

# Joungyun Yoo

Postdoctoral Fellow, Department of Medical Engineering

California Institute of Technology (Caltech)

E-mail: [yjh6798@caltech.edu](mailto:yjh6798@caltech.edu)/[yjh6798@gmail.com](mailto:yjh6798@gmail.com) | Phone: +1-626-365-3541

## EDUCATION

---

**Pohang University of Science and Technology (POSTECH)** 2014. 3 – 2019. 8

**Ph.D.** in Chemical Engineering

Advisor: Prof. Shi-Woo Rhee

**Pohang University of Science and Technology (POSTECH)** 2010. 3 – 2014. 2

**B.S.** in Chemical Engineering

Magna cum laude

## PROFESSIONAL EXPERIENCE

---

**California Institute of Technology (Caltech)** 2021. 9 – Present

Medical Engineering, Division of Engineering and Applied Science

Postdoctoral Researcher

Advisor: Prof. Wei Gao

Co-advisor: Prof. Jinmyoung Joo (UNIST)

**Ulsan National Institute of Science and Technology (UNIST)** 2024. 1 – Present

Biomedical Engineering 2021. 9 – 2022. 9

Postdoctoral Researcher

**Korea Institute of Science and Technology (KIST)** 2019. 9 – 2021. 8

Center for Theragnosis, Biomedical Research Institute

Postdoctoral Researcher

Advisor: Dr. Sehoon Kim

## RESEARCH INTERESTS

---

- Engineering advanced nanomaterials and micro/nanorobotic systems for adaptive navigation, responsive therapeutic delivery, and real-time interaction with complex biological environments
- Designing imaging-guided in vivo biofabrication platforms that leverage machine learning, including acoustic printing technologies for non-invasive, high-resolution patterning of functional materials within living systems
- Translating innovations in nanotechnology and biofabrication into next-generation precision medicine strategies

