

Jongyun Jung

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Research Interests

- **AI-Driven Fracture Risk Prediction & Musculoskeletal Aging:** Developing deep sequential models (e.g., HyTrax) that integrate genomic data, such as polygenic risk scores, with serial musculoskeletal measurements (bone mineral density, grip strength, lean mass) to predict osteoporotic fracture beyond FRAX and to identify older adults at rising risk before a fracture occurs.
- **Deep Sequence Modeling for Biological Aging:** Developing foundational “Time-Aware” deep learning architectures (e.g., PoA-HyTrax) utilizing Masked Trajectory Modeling and delta-time tokenization to model divergent, non-linear biological aging trajectories across irregular clinical visits.
- **Multi-Omic Data Fusion in Geroscience:** Integrating longitudinal epigenetic and proteomic data with clinical phenotypes to map multi-omic cross-talk. My focus is on producing highly sensitive, unified aging scores designed to quantify the deceleration of biological aging induced by gerotherapeutics.
- **Translational Bioinformatics & Biomarker Validation:** Leveraging data from randomized controlled trials (e.g., CALERIE, FAST Initiative) and large-scale biobanks to validate deep learning aging architectures. The overarching goal is to provide the methodological infrastructure required to rapidly and reliably evaluate interventions that extend human healthspan.
- **Algorithmic Stewardship & Health Equity:** Auditing clinical risk scores and aging diagnostic AI tools for calibration drift and biases. I develop “fairness-aware” algorithms to ensure that neurodegeneration and biological aging prediction models remain robust and equitable across diverse racial, socioeconomic, and underrepresented cohorts.
- **Natural Language Processing (NLP) for Clinical Phenotyping:** Utilizing Large Language Models (LLMs) to extract granular aging phenotypes (e.g., functional status, cognitive decline, frailty) from unstructured clinical notes to enrich digital phenotyping and improve diagnostic precision in secondary data analysis.

Research Experience

Columbia University, New York, New York

Postdoctoral Research Scientist, August 2026 - Present

Mentor: Dr. Daniel Belsky

The Ohio State University, Columbus, Ohio

Graduate Research Associate, Department of Biomedical Informatics, June 2025 - August 2026

Graduate Research Assistant, Department of Biomedical Informatics, August 2022 - May 2025

Advisor: Dr. Qing Wu

University of Nevada, Las Vegas, Las Vegas, Nevada

Graduate Research Assistant, Nevada Institute of Personalized Medicine, June 2019 - August 2022

Advisor: Dr. Qing Wu

Education

The Ohio State University, Columbus, Ohio

PhD in Biomedical Science (Biomedical Informatics Track), August 2022 - August 2026

Advisor: Dr. Qing Wu

University of Nevada, Las Vegas, Las Vegas, Nevada

Public Health - Certificate (Epidemiology and Biostatistics), August, 2022

Advisor: Dr. Qing Wu

Minnesota State University Mankato, Mankato, Minnesota *Cum Laude*

Master of Science, Mathematics and Statistics, Spring 2019

Advisor: Dr. Mezbah Rahman

Thesis: A Statistical Analysis and Machine Learning of Genomic Data

Minnesota State University Mankato, Mankato, Minnesota *Cum Laude*

Bachelor of Arts, Economics and Mathematics, Spring 2013

Publications

Published

1. Qing Wu, **Jongyun Jung**. "Response Regarding FRAX Performance Across Race/Ethnicity and Genetic Risk in the Women's Health Initiative" <https://doi.org/10.1093/jbmr/zjag134>, *Journal of Bone and Mineral Research* (IF: 6.2), 09/12/2026. [Response to published correspondence on publication 2]
2. Qing Wu, **Jongyun Jung**. "Uncovering Racial and Genetic Disparities in FRAX Performance for Fracture Risk Assessment in Postmenopausal Women" <https://doi.org/10.1093/jbmr/zjaf160>, *Journal of Bone and Mineral Research* (IF: 6.2), 2026;41(4):424-433 (published online 10/30/2025).
3. Qing Wu, **Jongyun Jung**, "Precision fracture risk assessment: leveraging genomic and clinical data for personalized care" <https://doi.org/10.1007/s00198-025-07517-x>, *Osteoporosis International* (IF: 4.7), 05/06/2025.
4. Qing Wu, **Jongyun Jung**, "Ensemble-Learning Approach Improves Fracture Prediction Using Genomic and Phenotypic Data" <https://doi.org/10.1007/s00198-025-07437-w>, *Osteoporosis International* (IF: 4.7), 03/07/2025.
5. **Jongyun Jung**, Qing Wu, "Identification of bone mineral density associated genes with shared genetic architectures across multiple tissues: Functional insights for EPDR1, PKDCC, and SPTBN1" <https://doi.org/10.1371/journal.pone.0300535>, *PLOS One* (IF: 3.7), 04/29/2024.
6. **Jongyun Jung**, J. Dai, B. Liu, and Q. Wu, "Artificial Intelligence in Fracture Detection with Different Image Modalities and Data Types: A Systematic Review and Meta-Analysis" <https://doi.org/10.1371/journal.pdig.0000000>, *PLOS Digital Health* (IF: 4.4), 01/30/2024.
7. Qing Wu, **Jongyun Jung**. Genome-wide polygenic risk score for major osteoporotic fractures in postmenopausal women using associated single nucleotide polymorphisms. 21, 127 (2023). <https://doi.org/10.1186/s12967-023-03974-2>, *Journal of Translational Medicine* (IF: 8.4), 02/27/2023

