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Associate Professor, Department of Chemical Engineering, POSTECH
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QUALIFICATION

Ph.D. – Chemical and Biomolecular Engineering Aug 2009

KAIST, Daejeon, Korea

Thesis: Metabolic engineering of *Mannheimia succiniciproducens* for the homo succinic acid production (supervisor: Dr. Sang Yup Lee)

B.S. – Chemical and Biomolecular Engineering Feb 2004

KAIST, Daejeon, Korea

PROFESSIONAL EXPERIENCE

POSTECH Sep 2021 – present

Department of Chemical Engineering
Associate Professor

MIT Aug 2023 – Jul 2024

Institute for Medical Engineering & Science
Visiting Scholar

Harvard University Sep 2023 – Jul 2024

Wyss Institute for Biologically Inspired Engineering
Harvard Medical School
Visiting Scholar

POSTECH Aug 2017 – Aug 2021

Department of Chemical Engineering
Assistant Professor

Harvard University (supervisor: Dr. James J. Collins) Dec 2015 – Jul 2017

Wyss Institute for Biologically Inspired Engineering
Harvard Medical School
Research Scientist (Jun 2016 – Jul 2017), Postdoctoral Fellow (Dec 2015 – Jun 2016)

- Paper-based molecular diagnostics
- Cell-free molecular manufacturing

MIT (supervisor: Dr. James J. Collins)

Dec 2014 – Nov 2015

Institute for Medical Engineering & Science
Department of Biological Engineering
Postdoctoral Associate

- Development of synthetic probiotics to detect and eliminate biothreat agents
- Designing genetic circuits for synthetic probiotics

Boston University (supervisor: Dr. James J. Collins)

Jan 2012 – Nov 2014

Department of Biomedical Engineering
Postdoctoral Researcher

- Development of kill switches to control proliferation of probiotics
- Development of genetic memory and trigger elements to record and monitor environmental conditions

KAIST (supervisor: Dr. Sang Yup Lee)

Sep 2009 – Dec 2011

Department of Chemical and Biomolecular Engineering
Postdoctoral Researcher / Senior Researcher

- Development of genome-based integrated bioprocess for succinic acid production
- Integrated bioprocess development for homo succinic acid production
- Development of efficient succinic acid producers

SELECTED PUBLICATION

12. Kim, D.[†], Sung, D.[†] and **Lee, J.W.*** “Expanding the Genetic Code: Strategies for Noncanonical Amino Acid Incorporation in Biopolymer”, **Bioresource Technol.**, 432:1-13 (2025) [JCR Top **2.5%**, IF 9.7]

11. Choi, Y.-N.[†], Kim, D.[†], Lee, S., Shin, Y. and **Lee, J.W.*** “Quadruplet codon decoding-based versatile genetic biocontainment system”, **Nucleic acids Res.**, 53(1):1-13 (2025) [JCR Top **1.8%**, IF 16.7]

10. Seo, E.[†], Choi, Y.-N.[†], Shin, Y.R., Kim, D., **Lee, J.W.***, “Design of synthetic promoters for cyanobacteria with generative deep-learning model”, **Nucleic Acids Res.**, 51(13):7071–7082 (2023) [JCR Top **1.8%**, IF 16.7]

9. Choi, Y.-N.[†], Cho, N.[†], Lee, K., Gwon, D., **Lee, J.W.***, Lee, J.* “Programmable synthesis of bio-based materials using cell-free systems”, **Adv. Mater.**, 35(4):2203433 (2022) [JCR Top **2.8%**, IF 29.4]

8. Woo, C.H.[†], Jang, S.[†], Shin, G., Jung, G.Y.* and **Lee, J.W.*** “Sensitive fluorescence detection of SARS-CoV-2 RNA in clinical samples via one-pot isothermal ligation and transcription”, **Nat. Biomed. Eng.** 4:1168-1179 (2020) [JCR Top **1.1%**, IF 25.7]

7. **Lee, J.W.[†]**, Chan, C.T.Y.[†], Slomovic, S. and Collins, J.J. “Next-generation biocontainment systems for engineered organisms”, **Nat. Chem. Biol.**, 14:530-537 (2018). ([†]equally contributed) [JCR Top **3.7%**, IF 14.8]

