANG**
Laboratory	**Biofabrication and Translational Medicine**
Web	**http://www.btmpostech.com/**
Email	**jinahjang@postech.ac.kr**
Research Topic	**Bioprinting system for Tissue Engineering**
Capacity	**1**
Remarks	

1-3. Dept. of Creative IT Engineering: Prof. Hyung Ham KIM

Prof. **Kim, Hyung Ham**
김 형 함

Education
2010: Ph.D., University of Southern California
2006: M.S., University of Southern California
1995: M.S., Seoul National University
1993: B.S., KAIST

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http://ultrasound.postech.ac.kr/

RESEARCH INTERESTS
- High frequency (15 MHz – 100 MHz) ultrasound transducers and imaging systems
- Cellular mechanics with high frequency (30 MHz – 1 GHz) ultrasound
- Neuromodulation with focused ultrasound

MAJOR RESEARCH ACHIEVEMENTS
- Preclinical and clinical imaging with high frequency ultrasound
- Cell trapping, mobilization and stimulation with high frequency ultrasound
- Photoacoustic imaging system for ophthalmic applications

RESEARCH KEYWORDS
High frequency ultrasound, ultrasound transducers, array transducers, Focused ultrasound, neuromodulation, cellular mechanics, Acoustic signal processing, ultrasound imaging, multimodal imaging

과학기술 관련 연구분야 분류
의공학기술(G31401), 신호처리(G30213), 음향 및 소음(G30405), 세라믹재료 (G30108)

Advisor	**Prof. Hyung Ham KIM**
Laboratory	**Kim Lab – Ultrasound Research Group**
Web	**http://ultrasound.postech.ac.kr/**
Email	**davidkim@postech.ac.kr**
Research Topic	**High-frequency ultrasound transducer design and fabrication**
Capacity	**1**
Remarks	**Lab safety training required**

2-1. Division of Environmental Science and Engineering: Prof. Seokhwan HWANG

Prof. **Hwang, Seok Hwan**
황 석 환

Education
1995: Ph.D., Utah State University
1993: M.S., Utah State University
1987: B.S., Yonsei University

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http://best.postech.ac.kr/

RESEARCH INTERESTS
- Biological Waste(water) Treatment / Scale-up
- Renewable energy (Biogas production) & Bioconversion process
- Bioprocess modeling and control
- Molecular biological monitoring

MAJOR RESEARCH ACHIEVEMENTS
- Development and statistical optimization of environmental bioprocesses
- Microbial dynamics in carbon-and nitrogen-removal systems using QPCR & other molecular methods
- Genetic recombination of methanogenic archaea to enhance anaerobiosis
- Bio-recycling of organic waste to value-added product (mycelia)

RESEARCH KEYWORDS
Biological Nitrogen Removal, Anaerobic Digestion, Waste(water) Treatment, Bioconversion Technology, Microbial Community Analysis

과학기술 관련 연구분야 분류
하수도 및 폐수처리(G30902), 자원재활용(G30908), 산업미생물 및 발효공학(G21102), 세균(G20201), 분자유전학(G21001)

Advisor	**Prof. Seokhwan HWANG**
Laboratory	**Environmental Bioprocess Lab**
Web	**http://best.postech.ac.kr/**
Email	**shwang@postech.ac.kr**
Research Topic	**Biological Wastewater Treatment**
Capacity	**1~2**
Remarks	

2-2. Division of Environmental Science and Engineering: Prof. Wonyong CHOI

RESEARCH INTERESTS

- Solar Photoenergy Conversion (hydrogen production, photoelectrochemical cell)
- Semiconductor Photocatalysis for Environmental Remediation
- Physicochemical Treatments of Polluted Water and Air
- Advanced Oxidation Processes (AOPs)
- Environmental Chemistry, Ice Chemistry

MAJOR RESEARCH ACHIEVEMENTS

- Mechanistic investigation of environmental photocatalysis
- Development of visible light active photocatalysts
- Solar conversion system for hydrogen production
- Physicochemical processes for environmental remediation

RESEARCH KEYWORDS

Photocatalysis, Solar Hydrogen, Artificial Photosynthesis, TiO_2, Environmental Redox processes

과학기술 관련 연구분야 분류

표면 · 계면 · 촉매 화학 공정(G30709), 하수도 및 폐수처리(G30902), 환경지구화학(G13201)