## PUBLICATIONS (†equal contribution, \*corresponding author)

---

1. **J. Yoo**†, S. Kim†, W. Yoo, H. Han, G. Kim, A. W. Tessema, S. Kim, S. Tang, J. Kim, H. D. Truong, X. Ma, G. Kim, S. Won, J.-W. Choi, J. Hwang, J. Oh, Y. Seok, J. K. Kim, H. Cho, T.-E. Park, J. Joo, W. Gao, Photothermally gated nanorobots for active blood-brain barrier transcytosis and brain delivery. *Science Robotics*, under revision.
2. H. Han†, X. Ma†, **J. Yoo**†, S. Tang, K. Zhao, E. Criado-Hidalgo, H. D. Truong, C. Fezzi, J. Zhang, G. Chen, C. Hays, R. J. Reyes Segura, Z. Jin, A. Liu, M. G. Shapiro, J. R. Greer, Q. Zhou, W. Gao, Programmable multigang cancer therapy using ultrasound-propelled microrobots. *Nature Communications*, under revision.
3. **J. Yoo**, J. Joo, W. Gao, Bridging the barrier: Micro- and nanorobotics for active brain delivery. *Matter*, in press. <https://doi.org/10.1016/j.matt.2026.102858>.
4. S. Tang, H. Han, X. Ma, P. N. Patel, C. Gong, J. Zhang, E. Criado-Hidalgo, **J. Yoo**, J. Li, G. Kim, M. G. Shapiro, Q. Zhou, W. Gao, Enzymatic microbubble robots. *Nature Nanotechnology*, 21, 397 (2026).
5. M. Kim, K. Kim, J. Lee, S. A. Park, E. Jeong, S.-Y. Choi, T. Kwon, K. Myung, **J. Yoo**\*, S. W. Cho\*, J. Joo\*, Directed and rapid intracellular delivery of CRISPR/Cas9 ribonucleoproteins using charge-reversible fusogenic nanoparticles for therapeutic genome editing. *Small*, 22, e11362 (2026). Featured on Journal Cover.
6. **J. Yoo**†, Y. Kim†, J. H. Back†, J. Shin, P. K. Bae, K. M. Park, M. Kim, Y. H. Seo, Y. Bak, Y. H. Heo, J. Heo, H. Choi, Y. Kim, S. Lee, J. E. Lee, S. Jeong, J.-K. Yang, S. Kim, Surface-engineered nanobeads for regioselective antibody binding: A robust immunoassay platform leveraging catalytic signal amplification. *Biosensors and Bioelectronics*, 281, 117463 (2025).
7. E. Davoodi, J. Li, X. Ma, A. H. Najafabadi, **J. Yoo**, G. Lu, E. S. Sani, S. Lee, H. Montazerian, G. Kim, J. W. Yang, J. Williams, Y. Zeng, L. S. Li, Z. Jin, B. Sadri, S. S. Nia, L. V. Wang, T. K. Hsiai, P. S. Weiss, Q. Zhou, A. Khademhosseini, D. Wu, M. G. Shapiro, W. Gao, Imaging-guided deep tissue in vivo sound printing. *Science*, 388, 616 (2025).
8. Y. Choi, P. Jin, S. Lee, Y. Song, R. Y. Tay, G. Kim, **J. Yoo**, H. Han, J. Yeom, J. H. Cho, D. Kim, W. Gao, All-printed chip-less wearable neuromorphic system for multimodal physiochemical health monitoring. *Nature Communications*, 16, 5689 (2025).
9. J. Seong, M. Kim, **J. Yoo**, D. L. Mack, J. H. Lee, J. Joo, Sustained release of HIF-2 $\alpha$  inhibitors using biodegradable porous silicon carriers for enhanced immunogenic cell death of malignant Merkel cell carcinoma. *ACS Applied Materials & Interfaces*, 17, 7449 (2025).
10. S. Lee†, **J. Yoo**†, G. Bae, R. Thangam, J. Heo, J. Y. Park, H. Choi, C. Kim, J. An, J. Kim, K. R. Mun, S. Shin, K. Zhang, P. Zhao, Y. Kim, N. Kang, S.-B. Han, D. Kim, J. Yoon, M. Kang, J. Kim, L. Yang, S. Karamikamkar, J. Kim, Y. Zhu, A. H. Najafabadi, G. Song, D.-H. Kim, K.-B. Lee, S. J. Oh, H.-D. Jung, H.-C. Song, W. Y. Jang, L. Bian, Z. Chu, J. Yoon, J. S. Kim, Y. S. Zhang, Y. Kim, H. S. Jang, S. Kim, H. Kang, Photonic control of ligand nanospacing in self-assembly regulates stem cell fate. *Bioactive Materials*, 34, 164 (2024).
11. H. Han, X. Ma, W. Deng, J. Zhang, S. Tang, O. S. Pak, L. Zhu, E. Criado-Hidalgo, C. Gong, E. Karshalev, **J. Yoo**, M. You, A. Liu, C. Wang, H. Shen, P. N. Patel, C. L. Hays, P. J. Gunnarson, L. Li, Y. Zhang, J. O. Dabiri, L. V. Wang, M. G. Shapiro, D. Wu, Q. Zhou, J. R. Greer, W. Gao, Imaging-guided bioresorbable acoustic hydrogel microrobots. *Science Robotics*, 9, eadp 3593 (2024).

