

*Curriculum Vitae***Byung-Kwan Cho, Ph.D.**

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NARRATIVE

Prof. Cho serves as a KAIST Endowed Chair Professor and Vice President of the Office of Research Affairs at the Korea Advanced Institute of Science and Technology (KAIST). Prior to joining KAIST, he worked as a project scientist in the Department of Bioengineering at the University of California San Diego, USA. He earned his Ph.D. from Seoul National University, Korea, specializing in molecular biotechnology and biomaterials. His research focuses on systems and synthetic biology, with his group making significant contributions to understanding microbial transcriptional and translational regulatory networks through high-throughput technologies. Current research initiatives include engineering microorganisms using information-rich datasets and synthetic biology tools for four main applications: developing C1 biorefinery systems using acetogens, constructing minimal genome *E. coli* chassis platform, discovering secondary metabolites from Streptomyces, and designing therapeutic microbes. As of June 2025, his scientific contributions include 230 published articles and 20 registered patents. His achievements have been recognized through several prestigious appointments, including KAIST Endowed Chair Professor (2021), World Top 2% Scientist by Elsevier (2024), and young scientist by both the World Economic Forum (2012) and the Korea Academy of Science and Technology (2013).

EDUCATIONAL BACKGROUND

2003 – 2008	Post-doctoral Researcher, Bioengineering University of California, San Diego (Advisor: Dr. Bernhard Ø. Palsson)
1997 – 2003	Ph.D., Biochemical Engineering and Biotechnology Seoul National University (Advisor: Dr. Byung-Gee Kim)

SELECTED PROFESSIONAL CAREERS

2010 – present	Full, Associate, Assistant Professor, KAIST
2023 – present	Vice President, Office of Research Affairs, KAIST
2023 – present	Head, Graduate School of Engineering Biology, KAIST
2023 – 2025	Director, AI Institute, KAIST
2021 – present	Director, KAIST Institutes for BioInnovation, KAIST
2025 – present	Adjunct Professor, DTU, Denmark
2024 – 2025	Member, Presidential Bioeconomy Committee, Korea
2024 – present	Scientific Advisory Board, Max Planck Institutes, Germany
2024 – present	Scientific Advisory Board, KRIBB, Korea
2024 – present	Steering Committee, Merck-KAIST Collaboration Center, KAIST
2024 – present	Non-Standing Director, Curiosis, Korea
2023 – present	Adjunct Researcher, KRIBB, Korea
2019 – 2022	Review Board, National Research Foundation, Korea

2019 – present	Steering Committee, Korean Society of Biotechnology and Bioengineering
2019 – 2025	Non-Standing Director, Daesung Holdings, Korea
2018 – present	Co-Chair, Asian Synthetic Biology Association
2016 – 2024	Steering Committee, Korean Society of Microbiology and Biotechnology
2008 – 2010	Project Scientist, Bioengineering, University of California, San Diego

PERSONAL STATISTICS

h-index: 61

Publications: 234, Book chapters: 7, Patents: 20, Scientific presentations: 385, Invited talks: 180

RESEARCH INTERESTS

Keywords: Synthetic Biology, Engineering Biology, Systems Biology, Biofoundry, Microbial chassis, Acetogens, Streptomyces, Microbiome, Multi-omics, C1 fermentation, Minimal genome, Secondary metabolites, Agricultural applications, Therapeutic microbes, Enzymatic DNA synthesis

[1] Development of Synthetic Microbes for C1 Feedstock Conversion (Pilot-stage): *Proc. Natl. Acad. Sci. USA*, 2023, 120(6), e2216244120; *Chem. Eng. J.*, 2022, 449, 137478; *Metab. Eng.*, 2022, 72, 215; *Proc. Natl. Acad. Sci. USA*, 2021, 118(9), e2020552118; *Proc. Natl. Acad. Sci. USA*, 2020, 117(13), 516.