Prof. **Choi, Wonyong**

최 원 용

Education

1996: Ph.D., California Institute of Technology

1990: M.S., Pohang University of Science & Technology

1988: B.S., Seoul National University

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Advisor	**Prof. Wonyong CHOI**
Laboratory	**Eco-friendly Photoenergy Applications Lab**
Web	**http://epa.postech.ac.kr/**
Email	**wchoi@postech.ac.kr**
Research Topic	**Solar energy utilization for energy and environmental applications, Photocatalysis, Environmental chemistry**
Capacity	**1**
Remarks	

3-1. Department of Chemistry: Prof. Kyo Han AHN

Prof. **Ahn, Kyo Han**
안 교 한

Education
1985: Ph.D., KAIST
1982: M.S., KAIST
1980: B.S., Seoul National University
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RESEARCH INTERESTS
- Molecular probes for diagnosis and imaging of disease biomarkers
- Luminescent materials for bioimaging
- Molecular recognition and sensing

MAJOR RESEARCH ACHIEVEMENTS
- Making dipolar dyes emit in aqueous media
- Two-photon dyes with suppressed autofluorescence in tissue imaging
- Reactive fluorescent probes for silver ions and nanoparticles
- Turn-on fluorescent sensing of amino-carboxylates
- Chiral discrimination in a C_3-symmetric environment

RESEARCH KEYWORDS
Molecular probes, Luminescent materials, Nano/bio-functional materials, Bioconjugation

과학기술 관련 연구분야 분류
생유기화학(G12307),유기광화학(G12305), 유기합성화학(G12302), 유기화학-기타(G12399)

Advisor	**Prof. Kyo Han AHN**
Laboratory	**Organic and Bioorganic Chemistry Lab**
Web	**https://www.ahn-postech.com/**
Email	**ahn@postech.ac.kr**
Research Topic	**organic fluorescent materials and molecular probes for biomedical imaging, basic chemical laboratory courses**
Capacity	**1**
Remarks	

3-2. Department of Chemistry: Prof. Young-Tae CHANG

RESEARCH INTERESTS
- Fluorescent sensor for everything
- Fluorescent bioimaging probe & chemical biology
- Human Cell Atlas

MAJOR RESEARCH ACHIEVEMENTS
- Diversity Oriented Fluorescence Library Approach for systematic sensor and probe development
- Tagged library approach for facilitated target identification
- Nano particle based SERS sensor development

RESEARCH KEYWORDS
Fluorescent sensor, Cell selective probe, bioimaging, Human Cell Atlas

과학기술 관련 연구분야 분류
분광학(G12103), 유기합성화학(G12302), 생유기화학(G12307), 의약화학(G12308), 조합화학(G21504)

Prof. **Chang, YoungTae**
장 영 태

Education
1997: Ph.D., POSTECH
1995: M.S., POSTECH
1991: B.S., POSTECH
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Advisor	**Prof. Young-Tae CHANG**
Laboratory	**Sensor & Molecular Bioimaging Lab**
Web	**http://ytchang.postech.ac.kr/**
Email	**ytchang@postech.ac.kr**
Research Topic	**Bioimaging** **Fluorescent sensor** **Chemical Biology** **Artificial Cell**
Capacity	**3**
Remarks	

4-1. Department of Electrical Engineering: Prof. Byungsub KIM

RESEARCH INTERESTS

- Analog/Mixed-Signal/Digital Circuit Design
- Computer-Aided Design
- Emerging Technology

MAJOR RESEARCH ACHIEVEMENTS

- Invention of Decision Feedback Equalizer with Infinite Impulse Response Filter
- Invention of Charge-Injecting Pre-distortion Transmit Equalizer
- Development of the first Co-optimization and Circuit Synthesis Software for High-Speed transmitter
- Development of the fastest body channel communication transceiver using decision feedback equalizer
- Derivation of relaxed impedance matching constraint
- Invention of the tx which automatically adapts its impedance to the arbitrary channel and receiver impedances

RESEARCH KEYWORDS

High-Speed I/O, Resistive Memory, Glucose Sensor Circuit

Prof. **Kim, Byungsub**
김 병 섭

Education
2010: Ph.D., MIT
2004: M.S., MIT
2000: B.S., POSTECH
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Advisor	**Prof. Byungsub KIM**
Laboratory	**Bevil Lab.**
Web	**https://sites.google.com/site/beviliclab/**
Email	**byungsub@postech.ac.kr**
Research Topic	**Biosensor Driving Module**
Capacity	**2**
Remarks	**Prerequisite: electronics, basic circuit theory, verilog skill, etc.**