12. S. Tang, D. Tang, H. Zhou, Y. Li, D. Zhou, X. Peng, C. Ren, Y. Su, S. Zhang, H. Zheng, F. Wan, **J. Yoo**, H. Han, X. Ma, W. Gao, S. Wu, Bacterial outer membrane vesicle nanorobot. *Proceedings of the National Academy of Sciences*, 121, e2403460121 (2024).
13. H. Chang, Y. Park, K. Kim, C. Han, Y. Yoon, W. Yoo, **J. Yoo**, D. Lee, H. Han, K. Kim, J. Joo, W. Kwon, Room-temperature phosphorescence of defect-engineered silica nanoparticles for high-contrast afterglow bioimaging. *Chemical Engineering Journal*, 493, 152529 (2024).
14. **J. Yoo**†, S. Tang†, W. Gao, Micro- and nanorobots for biomedical applications in the brain. *Nature Reviews Bioengineering*, 1, 308 (2023).
15. **J. Yoo**†, K. Kim†, S. Kim, H. H. Park, H. Shin, J. Joo, Tailored polyethylene glycol grafting on porous nanoparticles for enhanced targeting and intracellular siRNA delivery. *Nanoscale*, 14, 14482 (2022). Featured on Journal Cover.
16. T. F. Anjong†, H. Choi†, **J. Yoo**†, Y. Bak, Y. Cho, D. Kim, S. Lee, K. Lee, B.-G. Kim, S. Kim, Multifunction-harnessed afterglow nanosensor for molecular imaging of acute kidney injury in vivo. *Small*, 18, 2200245 (2022).
17. Y.-D. Lee†, H. J. Shin†, **J. Yoo**†, G. Kim, M.-K. Kang, J. J. Lee, J. Bang, J.-K. Yang, S. Kim, Metal complexation-mediated stable and biocompatible nanoformulation of clinically approved near-infrared absorber for improved tumor targeting and photonic theranostics. *Nano Convergence*, 8, 1 (2021).
18. Y. Kim, R. Thangam, **J. Yoo**, J. Heo, J. Y. Park, N. Kang, S. Lee, J. Yoon, K. R. Mun, M. Kang, S. Min, S. Y. Kim, S. Son, J. Kim, H. Hong, G. Bae, K. Kim, S. Lee, L. Yang, J. Y. Lee, J. Kim, S. Park, D.-H. Kim, K.-B. Lee, W. Y. Jang, B. H. Kim, R. Paulmurugan, S.-W. Cho, H.-C. Song, S. J. Kang, W. Sun, Y. Zhu, J. Lee, H.-J. Kim, H. S. Jang, J. S. Kim, A. Khademhosseini, Y. Kim, S. Kim, H. Kang, Photoswitchable microgels for dynamic macrophage modulation. *Advanced Materials*, 8, 2205498 (2022). Featured on Journal Cover.
19. D. Jang, S. Yu, K. Chung, **J. Yoo**, F. M. Mota, J. Wang, D. J. Ahn, S. Kim, D. H. Kim, Direct deposition of anatase TiO<sub>2</sub> on thermally unstable gold nanopyramid: Morphology-conserved plasmonic nanohybrid for combinational photothermal and photocatalytic cancer therapy. *Applied Materials Today*, 27, 101472 (2022).
20. K. Jeong, D. Kim, H. J. Kim, Y.-D. Lee, **J. Yoo**, D. Jang, S. Lee, H. Park, Y. Kim, A. Singh, D. J. Ahn, D. H. Kim, J. Bang, J. Kim, P. N. Prasad, S. Kim, Photoacoustic inflatable nanohybrids for upconversion-mediated sonotheranostics. *ACS Nano*, 15, 18394 (2021).
21. J. Shin, D. M. Kang, **J. Yoo**, J. Heo, K. Jeong, J. H. Chung, Y. S. Han, S. Kim, Superoxide-responsive fluorogenic molecular probes for optical bioimaging of neurodegenerative events in Alzheimer's disease. *Analyst*, 146, 4748 (2021). Featured on Journal Cover.
22. **J. Yoo**†, H. Kim†, H. Chang†, W. Park, S. K. Hahn, W. Kwon, Biocompatible organosilica nanoparticles with self-encapsulated phenyl motifs for effective UV protection. *ACS Applied Materials & Interfaces*, 12, 9062 (2020).
23. **J. Yoo**†, U. Ryu†, W. Kwon, K. M. Choi, A multi-dye containing MOF for the ratiometric detection and simultaneous removal of Cr<sub>2</sub>O<sub>7</sub><sup>2-</sup> in the presence of interfering ions. *Sensors and Actuators B: Chemical*, 283, 426 (2019).
24. Y. Park†, **J. Yoo**†, M.-H. Kang\*, W. Kwon, J. Joo, Photoluminescent and biodegradable porous silicon nanoparticles for biomedical imaging. *Journal of Materials Chemistry B*, 7, 6271 (2019). Featured on Journal Cover.

25. H. Chang†, **J. Yoo**†, H. Kim, W. Park, S. K. Hahn, W. Kwon, Controlled growth of silica nanoparticles using two-phase orthogonal solvents for bioimaging. *Journal of Luminescence*, 214, 116529 (2019).
26. T. Lee, H. T. Bui, **J. Yoo**, M. Ra, S. H. Han, W. Kim, W. Kwon, Formation of TiO<sub>2</sub>@carbon core/shell nanocomposites from single molecular layer of aromatic compounds for photocatalytic hydrogen peroxide generation. *ACS Applied Materials & Interfaces*, 11, 41196 (2019).
27. **J. Yoo**†, S. Han†, W. Park, T. Lee, Y. Park, H. Chang, S. K. Hahn, W. Kwon, Defect-induced fluorescence of silica nanoparticles for bioimaging applications. *ACS Applied Materials & Interfaces*, 10, 44247 (2018).
28. D. Lee†, S. Beack†, **J. Yoo**†, S.-K. Kim, C. Lee, W. Kwon, S. K. Hahn, C. Kim, In vivo photoacoustic imaging of livers using biodegradable hyaluronic acid-conjugated silica nanoparticles. *Advanced Functional Materials*, 28, 1800941 (2018). Featured on Journal Cover.
29. U. Ryu†, **J. Yoo**†, W. Kwon, K. M. Choi, Tailoring nanocrystalline metal-organic frameworks as fluorescent dye carriers for bioimaging. *Inorganic Chemistry*, 56, 12859 (2017).
30. Y. Park†, **J. Yoo**†, B. Lim, W. Kwon, S.-W. Rhee, Improving functionality of carbon nanodots: Doping and surface functionalization. *Journal of Materials Chemistry A*, 4, 11582 (2016).