8. Qing Wu, Fatma Nasoz, **Jongyun Jung**, Bibek Bhattarai, Robert A. Greenes, Kenneth G. Saag. Machine learning approaches for the prediction bone mineral density by using genomic and phenotypic data of 5,130 older men, doi: <https://doi.org/10.1038/s41598-021-83828-3>, *Scientific Reports* (IF: 4.9), 2021/02/24
9. Qing Wu, Fatma Nasoz, **Jongyun Jung**, Bibek Bhattarai, Mira V Han. Machine Learning Approaches for Fracture Risk Assessment: A Comparative Analysis of Genomic and Phenotypic Data in 5130 Older Men, doi: <https://doi.org/10.1007/s00223-020-00734-y>, *Calcified Tissue International* (IF: 4.0), 2020/07/29
10. **Jongyun Jung**, Qing Wu . "Contribution of Rare Variant(s) to the genetic risk score," *Genetic Epidemiology* (IF: 2.3), vol. 44, no. 5, pp. 469–533, 2020.
11. **Jongyun Jung** (2019). A statistical analysis and machine learning of genomic data [Master's thesis, Minnesota State University, Mankato]. Cornerstone: A Collection of Scholarly and Creative Works for Minnesota State University, Mankato. <https://cornerstone.lib.mnsu.edu/etds/899/>
12. **Jongyun (Formerly, Jongha) Jung**, Kwangwoo (Ken) Park. Industrial Systematic Risks and Business Cycles in US economy 2014 October, *Journal of International Finance and Economics* <http://dx.doi.org/10.18374/JIFE-14-4.13> .

Under Review

1. **Jongyun Jung**, Qing Wu. "HyTrax: Deep Sequential Modeling of Serial Musculoskeletal Measurements for Fracture Prediction in the Women's Health Initiative with External Evaluation in the Framingham Heart Study", *PLOS Digital Health*. Preprint: medRxiv, July 2026, doi:10.64898/2026.06.30.26356875
2. **Jongyun Jung**, Qing Wu. "Prognostic Association of Handgrip-Defined Probable or Possible Sarcopenia Status and Polygenic Risk with 10-Year Fracture Incidence among Black, Hispanic, and White Women: A Women's Health Initiative Study", *Osteoporosis International*. Preprint: medRxiv, July 2026, doi:10.64898/2026.06.30.26356931
3. **Jongyun Jung**, Qing Wu. "Genetic architecture of aging-related bone mineral density trajectories in diverse women implicates SPTBN1 in fracture risk". Available at SSRN: <https://ssrn.com/abstract=6031397> or <http://dx.doi.org/10.2139/ssrn.6031397>, *PLOS Aging and Health*
4. Jianing Liu, **Jongyun Jung**, Qiangwei Li, Lang Wu, Qing Wu. "How do Social Determinants of Health Influence Bone Mineral Density? A Machine Learning Analysis in Adults Aged 50 Years and Older", *JAMIA Open* (IF: 3.4)

Awarded

1. **NIA Biomarker Network Annual Pilot Project (\$25,000)** Awarded: Aug 2026
Project Title: SS-HyTrax: A Self-Supervised Transformer Model for Biological Aging Trajectories Across Harmonized Multi-Cohort Data
 - **Role:** Principal Investigator (Project Lead)*
 - **Sponsor:** NIA Biomarker Network (NIA R24AG037898), University of Michigan; project period Sept 2026 – Mar 2027
 - Designed a comprehensive research strategy and budget.
 - *PI of record: Dr. Daniel W. Belsky, per Columbia University policy; as project lead, I hold full control of the project budget and scientific direction.