6. Pardee, K.[†], Slomovic, S.[†], Nguyen, P.Q.[†], **Lee, J.W.[†]**, Donghia, N., Burrill, D., Ferrante, T., McSorley, F., Furuta, Y., Vernet, A., Lewandowski, M., Boddy, C.N., Joshi, N.S., Collins, J.J. “Portable, On-demand Biomolecular Manufacturing”, **Cell**,

167(1): 248-259 (2016). (†equally contributed) [JCR Top **0.5%**, IF 64.5]

5. **Lee, J.W.**, Gyorgy, A., Cameron, D.E., Pyenson, N., Choi, K.R., Way, J.C., Silver, P.A., Del Vecchio, D., and Collins, J.J., “Creating single-copy genetic circuits”, **Mol. Cell**, 63:329-336 (2016). [JCR Top **2.6%**, IF 16.0]

4. Chan, C.T.Y.†, **Lee, J.W.†**, Cameron, D. E.†, Bashor, C. J., and Collins, J. J. “Deadman and Passcode Microbial Kill switches for bacterial containment”, **Nat. Chem. Biol.**, 12:82-86 (2016). (†equally contributed) [JCR Top **3.7%**, IF 14.8]

3. **Lee, J.W.**, Na, D., Park, J. M., Lee, J., Choi, S., and Lee, S.Y. “Systems metabolic engineering of microorganisms for natural and nonnatural chemicals”, **Nat. Chem. Biol.**, 8:536-546 (2012). [JCR Top **3.7%**, IF 14.8]

2. **Lee, J.W.**, Kim, H.U., Choi, S., Yi, J., and Lee, S.Y. “Microbial production of building block chemicals and polymers”, **Curr. Opin. Biotechnol.**, 22(6):758–767 (2011). [JCR Top **4.5%**, IF 7.7]

1. **Lee, J.W.**, Kim, T.Y., Jang, Y.S., Choi, S., and Lee, S.Y. “Systems metabolic engineering for chemicals and materials”, **Trends Biotechnol.**, 29(8): 370-378 (2011). (Journal cover paper) [JCR Top **1.6%**, IF 17.3]

INTERNATIONAL JOURNAL PUBLICATION

(† co-first, * co-corresponding)

60. Park, J., **Jeon, H.H.**, **Lee, J.W.**, and Park, H., Sequence analysis and decoding with extra low-quality reads for DNA data storage”, **Bioinformatics**, 41(6): btaf335 (2025)

59. Jin, S., **Ganesh, I.**, Bae, J., Lee, D., Kang, S., Lee, H., **Lee, J.W.*** and Cho, B.-K.* “Metabolic engineering of acetogenic bacteria using CO gas-sensing transcriptional ON/OFF modules”, **Metab. Eng.**, 91:290-301 (2025)

58. **Park, S.**, Lee, K.†, An, H.-J.†, Lin, E.†, Kim, H., Jeong S., Roy, S., Kang, Y.W., Yang, J., Lee, S.-W., Yi, G.-R., Lee, H.*, Seo, D.*, Hwang, D.S.*, Lee, J.* and **Lee, J.W.*** “mRNA vaccine”, (in revision) (2025)

57. **Kwon, D.†**, **Lee, S.†**, Jeong, Y.-J.†, Ganesh, I., Na, J.-G.*, Yeom, S.-J.* and **Lee, J.W.*** “Enzyme prototyping platform”, (submitted) (2025)

56. **Chauhan, S.** and **Lee, J.W.*** “Development of a Femtosensitive Electrochemical Aptasensor for Tuberculosis Ag85B Detection”, **Anal. Chem.**, 1:1-10 (2025)

55. **Kim, W.†**, **Han, J.†**, **Chauhan, S.** and **Lee, J.W.*** “Cell-free Protein Synthesis and Vesicle Systems”, **J. Biol. Eng.**, 55:1-17 (2025)