5-1. Department of Life Sciences: Prof. Joung-Hun KIM

Prof. **Kim, Joung-Hun**
김 정 훈

Education
2000: Ph.D., Imperial College, University of London
1996: M.S., Seoul National University
1992: B.S., Seoul National University

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http://joungkim-lab.org/

RESEARCH INTERESTS
- Molecular mechanisms of synaptic plasticity
- Cellular underpinnings for addictive behaviors
- Regulation of neural circuits underlying emotional memory

MAJOR RESEARCH ACHIEVEMENTS
- Cellular and physiological characterization of cell type-specific alterations in reward circuits for addictive behaviors
- Identification of dopamine-mediated regulation of learned fear expression in amygdala inhibitory circuits
- Identification of cell adhesion molecules as determinants for synaptic plasticity at the circuit levels
- Functional roles of phospholipase Cγ1 in forebrain for manic-like behaviors
- Visualization and quantification of microRNA in single cells

RESEARCH KEYWORDS
Synaptic plasticity, Addiction, Emotional memory, Neural circuits

과학기술 관련 연구분야 분류
전기생리(G21402), 신경생리(G21302), 세포 및 분자신경생물학(G21304), 신경병리(G21305)

Advisor	**Prof. Joung-Hun KIM**
Laboratory	**Lab of Molecular Neuroscience**
Web	**https://www.joungkim-lab.com/**
Email	**joungkim@postech.ac.kr**
Research Topic	**Neural circuits for emotional memory**
Capacity	**2**
Remarks	

5-2. Department of Life Sciences: Prof. Kunyoo SHIN

RESEARCH INTERESTS
- Stem cell niches and tumor microenvironment
- Hedgehog signaling in tissue regeneration and cancer
- Stem cell therapy

MAJOR RESEARCH ACHIEVEMENTS
- To educidate the role of Hedgehog signaling in postnatal tissue regeneration and cancer
- To identify molecular basis of bladder cancer development
- To understand cellular basis of prostate branching

RESEARCH KEYWORDS
Hedgehog signaling, stem cells, cancer

과학기술 관련 연구분야 분류
발암(G20801), 발생유전학(G21002), 세포분열 및 분화(G20707)

Prof. **Shin, Kunyoo**
신 근 유

Education
2006: Ph.D., University of Michigan
2000: M.S., Korea University
1998: B.A., Korea University
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Advisor	**Prof. Kunyoo SHIN**
Laboratory	**Stem cell and cancer biology**
Web	**https://www.shinlaboratory.net/**
Email	**kunyoos@postech.ac.kr**
Research Topic	**Stem cells, organoid, miniature tissue**
Capacity	**1~2**
Remarks	**Undergraduate 3~4 year students only**

5-3. Department of Life Sciences: Prof. Jin-Kwan HAN

Prof. **Han, Jin-Kwan**
한 진 관

Education
1991: Ph.D., University of California, Davis
1982: B.S., Yeungnam University
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RESEARCH INTERESTS
- Pattern formation in vertebrate embryo; control of morphogentic cell movement
- Cell fate determination in vertebrate; regulation of Wnt and TGF-ß signaling pathways
- Molecular mechanisms of organogensis in vertebrate embryo

MAJOR RESEARCH ACHIEVEMENTS
- Elucidation of control mechanism of gastrulation cell movement
- Elucidation of molecular mechanism of Wnt/Fz signaling pathway in early animal development
- Elucidation of mechanism of TGF-β signaling pathway in germ layer specification
- Genome-wide screening and molecular characterization of genes involved in organogenesis

RESEARCH KEYWORDS
Xenopus, Animal Development, Embryogenesis, Organogenesis, TGF-β, Wnt Signaling, Gastrulation

과학기술 관련 연구분야 분류
발생(G20701), 세포운동(G20709), 세포분열 및 분화(G20707), 유전자 발현 및 조절(G20908)

Advisor	**Prof. Jin-Kwan HAN**
Laboratory	**Developmental Biology**
Web	**http://dev.postech.ac.kr/**
Email	**jkh@postech.ac.kr**
Research Topic	**Signaling control vertebrate development**
Capacity	**1**
Remarks	