[2] Design of Minimal Genome Microbes for Synthetic Biology Applications (Conceptual): *Trends Biotechnol.*, (2024) 42(8): 1048-1063; *Metab. Eng.*, (2024) 83, 160; *Nucleic Acids Res.*, (2022) 50(7), 4171; *Nat. Commun.*, (2019) 10, 935; *Nat. Chem. Biol.*, (2012) 8(1), 65; *Nature Biotechnol.*, (2009) 27(11), 1043.

[3] Engineering Secondary Metabolites Production for Therapeutic and Agricultural Applications (Pilot-stage): *Nat. Commun.*, (2025) 16: 1-15; *Adv. Sci.*, (2024) 11(41): 2403912; *ISME J.*, (2020) 14, 1111; *Nucleic Acids Res.*, (2019) 47(12), 6114; *Nat. Commun.*, (2016) 7, 11605.

[4] Microbiome Engineering for Therapeutic Applications (Conceptual): *ACS Nano*, (2023) 17(11), 10996; *Front. Bioeng. Biotechnol.*, (2023) 11, 1267378; *Microbiome*, (2021) 9, 240; *Metab. Eng.*, (2021) 68, 174; *Proc. Natl. Acad. Sci. USA*, (2008) 105(49), 19462; *Genome Res.*, (2008) 18(6), 900.

HONORS AND AWARDS

- 2025 Vision Leadership Award from KAIST
- 2024 World Top 2% Scientist by Elsevier
- 2023 Innovative Education Award from KAIST
- 2023 Minister Award from Ministry of Science and ICT of Korea
- 2023 Minister Award from Ministry of Environment of Korea
- 2023 Research Award from the Korean Society of Biotechnology and Bioengineering
- 2023 Research Award from the Yang-young Foundation
- 2022 Research Award from the Korean Society of Microbiology and Biotechnology
- 2021 KAIST Endowed Chair Professor
- 2021 Research Award from the Korean Society of Biotechnology and Bioengineering
- 2021 International Joint Research Award from KAIST
- 2019 Misan Research Award from the Korean Society of Microbiology and Biotechnology
- 2019 Collaborated Research Award from KAIST Institutes
- 2017 Y-KAST from Korea Academy of Science and Technology
- 2017 Outstanding Research Award from KAIST Institutes
- 2016 Outstanding Faculty Award from KAIST
- 2014 Minister Award from Ministry of Science, ICT and Future Planning of Korea