54. **Kim, D.†**, **Sung, D.†** and **Lee, J.W.*** “Expanding the Genetic Code: Strategies for Noncanonical Amino Acid Incorporation in Biopolymer”, **Bioresource Technol.**, 432:1-13 (2025)

53. **Lee, J.†**, **Sung, D.†**, **Woo, C.H.†**, **Kim, B.G.** and **Lee, J.W.*** “SNP discrimination”, (in revision) (2025)

52. **Lee, J., Jeon, H., Seo, E., Park, S., Choe, D., Cho, B.-K. and Lee, J.W.*** “Direct mRNA-to-sgRNA conversion generates design-free ultra-dense CRISPRi libraries for systematic phenotypic screening”, **Metab. Eng.**, 89:108-120 (2025)
51. **Choi, Y.-N.[†], Kim, D.[†], Lee, S., Shin, Y. and Lee, J.W.*** “Quadruplet codon decoding-based versatile genetic biocontainment system”, **Nucleic acids Res.**, 53(1):1-13 (2025)
50. **Park, S., Kim, M., and Lee, J.W.*** “Optimizing nucleic acid delivery systems through barcode technology”, **ACS Synth. Biol.**, 13(4):1006-1018 (2024)
49. **Kim, W.[†], Lee, S.[†], Sung, B.H.* , Na, J.-G.* and Lee, J.W.*** “Cell-free systems and genetic biosensors for accelerating enzyme and pathway prototyping”, **Curr. Opin. Syst. Biol.**, 37:100501 (2024)
48. Jeong, J., Park, H., Kwak, H.Y., No, J.-S., **Jeon, H., Lee, J.W.** and Kim, J.W. “Iterative Soft Decoding Algorithm for DNA Storage Using Quality Score and Redecoding”, **IEEE Trans. Nanobioscience**, 23(1):81-90 (2024)
47. Son, J., Lee, H., Lee, T., Sohn, H., Park, S.J., Na, J.-G., Seo, S.W., **Lee, J.W.**, Hah, Y.Y. and Park, C. “Novel synthetic pathway for methyl 3-hydroxybutyrate from β -hydroxybutyric acid and methanol by enzymatic esterification”, **J Ind Eng Chem**, 123:355-360 (2023)
46. Kang, S., GAO, Y., Jeong, J., Park, S.-J., Kim, J.-W., No, J.-S., Jeon, H., **Lee, J.W.**, Kim, S.H., Park, H. and No. A. “Generative Adversarial Networks for DNA Storage Channel Simulator”, **IEEE Access**, 11:3781-3793 (2023)
45. Seo, E.[†], Choi, Y.-N.[†], Shin, Y., Kim, D., and Lee, **J.W.*** “Design of synthetic promoters for cyanobacteria with generative deep-learning model”, **Nucleic acids Res.** (2023)
44. Gwon, D., Seo, E., and **Lee, J.W.*** “Construction of Synthetic Microbial Consortium for Violacein Production”, **Biotechnol. Bioprocess Eng.** (2023)
43. Ryu, M.[†], Choi, H.[†], Yoon, J., Choi, Y.-N., Lee, S., Kim, H., Chae, M., **Lee, J.W.**, Kang, J., and Lee. H. “Silica-Nanoparticle Reinforced Lubricant-Infused Copper Substrates with Enhanced Lubricant Retention for Maintenance-Free Heat Exchangers”, **Chem. Eng. J.** 451:138657 (2023)
42. Ye, D.-Y., Noh, M.H., Milito, A., Kim, M., **Lee, J.W.**, Yang, J.-S. and Jung. G.Y. “Kinetic Compartmentalization by Unnatural Reaction for Itaconate Production”, **Nat. Commun** 13:5353 (2022)
41. Yoon, J., Zhang, X., Ryu, M., Kim, W.H., Ihm, K., **Lee, J.W.***, Li, W.* and Li, H.* “Tailoring the hydrophilicity for delayed condensation frosting in antifogging coatings” **ACS Appl. Mater. Interfaces**, 30(14):35064-35073 (2022)
40. Choi, Y.-N.[†], Cho, N.[†], Lee, K., Gwon, D., **Lee, J.W.***, Lee, J.* “Programmable synthesis of bio-based materials using cell-free systems” **Adv. Mater.**, 35(4):2203433 (2022)
39. Kim, M.[†], Jeon, K.[†], Kim, W.H., **Lee, J.W.**, Hwang, Y.-H.*, and Lee, H* “Biocompatible amphiphilic Janus nanoparticles with enhanced interfacial properties for colloidal surfactants”, **J. Colloid Interface Sci.**, 616: 488-498 (2022).