Research Funding

1. **NIH/NIA K99/R00 Pathway to Independence Award** Submitted: Oct 2026
Project Title: PoA-HyTrax: A Self-Supervised Transformer Model for Biological Aging Trajectories Across Harmonized Multi-Cohort Data
 - **Role:** Principal Investigator
 - **Total requested:** \$1,012,734 (proposed July 2027 – June 2032)
 - **Mentors:** Dr. Daniel Belsky (primary), Dr. George Hripcsak and Dr. Yousin Suh (co-mentors)
2. **NIH/NIA F99/K00 Predoctoral to Postdoctoral Transition Award** Submitted: Oct 2024
Project Title: Developing a Personalized Fracture Trajectory Model: Integrating Muscle Metrics, Genetic Variability, and Longitudinal Data
 - **Role:** Principal Investigator (Applicant)
 - Designed a comprehensive research strategy for transitioning from predoctoral biomedical informatics to independent aging research.
3. **NIH/NIA R01 Award (R01AG080017)** Dec 2023 – Nov 2027
PI: Qing Wu
 - **Role:** Lead Graduate Research Assistant / Grant Writer
 - Contributed significantly to the proposal preparation, including conducting preliminary machine learning analyses, drafting specific aims related to data integration, performing comprehensive literature reviews, and final administrative review before submission.
4. **NIH/NIMHD R21 Award (R21MD013681)** Dec 2021 – June 2025
PI: Qing Wu
 - **Role:** Graduate Research Assistant / Grant Writer
 - Assisted in the development of the grant proposal focusing on health disparities, including preliminary data analysis on racial differences in fracture risk, literature synthesis, and drafting technical sections.
5. **Amazon Web Services (AWS) Research Grant** Awarded: April 2020
Cloud Computing Credits for Genomic Analysis
 - **Amount:** \$9,000
 - **Role:** Co-Author
 - Secured computational credits to support high-performance computing tasks for large-scale genomic data analysis.

Awards and Honors

1. 2026 September - December: **InnovAGE Fellowship (Cohort 6)**, UMass Massachusetts Medical Device Development Center (M2D2); selected August 2026. Semester-long accelerator to translate aging-related research into real-world biotech and medtech solutions.
2. 2025 December: **OSU Ray Travel Award** from The Council of Graduate Students at the Ohio State University
3. 2025 July: **ASBMR 2025 Annual Meeting Young Investigator Travel Grant**
4. 2025 January - Present: **2025 ASBMR Student Cohort Program** from The American Society for Bone and Mineral Research
5. 2025 May: **OSU Career Development Grant** from The Council of Graduate Students at the Ohio State University

6. 2025 May: **2025 KSEA-KUSCO Graduate Scholarship** from The Korean-American Scientist and Engineer Association - Korea-U.S. Science Cooperation Center
7. 2020 April: **Outstanding Graduate Student Award** from Department of Epidemiology and Biostatistics of Public Health, University of Nevada, Las Vegas
8. 2019 May: **Student & Early Career Travel Award for 2019 Symposium on Data Science & Statistics** from American Statistical Association
9. 2019 May: **Certificate of Achievement** from Symposium on Data Science & Statistics Data Challenge of American Statistical Association
10. 2019 May: **Travel Funding** from the Iowa State University for presenting at the 2nd Midwest Statistical Machine Learning Colloquium
11. 2018 September: **Travel Funding** from College of Science, Engineering and Technology for presenting at Michigan State Symposium on Mathematical Statistics and Applications
12. 2018 September: **Travel Funding** from Michigan State University for presenting at Michigan State Symposium on Mathematical Statistics and Applications
13. 2018 August: **Travel Funding** from American Statistical Association for Preparing to Teach Workshop

Presentation

Invited Oral Presentation

1. **HyTrax: A Hybrid Trajectory-Based Model for Personalized Fracture Risk Prediction** at 2025 ASBMR Muscle and Bone Virtual Abstract Presentation Webinar, November 19. 2025