2013 Young Scientist from Korean Academy of Science and Technology

2012 Young Scientist Award from Davos World Economic Forum

SELECTED KEY PUBLICATIONS

- 1 Kim, K., Choe, D., Kim, S.C., Yim, S.S., Jeong, K.J., Palsson, B., Cho, S., **Cho, B.-K.** (2025) Transcriptional regulatory networks of the human gut symbiont *Bacteroides thetaiotaomicron* are uncovered using machine-learning. **Nucleic Acids Res.**, Accepted. (IF=16.971)
- 2 Kim, H., Hillson, N. J., **Cho, B.-K.**, Sung, B. H., Lee, D.-H., Kim, D.-M., Oh, M.-K., Chang, M. W., Jin, Y.-S., Rosser, S. J., Vegh, P., Fragkoudis, R., Le Feuvre, R., Scrutton, N. S., Storch, M., Seong, W., Freemont, P. S.*, Lee, S.-G.* (2025) Abstraction hierarchy to define biofoundry workflows and operations for interoperable synthetic biology research and applications. **Nat. Commun.**, 16 (IF=14.919)
- 3 Kim, G., Lee, D., Kim, J.H., Kim, S.D., Kim, H., Kim, J.H., Yim, S.S., Yeom, S.-J., Keasling, J.D., **Cho, B.-K.** (2025) Engineering modular enzyme assembly: Synthetic interface strategies for natural products biosynthesis applications. **Nat. Prod. Rep.**, Accepted. (IF=13.423)
- 4 Jin, S., Ganesh I., Bae, J., Lee, D., Kang, S., Lee, H., Lee, J. W., **Cho, B.-K.** (2025) Metabolic engineering of acetogenic bacteria using CO gas-sensing transcriptional ON/OFF modules. **Metab. Eng.**, In press. (IF=9.78)
- 5 Lee, J., Ha, H.J., Seo, E., Park, S., Choe, D., **Cho, B.-K.**, Lee, J.W. (2025) Direct mRNA-to-sgRNA conversion generates design-free ultra-dense CRISPRi libraries for systematic phenotypic screening. **Metab. Eng.**, In press (IF=9.78)
- 6 Kim, D., Gu, B., Cha, Y., Ha, J., Lee, Y., Kim, G., **Cho, B.-K.**, Oh, M.-K. (2025) Engineered CRISPR-Cas9 for *Streptomyces* sp. genome editing to improve specialized metabolite production. **Nat. Commun.**, 16: 1-15. (IF=14.919)
- 7 Lee, Y., Choe, D., Palsson, B., **Cho, B.-K.** (2024) Machine-learning analysis of *Streptomyces coelicolor* transcriptomes reveals a transcription regulatory network encompassing biosynthetic gene clusters. **Adv. Sci.**, 2403912. (IF=16.3)
- 8 Kim, K., Choe, D., Kang, M., Cho, S.-H., Cho, S., Jeong, K. J., Palsson, B., **Cho, B.-K.** (2024) Serial adaptive laboratory evolution enhances mixed carbon metabolic capacity of *Escherichia coli*. **Metab. Eng.**, Accepted. (IF=9.78)
- 9 Kim, K., Choe, D., Cho, S., Palsson, B., **Cho, B.-K.** (2024) Reduction-to-synthesis: The dominant approach to genome-scale synthetic biology. **Trends Biotechnol.**, Accepted. (IF=17.3)
- 10 Rahman, A., Shin, J., Whang, C.-H., Jung, W., Yoo, D., Seo, C., **Cho, B.-K.**, Jon, S. (2023) Bilirubin Nanomedicine Rescues Intestinal Barrier Destruction and Restores Mucosal Immunity in Colitis. **ACS Nano**, Accepted. (IF=18.027)
- 11 Shin, J.†, Bae, J.†, Lee, H., Kang, S., Jin, S., Song, Y., Cho, S., **Cho, B.-K.** (2023) Genome-wide CRISPRi screen identifies enhanced autolithotrophic phenotypes in acetogenic bacterium *Eubacterium limosum*. **Proc. Natl. Acad. Sci. USA**, 120(6): e2216244120. (IF=11.205)
- 12 Jin, S.†, Kang, S.†, Bae, J., Lee, H., **Cho, B.-K.** (2022) Development of CO gas conversion system using high CO tolerance biocatalyst. **Chem. Eng. J.**, 449: 137678. (IF=13.273)
- 13 Choe, D., Kim, K., Kang, M., Lee, S.G., Cho, S., Palsson, B., **Cho, B.-K.** (2022) Synthetic 3'-UTR valves for optimal metabolic flux control in *Escherichia coli*. **Nucleic Acids Res.**, 50: 4171-4186. (IF=16.971)
- 14 Song, Y., Bae, J., Jin, S., Lee, H., Kang, S., Lee, J., Shin, J., Cho, S., **Cho, B.-K.** (2022) Development of highly characterized genetic bioparts for efficient gene expression in CO₂-fixing *Eubacterium limosum*. **Metab. Eng.**, 72: 215-226. (IF=9.78)