38. Kim, H.[†], Lee, S.[†], Choi, Y.-N., Shin, Y., Yoon, J., Ryu, M., **Lee, J.W.***, and Lee, H.* “Durable superhydrophobic Poly(vinylidene fluoride) (PVDF)-based nanofibrous membranes for reusable air filters”, **ACS Appl. Polym. Mater.**, 4(1): 338-347 (2022).
37. Gwon, D.[†], Seok, J.Y.[†], Jung, G.Y., and **Lee, J.W.*** “Biosensor-assisted adaptive laboratory evolution for violacein production”, **Int. J. Mol. Sci.**, 22(12):6594 (2021).
36. Choi, Y.-N., Shin, Y., Park, J.M.* and **Lee, J.W.*** “Cell-free transcription-coupled CRISPR/Cas12a assay for prototyping cyanobacterial promoters”, **ACS Synth. Biol.**, 10(6):1300-1307 (2021).
35. Jeong, J.*, Park, S.J., Kim, J.-W., No, J.-S.*, Jeon, H.H., **Lee, J.W.***, No, A., Kim, S., and Park, H.* “Cooperative Sequence Clustering and Decoding for DNA Storage System with Fountain Codes”, **Bioinformatics**, 37(19):3136-3143 (2021).
34. Park, S., and **Lee, J.W.*** “Detection of coronaviruses using RNA toehold switch sensors”, **Int. J. Mol. Sci.**, 22(4):1772 (2021).
33. Woo, C.H.[†], Jang, S.[†], Shin, G., Jung, G.Y.*, and **Lee, J.W.*** “Sensitive fluorescence detection of SARS-CoV-2 RNA in clinical samples via one-pot isothermal ligation and transcription”, **Nat. Biomed. Eng.** 4:1168-1179 (2020).
32. Kim, D., and **Lee, J.W.*** “Genetic biocontainment systems for the safe use of engineered microorganisms”, **Biotechnol. Bioprocess Eng.** 25:974-984 (2020).
31. Jung, J.K., Alam, K.K., Verosloff, M.S., Capdevila, D.A., Desmau, M., Clauer, P.R., **Lee, J.W.**, Nguyen, P.Q., Pastén, P.A., Matiassek, S.J., Gaillard, J.-F., Giedroc, D.P., Collins, J.J., and Lucks, J.B. “Cell-free biosensors for rapid detection of water contaminants”, **Nat. Biotechnol.** 38:1451-1459 (2020).
30. Ganesh, I., Gwon, D., and **Lee, J.W.*** “Gas-sensing transcriptional regulators”, **Biotech. J.**, 15:1900345 (2020).
29. Choi, Y.-N, **Lee, J.W.**, Kim, J.W., and Park, J.M. “Acetyl-CoA-derived biofuel and biochemical production in cyanobacteria: a mini review.” **J. Appl. Phycol.** 32:1643-1653 (2020).
28. **Lee, J.W.[†]**, Chan, C.T.Y.[†], Slomovic, S., and Collins, J.J. “Next-generation biocontainment systems for engineered organisms”, **Nat. Chem. Biol.**, 14:530-537 (2018).
27. Gootenberg, J.S., Abudayyeh, O.O., **Lee, J.W.**, Essletzbichler, P., Dy A., Joung, J., Verdine, V., Donghia, N., Daringer, N.M., Freije, C.A., Myhrvold, C., Bhattacharyya, R.P., Livny, J., Regev, A., Koonin, E.V., Hung, D.T., Sabeti, P.C., Collins, J.J., and Zhang, F. “Nucleic acid detection with CRISPR-Cas13a/C2c2”, **Science**, 356(6336): 438-442 (2017).
26. **Lee, J.W.**, Yi, J., Kim, T.Y., Choi, S., Ahn, J.H., Song, H., Lee, M.-H., and Lee, S.Y. “Homo-succinic acid production by metabolically engineered *Mannheimia succiniciproducens*”, **Metab. Eng.**, 38: 409-417 (2016).
25. Pardee, K.[†], Slomovic, S.[†], Nguyen, P.Q.[†], **Lee, J.W.[†]**, Donghia, N., Burrill, D., Ferrante, T., McSorley, F., Furuta, Y., Vernet, A., Lewandowski, M., Boddy, C.N., Joshi, N.S., Collins, J.J. “Portable, On-demand Biomolecular Manufacturing”, **Cell**,