6-1. Division of Integrative Biosciences and Biotechnology (IBB): Prof. Kyong Tai KIM

Prof. **Kim, Kyong Tai**
김 경 태

Education
1989: Ph.D., University of Massachusetts
1982: M.S., KAIST
1980: B.S., Seoul National University

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http://mnp.postech.ac.kr/

RESEARCH INTERESTS
- Study for oscillatory expression mechanism of biorhythm-related genes
- Translational regulation and decay process of mRNA in synapse
- Functional characterization of Vaccinia-related kinase(VRK) family
- Development of drugs for Alzheimer's disease

MAJOR RESEARCH ACHIEVEMENTS
- Identification of VRK3 function in ERK signalings
- Functional roles of VRK1 in cell cycle and development of VRK1 inhibitors as antitumor agents
- Involvement of VRK2 in neurodegenerative diseases
- Identification of IRES-mediated translation of biorhythmic mRNAs
- Functional analysis of mRNA binding proteins in synaptogenesis

RESEARCH KEYWORDS
VRK, circadian rhythm, cell cycle, Synaptic mRNAs

과학기술 관련 연구분야 분류
세포분열 및 분화(G20707), 유전자 발현 및 조절(G20908), 세포 및 분자신경생물학(G21304)

Advisor	**Prof. Kyong Tai KIM**
Laboratory	**Molecular Neurophysiology**
Web	**http://mnp.postech.ac.kr/**
Email	**ktk@postech.ac.kr**
Research Topic	**Regulation of Synaptic mRNA translation**
Capacity	**1~2**
Remarks	

6-2. Division of Integrative Biosciences and Biotechnology (IBB): Prof. G-One AHN

Prof. **Ahn, G-One**
안 지 완

Education
2003: Ph.D., University of Auckland
2000: M.S., University of Auckland
1998: B.Sc., University of Auckland

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RESEARCH INTERESTS

- Cellular and molecular mechanisms by which tumor microenvironment impacts cancer treatment
- Crosstalk between immune cells and tumor microenvironment (hypoxia, acidosis, metabolism)
- Mechanism of radiotherapy resistance of tumors

MAJOR RESEARCH ACHIEVEMENTS

- Paradigm shift by demonstrating myeloid cell-mediated resistance in tumors to radiotherapy
- Exploring tumor hypoxia as a selective advantage for cancer therapy
- Pre-clinical drug development expertise (medicinal chemistry, in vitro and in vivo testing combined with state-of-the-art analytical techniques)

RESEARCH KEYWORDS

Tumor microenvironment, Myeloid cells, Hypoxia, Cancer, Radiotherapy, Experimental therapeutics

과학기술 관련 연구분야 분류

발암예방 및 치료(G20802), 종양면역(G21206)

Advisor	**Prof. G-One AHN**
Laboratory	**Tumor microenvionment lab**
Web	**https://tml.postech.ac.kr/**
Email	**goneahn@postech.ac.kr**
Research Topic	**Investigating the interplay between tumor microenvironmental factors influencing tumor progression**
Capacity	**1**
Remarks	

6-3. Division of Integrative Biosciences and Biotechnology (IBB): Prof. Inhwan HWANG

RESEARCH INTERESTS
- Protein Distribution Systems in Plant Cell
- Organelle Development and Evolution of Plant Cell
- Molecular Reprogramming of Plant Cells
- Expression of Foreign Proteins in Plant cells

MAJOR RESEARCH ACHIEVEMENTS
- Elucidation of protein trafficking mechanism
- Elucidation of protein targeting mechanism to chloroplasts and mitochondria
- Elucidation of molecular mechanism of ABA homeostasis
- Establishment of High level protein expression system

RESEARCH KEYWORDS
Protein biogenesis, organelle development, protein expression, protein trafficking and targeting, phytohormone ABA, dehydration stress

과학기술 관련 연구분야 분류
분자유전학(G21001), 식물생리(G20302), 세포유전학(G21003)

Prof. **Hwang, Inhwan**
황 인 환

Education
1988: Ph.D., University of North Carolina-Chapel Hill
1983: M.S., Seoul National University
1981: B.S., Seoul National University

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Advisor	**Prof. Inhwan HWANG**
Laboratory	**Cellular Systems Biology**
Web	**http://csb.postech.ac.kr/**
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Research Topic	**Plant Biotech**
Capacity	**2**
Remarks	