- 15 Kim, K., Kang T.J., **Cho, B.K.** et al. (2022) Adaptive laboratory evolution of *Escherichia coli* W enhances gamma-aminobutyric acid production using glycerol as the carbon source. **Metab. Eng.**, 69: 59-72. (IF=9.78)
- 16 Yoon, J., Bae, J., Kang, S., **Cho, B.-K.**, Oh, M.-K. (2022) Poly-3-hydroxybutyrate production in acetate minimal medium using engineered *Methylobacterium extorquens* AM1. **Bioresource Technol.**, 353: 127127. (IF=11.01)
- 17 Shin, J., Lee, C.-H., **Cho, B.K.** et al. (2021) Ageing and rejuvenation models reveal changes in key microbial communities associated with healthy ageing. **Microbiome**, 9: 240. (IF=15.677)
- 18 Kim, K., Choe, D., Song, Y., Kang, M., Lee, S.G., Lee, D.H., **Cho, B.K.** (2021) Engineering *Bacteroides thetaiotaomicron* to produce non-native butyrate based on a genome-scale metabolic model-guided design. **Metab. Eng.**, 68: 174-186. (IF=9.78)
- 19 Decker, K., **Cho, B.K.**, Palsson, B. et al. (2021) proChIPdb: a chromatin immunoprecipitation database for prokaryotic organisms. **Nucleic Acids Res.**, 50: D1077-D1084. (IF=16.971)
- 20 Gao, Y., **Cho, B.K.**, Palsson, B. et al. (2021) Unraveling the functions of uncharacterized transcription factors in *Escherichia coli* using ChIP-exo. **Nucleic Acids Res.**, 49: 9696-9710. (IF=16.971)
- 21 Bae, J., Song, Y., Lee, H., Shin, J., Jin, S., Kang, S., **Cho, B.K.** (2021) Valorization of C1 gases to value-added chemicals using acetogenic biocatalysts, **Chem. Eng. J.**, 428: 131325. (IF=13.273)
- 22 Jin, S., Jeon, Y., Jeon, M.S., Shin, J., Song, Y., Kang, S., Bae, J., Cho, S., Lee, J.K., Kim, D.R., **Cho, B.K.** (2021) Acetogenic bacteria utilize light-driven electrons as an energy source for autotrophic growth. **Proc. Natl. Acad. Sci. USA**, 118(9): e2020552118. (IF=11.205)
- 23 Lee, N., Hwang, S., Kim, W., Lee, Y., Kim, J.H., Cho, S., Kim, H.U., Yoon, Y.J., Oh, M.K., Palsson, B.O., **Cho, B.K.** (2021) Systems and synthetic biology to elucidate secondary metabolite biosynthetic gene clusters encoded in *Streptomyces* genomes. **Nat. Prod. Rep.**, 38: 1330-1361. (IF=13.423)
- 24 Song, Y., Shin, J., Jin, S., Lee, G.M., Lee, J.S., Kang, S.G., Lee, J.K., Kim, D.R., Lee, E.Y., Cho, S., Kim, S.C., Kim, D., **Cho, B.K.** (2020) Functional cooperation of the glycine synthase-reductase and Wood-Ljungdahl pathways for autotrophic growth of *Clostridium drakei*. **Proc. Natl. Acad. Sci. USA**, 117(13):7516-7523. (IF=11.205)
- 25 Lee, N., Kim, W., Chung, J., Cho, S., Jang, K.S., Palsson, B.O., **Cho, B.K.** (2020) Iron competition triggers antibiotics biosynthesis in *Streptomyces coelicolor* during co-culture with *Myxococcus xanthus*, **ISME J.**, 14:1111-1124. (IF=10.302)
- 26 Lamoureux, C.R., Choudhary, K.S., King, Z.A., Sandberg, T.E., Gao, Y., Sastry, A.V., Phaneuf, P.V., Choe, D., **Cho, B.K.**, Palsson, B.O. (2020) The Bitome: digitized genomic features reveal fundamental genome organization. **Nucleic Acids Res.**, 48(18): 10157-10163. (IF=16.971)
- 27 Hwang, S., Lee, N., Jeong, Y., Lee, Y., Kim, W., Cho, S., Palsson, B., **Cho, B.K.** (2019) Primary transcriptome analysis determines transcriptional and translational regulatory elements encoded in the *Streptomyces* genomes, **Nucleic Acids Res.**, 47(12):6114-6129. (IF=16.971)
- 28 Choe, D., Lee, J.H., Yoo, M., Hwang, S., Sung, B.H., Cho, S., Palsson, B., Kim, S.C., **Cho, B.K.** (2019) Adaptive laboratory evolution of a genome-reduced *Escherichia coli*, **Nat Commun.**, 10: 935. (IF=14.919)
- 29 Gao, Y., **Cho, B.K.**, Kim, D., Palsson, B. et al. (2018) Systematic discovery of uncharacterized transcription factors in *Escherichia coli* K-12 MG1655, **Nucleic Acids Res.**, gky752. (IF=16.971)
- 30 Kim, D., **Cho, B.K.**, Palsson B. et al. (2018) Systems assessment of transcriptional regulation on central carbon metabolism by Cra and CRP, **Nucleic Acids Res.**, gky096. (IF=16.971)
- 31 Jeong, Y., Kim, J.N., Kim, M.W., Bucca, G., Cho, S., Yoon, Y.J., Kim, B.K., Roe, J.H., Kim, S.C., Smith, C.P., **Cho, B.K.** (2016) The Dynamic Transcriptional and Translational Landscape

