Kwak Yejin

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Education

2020.03 – 2023.08 B.S., Biomedical Convergence Engineering, Data Science Major
Pusan National University, Yangsan
(GPA: 3.95 / 4.5) *(Magna cum laude, Dean's list)*

2023.09 – 2025.02 M.Sc., Information Convergence Engineering, Biomedical Engineering Major
Pusan National University, Yangsan
(GPA: 4.5 / 4.5)

Research Experience

2025.03 – present **Associate Researcher**
Medical Research Institute at Pusan National University
(Advisor: Prof. Dr. Jeongbin Park)
Germline Stem Cells in vitro
- Conducted scRNA-seq analysis uncovering dynamic state heterogeneity in germline stem cells cultured in vitro.

2022.06 – 2025.02 **M.Sc. Candidate (via combined B.Sc. - M.Sc. course)**
Computational Omics Laboratory at Pusan National University
(Advisor: Prof. Dr. Jeongbin Park)

**2022.06-2023.08: Undergraduate Researcher*

**2023.09-2025.02: Master's student*

Web Development Projects
1) HCA(Human Cell Atlas):Organoid Data Portal, https://portal.hca-organoid.eu/
- Converted organoid sequencing data from the HCA:Organoid into Zarr format.
- Developed a WebGL-powered portal for rapid scatter plot visualization of data.

2) READRetro Web Portal, https://readretro.net/
Developed a website to support visualization and execution of AI-based multi-step retrosynthesis predictions for plant metabolites.

Data Analysis Using SSAM
1) MERSCOPE Alzheimer's Disease Mouse Models Analysis
Identified key differentially expressed genes (DEGs) within the hippocampus (ROI).
2) MERSCOPE Duchenne Muscular Dystrophy (DMD) Patient Data Analysis
Highlighted genes with high Moran's I values were examined to confirm their alignment with lesion areas.

SSAM2 Development
- Extended the SSAM framework to support Visium HD.
- Added GPU-based preprocessing steps(sum normalization, average convolution) to correct screen door artifacts in Visium HD.
- Implemented AAEC clustering, replacing SSAM's original KDE-based method.

**SSAM: A cell segmentation-free method for inferring cell types from spatial transcriptomics.*

2023.10 – 2023.12 **Internship**
Computational Genomics and Systems Genetics at the German Cancer

Edited 2025.08.19

Research Center (DKFZ), Germany
(Head: Dr. Oliver Stegle, Advisor: Dr. Florian Heyl, Dr. Luca Marconato)
SSAM2 Development
Enabled SSAM to read and write SpatialData format, improving interoperability with multi-modal spatial omics tools.
HCA:Organoid (Human Cell Atlas Organoid) Data Portal
Enhanced visualization capabilities by incorporating additional interactive components to improve user experience.

2024.07 – 2025.01 **Internship**
Center for Genome Engineering at the Institute for Basic Science (IBS), Korea
(Head: Dr. Bon-Kyoung Koo, Advisor: Dr. Heetak Lee)
SCON DB Portal, https://genpos.org/
Developed a portal providing comprehensive details on SCON(Short Conditional intrON: inserted into a specific SCONable exon for precise gene editing).

Scholarships

2020 – 2025 School Scholarships, Pusan National University

2020 School Leader Scholarships, Pusan National University

2021 – 2022 Mentoring Scholarships, Samsung Welfare Foundation

2022 Student Scholarships, PNU Medical AI Human Resource Training Project

2024 Graduate Student Scholarship, Paan Scholarship and Cultural Foundation

Poster Presentation

2023.01 KSBMB(Korean Society for Biochemistry and Molecular Biology), “HCA|Organoid portal: An easy-to-use web portal provides comprehensive organoid data”, Korea

2023.05 KSBMB, “HCA:Organoid data portal - a comprehensive web database for organoids”, Korea

2024.01 SCSOK(Single Cell & Spatial Omics Korea), “Standardizing data format for cell segmentation-free in situ spatial transcriptomics data analysis framework (SSAM)”, Korea

2024.09 scverse, “Standardizing data format for cell segmentation-free in situ spatial transcriptomics data analysis framework (SSAM)”, Munich, Germany