167(1): 248-259 (2016).

24. **Lee, J.W.**, Gyorgy, A., Cameron, D.E., Pyenson, N., Choi, K.R., Way, J.C., Silver, P.A., Del Vecchio, D., and Collins, J.J., "Creating single-copy genetic circuits", **Mol. Cell**, 63: 329-336 (2016).

23. Pardee, K., Green, A.A., Takahashi, M.K., Braff, D., Lambert, G., **Lee, J.W.**, Ferrante, T., Ma, D., Donghia, N., Fan, M., Daringer, N.M., Bosch, I., Dudley, D.M., O'Connor, D.H., Gehrke, L., and Collins, J.J. "Rapid, low-cost detection of Zika virus using programmable biomolecular components", **Cell**, 165(5):1255-1266 (2016).

22. Chan, C.T.Y.[†], **Lee, J.W.**[†], Cameron, D. E.[†], Bashor, C. J., and Collins, J. J. "Deadman and Passcode Microbial Kill switches for bacterial containment", **Nat. Chem. Biol.**, 12:82-86 (2016). (***equally contributed**)

21. Choi, S., Song, H., Lim, S.W., Kim, T.Y., Ahn, J.H., **Lee, J.W.**, Lee, M.-H., and Lee, S.Y. "Highly selective production of succinic acid by metabolically engineered *Mannheimia succiniciproducens* and its efficient purification", **Biotechnol. Bioeng.**, 113(10):2168-77 (2016).

20. Jung, K., Choi, J.-D.-R., Lee, D., Seo, C., **Lee, J.W.**, Lee, S.Y., Chang, H.N., and Kim, Y.-C., "Permeation characteristics of volatile fatty acids solution by forward osmosis", **Process Biochem.**, 50:669-677 (2015).

19. **Lee, J.W.**, Na, D., Park, J. M., Lee, J., Choi, S., and Lee, S.Y. "Systems metabolic engineering of microorganisms for natural and nonnatural chemicals", **Nat. Chem. Biol.**, 8:536-546 (2012).

18. Lee, S.Y., Sohn, S.B., Park, J.M., **Lee, J.W.**, "Biorefinery Research in Korea", **Asia Pacific Biotech. News**, 15(12): 15-21 (2011). (Journal cover paper)

17. **Lee, J.W.**, Kim, H.U., Choi, S., Yi, J., and Lee, S.Y. "Microbial production of building block chemicals and polymers", **Curr. Opin. Biotechnol.**, 22(6):758–767 (2011).

16. **Lee, J.W.**, Kim, T.Y., Jang, Y.S., Choi, S., and Lee, S.Y. "Systems metabolic engineering for chemicals and materials", **Trends Biotechnol.**, 29(8): 370-378 (2011). (Journal cover paper)

15. Park, J.H., Jang, Y.S., **Lee, J.W.**, and Lee, S.Y. "*Escherichia coli* W as a new platform strain for the enhanced production of L-valine by systems metabolic engineering", **Biotechnol. Bioeng.**, 108(5):1140-1147 (2011).

14. Han, M.-J.[†], **Lee, J. W.**[†], Lee, S. Y., "Understanding and engineering microbial cells based on proteomics and its combined analyses", **Proteomics**, 11(4): 721-743 (2011).