## MANUSCRIPTS IN PREPARATION

---

1. **J. Yoo**, D.-M. Lee, Y. E. Cho, et al., W. Gao, Machine learning-guided in vivo acoustic printing for dynamic biological interfaces.

## PATENTS

---

1. H. Kang, S. Kim, H. S. Jang, Y. Kim, **J. Yoo**, J. Heo, G. Bae, N. Kang, S. Lee, Y. Kim, Self-assembled complex controlled by light energy for stem cells and nanosystem including same, Korean patent (application: 10-2023-0029829, 7 Mar. 2023, granted: 10-2897463-0000, 3 Dec 2025)
2. W. Kwon, **J. Yoo**, S. K. Hahn, H. Kim, Ultraviolet protection silica nanoparticle composition and its manufacturing method, Korean patent (application: 10-2019-0173419, 23 Dec. 2020, granted: 10-2340304-0000, 13 Dec 2021)
3. K. M. Choi, W. Kwon, U. Ryu, **J. Yoo**, Imaging-agents Loaded Nanocrystalline Metal-Organic Frameworks for Containing and Method for Preparing the Same, Korean patent (application:10-2017-0052355, 24 Apr. 2017, granted: 10-1890588-0000, 16 Aug 2018)

## HONORS

---

<b>Sejong Science Fellowship (Overseas Training Track)</b> Supported by the Ministry of Science and ICT (MSIT), Republic of Korea.	2024. 09 – 2025. 08
<b>Korea Health Industry Development Institute (KHIDI) Fellowship</b> Supported by the Ministry of Health and Welfare, Republic of Korea.	2021. 09 – 2022. 09
<b>The Winner for Best Paper of the Year</b> Awarded by the department of chemical engineering at POSTECH	2018. 11

**The National Scholarship for Science and Engineering**  
Supported by Korea Student Aid Foundation (KOSAF)

2010. 03 – 2014. 02

## **TEACHING & LEADERSHIP EXPERIENCE**

---

**Postdoctoral Researcher Coordinator**

2024. 01 – 2024. 09

Appointed by Caltech Korean Graduate Student Association (CKGSA)

**Project Leader & Research Mentor at KIST**

Fall 2019 – Spring 2021

Undergraduate and Master Student Research Program (Supervising 9 students)

**Teaching Assistant at POSTECH**

Solid State Chemical Engineering (CHEB360)

Spring 2016 – Spring 2018

Physical Chemical Laboratory (CHEB212)

Fall 2015

Introduction to Chemical Engineering (CHEB100)

Fall 2014

**Peer Tutor at POSTECH**

Spring 2013

Chemical Engineering Thermodynamics (CHEB204)

**Student Advisor at POSTECH**

Spring 2012

Future Planning for College Life I (MSUS102)

---

## REFERENCES

---

**Prof. Wei Gao** (Current Postdoc advisor)  
Professor in the Department of Medical Engineering  
California Institute of Technology (Caltech)  
E-mail: weigao@caltech.edu

**Prof. Jinmyoung Joo** (Current Postdoc co-advisor)  
Associate Professor in the Department of Biomedical Engineering  
Ulsan National Institute of Science and Technology (UNIST)  
E-mail: jjoo@unist.ac.kr

**Dr. Sehoon Kim** (Formal Postdoc advisor)  
Principal Research Scientist  
Chemical and Biological Integrative Research Center  
Korea Institute of Science and Technology (KIST)  
E-mail: sehoonkim@kist.re.kr

**Prof. Shi-Woo Rhee** (Ph.D. advisor)  
Professor Emeritus in the Department of Chemical Engineering  
Pohang University of Science and Technology (POSTECH)  
E-mail: srhee@postech.ac.kr

**Prof. Woosung Kwon** (Ph.D. co-advisor)  
Associate Professor in the Department of Chemical and Biological Engineering  
Sookmyung Women's University  
E-mail: wkwon@sookmyung.ac.kr