Oral Presentation

1. **HyTrax: Deep Sequential Modeling and Musculoskeletal Trajectories Enhance Fracture Prediction Beyond Baseline FRAX** (Late-Breaking Oral Communication) at 2026 Intrinsic Capacity, Frailty & Sarcopenia Research Conference for Healthy Longevity (ICFSR), Washington, D.C., March 11. 2026
2. **Transforming Fracture Prediction in Older Men: A Genomics-AI Synergy** at ASBMR, September 29. 2024
3. **Exploring the Interconnected Genetic Landscape: Insights into Shared Architecture between Muscle and Bone, and Mechanisms of Bone Fracture-Related Variants Explored through Single Cell RNA Sequencing** at OSU The Discovery Postbaccalaureate Research Education Program, December 11. 2023
4. **Machine learning approaches for the prediction of bone mineral density by using genomic and phenotypic data of 5130 older men** at 23rd Annual Graduate and Professional Student Research Forum, UNLV, April 3. 2021
5. **Genome-wide polygenic scores for Major Osteoporotic Fractures in Postmenopausal Women using Associated Single Nucleotide Polymorphisms** at Annual NIPM Symposium, March 4, 2021
6. Introduction to Fourier Analysis from R.L. Herman's An Introduction to Fourier and Complex Analysis with Applications to the Spectral Analysis of Signals at the Seminar of "An Introduction to Fourier and Complex Analysis with Applications to the Spectral Analysis of Signals", Spring 2019
7. **Industrial Systematic Risks and Business Cycles in US economy** at Minnesota Undergraduate Research Symposium, April 2013

Poster

1. **HyTrax: Deep Sequential Modeling of Musculoskeletal Trajectories as Dynamic Biomarkers of Aging** at 2026 Biomarkers of Aging Conference, Harvard Medical School, Boston, MA (Poster 44), October 5–6. 2026
2. **Beyond FRAX: Personalized Fracture Trajectory Model Using Genetic, Muscle, and Longitudinal Data** at ASBMR, September 5 (Plenary Poster Session)-6 (Basic and Translational). 2025
3. **Personalized Fracture Trajectory Model Integrating Genetic, Clinical, and Longitudinal Risk Factors** at the 2025 US-Korea Conference on Science, Technology, and Entrepreneurship, August 8. 2025
4. **Deciphering Bone Health: A Comprehensive Machine Learning Analysis of Socio-Biological Determinants** at ASBMR, September 29. 2024
5. **Machine Learning Approaches Improve The Prediction of Total Body Bone Mineral Density Using Genomic and Phenotypic Data of 1,432 European-American Premenopausal Women** at Department of Biomedical Informatics Internships, The Ohio State University, August 1. 2024
6. **Functional genomic analysis identifies three new genes that shared genetic regulatory mechanisms between bone and muscle** at 2023 Edward F. Hayes Advanced Research Forum, February 25. 2023
7. **A comparison of machine learning and deep learning performance in the classification of osteoporotic fracture from medical imaging and tabular data: a systematic review and meta- analysis** at Annual NIPM Symposium, March 10. 2022
8. **Machine learning approaches for the prediction of bone mineral density by using genomic and phenotypic data of 5130 older men** at Annual NIPM Symposium, March 4. 2021
9. **Machine learning approaches improve the prediction of the major osteoporotic fracture using genomic and phenotypic data of 25,772 postmenopausal women** at Annual NIPM Symposium, March 4. 2021
10. **Genomic Prediction of Osteoporotic Fracture Risk using Machine Learning Techniques on 1,103 SNPs of 5,133 Individuals in the Cohort Study of Osteoporotic Fractures in Men** at Annual NIPM Symposium, March 4. 2021
11. **Polygenic Prediction of Major Osteoporotic Fracture in Postmenopausal Women using Associated Single Nucleotide Polymorphisms and a Machine Learning Algorithm** at ASHG (Virtual) 2020, Oct, 2020
12. **Machine learning approaches improve the prediction of the major osteoporotic fracture using genomic and phenotypic data of 25,772 postmenopausal women** at ASBMR (Virtual) 2020, Sep, 2020
13. **Genomic Prediction of Osteoporotic Fracture Risk using Machine Learning Techniques on 1,103 SNPs of 5,133 Individuals in the Cohort Study of Osteoporotic Fractures in Men** at ASHG, 2019
14. **A Statistical Analysis and Machine Learning of Genomic Data** at the 2nd Midwest Statistical Machine Learning Colloquium, May/13, 2019
15. **Machine Learning meets Survival Analysis for the personalized medicine** at 2019 Symposium on Data Science and Statistics, May/31, 2019
16. **Survival Analysis in Lung Cancer Study** at Michigan State Symposium on Mathematical Statistics and Applications, September 2018

Teaching Experience

1. The Ohio State University
 - **BMI 7050: Meta-Analysis** (Autumn 2024, Summer 2025): Presented the published work (Artificial Intelligence in Fracture Detection with Different Image Modalities and Data Types: A Systematic Review and Meta-Analysis, 2024) as a case-study. Worked as a course designer to take care of Carmen. Helped students with the data analysis.
 - **BMI 5780: Programming for Biomedical Informatics** (Autumn 2023): Prepared the case-study demonstration of machine learning models (Homeworks and Python Code).
2. Minnesota State University, Mankato, Minnesota (Jan 2017 - May 2019)
 - **College Algebra (Math 112)**, Spring 2017, Fall 2017. - **Elementary Statistics (Stat 154)**, Spring 2018, Fall 2018, Spring 2019.