13. Han, M.-J., Yun, H., **Lee, J. W.**, Lee, Y. H., Lee, S. Y., Yoo, J.-S., Kim, J. F. Hur, C.-G., "Genome-wide identification of the subcellular localization of the *Escherichia coli* B proteome using experimental and computational methods", **Proteomics**, 11(7): 1213-1227 (2011).

12. **Lee, J.W.**, Choi, S., Park, J.H., Vickers, C., Nielsen, L.K., and Lee, S.Y., "Development of sucrose-utilizing *Escherichia coli* K-12 strain by cloning β -fructofuranosidases and its application for L-threonine production", **Appl. Microbiol. Biotechnol.**, 88(4): 905-913 (2010).

11. **Lee, J.W.**, Choi, S., Kim, J.M., and Lee, S.Y., "*Mannheimia succiniciproducens* phosphotransferase system for sucrose utilization ", **Appl. Environ. Microbiol.**, 76(5): 1699-1703 (2010).
10. **Lee, J.W.** and Lee, S.Y., "Proteome-based physiological analysis of the metabolically engineered succinic acid producer *Mannheimia succiniciproducens* LPK7", **Bioprocess Biosyst. Eng.**, 33(1): 97-107 (2010).
9. Lee, S.Y., Kim, J.M., Song, H., **Lee, J.W.**, Kim, T.Y., and Jang, Y.-S., "From genome sequence to integrated bioprocess for succinic acid production by *Mannheimia succiniciproducens*", **Appl. Microbiol. Biotechnol.**, 79(1): 11-22 (2008).
8. Han, M. -J., **Lee, J. W.**, Lee, S. Y., and Yoo, J. S. "Proteome-Level Responses of *Escherichia coli* to Long-Chain Fatty Acids and Use of Fatty Acid Inducible Promoter in Protein Production", **J. Biomed. Biotechnol.**, Article ID 735101, (2008).
7. Yun, H., **Lee, J. W.**, Jeong, J., Chung, J., Park, J. M., Myoung, H. N., and Lee, S. Y., "EcoProDB: the *Escherichia coli* protein database", **Bioinformatics**, 23(18): 2501-2503 (2007).
6. Jang, Y.-S., Jung, Y.R., Lee, S.Y., Kim, J.M., **Lee, J.W.**, Oh, D.-B., Kang, H.A., Kwon, O., Jang, S.H., Song, H., Lee, S.J., and Kang, K.Y. "Construction and characterization of shuttle vectors for succinic acid producing rumen bacteria", **Appl. Environ. Microbiol.**, 73(17): 5411-5420 (2007).
5. Song, H., **Lee, J.W.**, Choi, S., You, J.K., Hong, W.H., and Lee, S.Y., "Effects of dissolved CO₂ levels on the growth of *Mannheimia succiniciproducens* and succinic acid production", **Biotechnol. Bioeng.**, 98(6): 1296-1304 (2007).
4. Han, M.-J., Park, S.J., **Lee, J.W.**, Min, B.H., Lee, S.Y., Kim, S.-J., and Yoo, J.-S. "Analysis of poly(3-hydroxybutyrate) granule-associated proteome in recombinant *Escherichia coli*", **J. Microbiol. Biotechnol.**, 16(6): 901-910 (2006).
3. **Lee, J.W.**, Lee, S.Y., Song, H., and Yoo, J.S. "The proteome of *Mannheimia succiniciproducens*, a capnophilic rumen bacterium", **Proteomics**, 6: 3550-3566. (2006)
2. Han, M.-J., **Lee, J.W.**, and Lee, S.Y., "Enhanced Proteome Profiling by Inhibiting Proteolysis with Small Heat Shock Proteins", **J. Proteome Res.**, 4(6): 2429-2434. (2005)
1. Park, S.J., Lee, S.Y., Cho, J., Kim, T.Y., **Lee, J.W.**, Park, J.H., and Han, M.-J., "Global physiological understanding and metabolic engineering of microorganisms based on omics studies", **Appl. Microbiol. Biotechnol.**, 68:567-579. (2005)

PATENT (29 registered and 66 applied)