- of the Model Antibiotic Producer *Streptomyces coelicolor* A3(2). **Nat. Commun.**, 7: 11605 (IF=14.919)
- 32 Cho, S., Cho, Y.B., Kang, T.J., Kim, S.C., Palsson, B., **Cho, B.K.** (2015) The architecture of ArgR-DNA complexes at the genome-scale in *Escherichia coli*. **Nucleic Acids Res.**, 43(6): 3079-3088. (IF=16.971)
 - 33 **Cho, B.K.***, Federowicz, S., Park, Y.S., Zengler, K., Palsson, B.O. (2012) Deciphering the transcriptional regulatory logic of metabolism. **Nat. Chem. Biol.**, 8(1): 65-71 (IF=15.668)
 - 34 **Cho, B.K.**, Federowicz, S., Embree, M., Park, Y.S., Zengler, K., Palsson, B.O. (2011) The PurR regulon in *Escherichia coli* K-12 MG1655. **Nucleic Acids Res.**, 39(15): 6456-6464. (IF=16.971)
 - 35 Barrett, C.L., **Cho, B.K.**, Palsson, B.O. (2011) Sensitive and accurate identification of protein-DNA binding events in ChIP-chip assays using higher-order derivative analysis. **Nucleic Acids Res.**, 39(5): 1656-1665. (IF=16.971)
 - 36 Qiu, Y., **Cho, B.K.**, Park, Y.S., Lovley, D., Palsson, B.O. (2010) Structural and operational complexity of the *Geobacter sulfurreducens* genome. **Genome Res.**, 20(9): 1304-1311 (IF=11.093)
 - 37 **Cho, B.K.**, Zengler, K., Qiu, Y., Knight, E.M., Park, Y.S., Barrett, C.L., Gao, Y., Palsson, B.O. (2009) The transcription unit architecture of the *Escherichia coli* K-12 MG1655 genome. **Nat. Biotechnol.**, 27(11): 1043-1049. (IF=54.908)
 - 38 **Cho, B.K.** Palsson, B.O. (2009) Probing the basis for genotype-phenotype relationships. **Nat. Methods**, 6(8): 565-566. (IF=28.467)
 - 39 **Cho, B.K.**, Barrett, C.L., Knight, E.M., Park, Y.S., Palsson, B.O. (2008) Genome-scale reconstruction of Lrp-regulatory network in *Escherichia coli*. **Proc. Natl Acad. Sci. USA**, 105(49): 19462-19467. (IF=11.205)
 - 40 **Cho, B.K.**, Knight, E.M., Barrett, C.L., Palsson, B.O (2008) Genome-wide analysis of Fis binding in *Escherichia coli* indicates a causative role for A-tracts. **Genome Res.**, 18(6): 900-910. (IF=11.093)