2025.06 HCA(Human Cell Atlas) General Meeting, “HCA|Organoid data portal: a comprehensive web-based database for organoids”, Singapore

Skills

Programming (Languages) Python, R, MATLAB, JavaScript, C/C++, HTML, Java, C#, Kotlin
(Platforms) Linux, Git, Bash

Deep learning PyTorch, Numpy, Pandas, Scikit-learn, Tensorflow, SciPy

Bioinformatics Single-cell and spatial data analysis, with both scverse tools (Scanpy, SpatialData, Squidpy etc.) and Seurat

Language Korean (native), English (TOEFL IBT: 92, TOEIC: 845), German (basic)

Edited 2025.08.19

Awards

2025.06 **KOBRA (Korea Bio Research Association) - travel award**

2024.09 **scverse 2024 conference - travel grant**

2023.08 **Busan ICT Convergence Hackathon - 3rd place**
https://github.com/Kwakyejin/daw_app
Create an AI-powered app that recommends travel routes by applying Dijkstra's algorithm.

2023.02 **Bio-Health Medical Entrepreneurship Contest – 2nd place**
https://github.com/Kwakyejin/memorygame
Web-based platform for memory training to slow cognitive decline in dementia.

2022.12 **Sports data analysis/utilization contest – 3rd place**
https://github.com/Kwakyejin/Sports-data-analysis-contest
AI model that recommends exercise for disabled individuals by matching with healthy counterparts using propensity scores.

2022.01 **AI Hackathon – 3rd place**
https://github.com/Kwakyejin/gongbang_app
Plant prediction app using EfficientNetV2 to identify native plants of Jeju Island.

2021.12 **Mini Kaggle Contest - Kong counting night – 2nd place**
https://github.com/Kwakyejin/Team_countingkong
Bean counting contest using OpenCV to estimate bean quantities from multi-angle images.

2021.12 **Try anything contest – 2nd place**
Developed EEG/EMG devices with OpenBCI and 3D printing; created EMG-based game; awarded Best Poster & Video.

Publication

Kim, T., Lee, S., **Kwak, Y.**, Choi, M.-S., Park, J., Hwang, S.J. and Kim, S.-G. (2024), READRetro: natural product biosynthesis predicting with retrieval-augmented dual-view retrosynthesis. *New Phytologist*, 243, 2512-2527. https://doi.org/10.1111/nph.20012

Jeon, E.Y., **Kwak, Y.**, Kang, H., Jin, S.Y., Park, S., Kim, R., Ko, D., Won, J.-K., Cho, A., Jung, I., Lee, C.-H., Park, J., Kim, H.-Y., Chae, J.-H., & Choi, M. (2025), Inhibiting EZH2 complements steroid effects in Duchenne muscular dystrophy. *Science Advances*, 11, eadr4443. https://doi.org/10.1126/sciadv.adr4443

Kwak, Y., Kim, T., Kim, S.-G., & Park, J. (2025), READRetro Web: A User-Friendly Platform for Predicting Plant Natural Product Biosynthesis, *Molecules and Cells*, 100235, ISSN 1016-8478, https://doi.org/10.1016/j.mocell.2025.100235

SCON, Gene editing technique with database (submitted)

scRNA-seq Reveals State Heterogeneity Dynamics of Germline Stem Cells in vitro (in preparation)

HCA:Organoid data portal, a comprehensive web database for organoids (in preparation)

SSAM2 Development (in preparation)

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Extracurricular Activities

Apptive, University mobile app development club; developed Emma, a self-portfolio organizer, and Parking People, a parking spot locator. (https://github.com/Kwakyejin/emma, https://github.com/ParkingPeople)

Core Team Member, Single Cell and Spatial Omics Korea (SCSOK, https://scsok.io/),
Organized conferences and hackathons on single-cell and spatial omics, fostering interdisciplinary exchange among students.

Founding First-Year Representative, Dept. of Biomedical Convergence Engineering,
Built the student council's administrative foundation as the first-ever first-year representative of the inaugural cohort; awarded the School Leader Scholarship, Pusan National University.

Volunteer Teaching, Mentored junior undergraduates in coding and taught English to elementary and middle school students.

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