Industry Experience

1. Secondary Data Analyst, IMS Health (Jul 2013 – Dec 2015), Seoul, South Korea
 - Developed business intelligence and data warehousing tools using SQL to support pharmaceutical marketing analytics.
 - Designed automated reporting systems and promotional dashboards using Excel VBA and SQL, delivering actionable insights and periodic market newsletters to major pharmaceutical clients.

Software Skills

1. **Computing/Statistical Software:** R (Proficient), Matlab (Intermediate), SAS (Proficient), Python (Proficient), C (Intermediate), C++ (Intermediate), Julia (Beginner)
2. **Genomic Data Tools:** Plink, GCTA, BCFtools, NANO, VIM, Command Lines
3. **High Performance Computing:** AWS, Cherry-Creek, OpenMP, MPI, GPU
4. **Document Preparation:** L^AT_EX, Markdown
5. **Computer Skills:** Microsoft Office
6. **Reference Program:** Zotero, Mendeley

Advanced Methodological Training & Certifications

1. **Center for Ethics and Human Values (CEHV) Research Ethics Training** Apr 2025
The Ohio State University Center for Bioethics Completed intensive training based on NIH Responsible Conduct of Research guidelines.
2. **Bioinformatics Bootcamp: Single Cell Analysis** May 2024
10x Genomics Webinar Series
3. **Summer Institute in Statistical Genetics (SISG), University of Washington**
 2022: Advanced Quantitative Genetics · Multivariate Analysis · Statistical Genetics
 2021: Gene Expression Profiling · Pathway & Network Analysis for Omics Data
 2020: Computational Pipeline for WGS Data · MCMC · Bayesian Statistics for Genetics
4. **Grad Rebel Writing Boot Camp** Jan 2021
University of Nevada, Las Vegas

Leadership & Professional Service

1. **Invited Panelist, Biomedical Sciences Graduate Program New Student Orientation**, The Ohio State University, June 2026
 - Selected by program leadership to share dissertation, research development, and career transition insights with incoming doctoral students on the panel "Where You Are Going: From Research to Dissertation to Career."
2. **President, Ohio Korean-American Scientists and Engineers Association Young Generation Group**, January 2024 – December 2025
 - Founded and led a new KSEA YG chapter at OSU, securing a \$3,000 student organization grant and organizing academic panels, networking events, and mentorship programs connecting students with Korean-heritage faculty.
 - Expanded membership and collaborations with national KSEA chapters, fostering an inclusive and professional community for Korean-American and international students in science and engineering.
3. **Membership Engagement Committee, American Statistical Association (ASA) Section on Genetics and Genomics**, January 2021 – December 2022
 - Managed member outreach, maintained social-media presence, and posted monthly webinars and newsletters to strengthen section engagement.
 - Analyzed membership data and contributed to communication strategies for sustained participation.
4. **Reviewer, Richard J. and Martha D. Denman Undergraduate Research Forum**, March 4, 2025
 - Evaluated 20 research posters in the Pediatric and Family Health section and provided constructive feedback on study design and presentation quality.
5. **Journal Club Organizer**, University of Nevada, Las Vegas, 2019 – 2021
 - Organized weekly lab journal clubs, created schedules, and coordinated paper distribution among presenters.
6. **Judge, ASHG DNA Day Essay Contest**, March 2020 – 2021
 - Reviewed and scored over 80 essays across two judging rounds, assessing scientific accuracy and clarity of communication.
7. **Reviewer, SciPy 2020 Conference Abstracts**, March 2020
 - Reviewed and evaluated six abstracts for relevance and quality in computational science submissions.
8. **Founder and President, ASA Student Chapter and Statistics Club, Minnesota State University Mankato**, 2018 – 2019
 - Established campus ASA chapter, arranged invited talks and workshops on statistical methods and career development.
9. **Instructor, "Editing Mendeley Styles" Workshop**, University of Nevada, Las Vegas, 2020
 - Assisted the main instructor in teaching reference style customization using the Mendeley CSL Editor at UNLV Lied Library.
10. **Volunteer**, Education & History Booth, Joint Statistical Meetings, 2018
11. **Seminar Organizer**, Minnesota State University, 2019
 - Organized seminar "An Introduction to Fourier and Complex Analysis with Applications to the Spectral Analysis of Signals," supervised by Dr. In-Jae Kim.

Professional Membership

- American Statistical Association, since 2018
- American Society for Bone and Mineral Research, since 2022
- Korean-American Scientists and Engineers Association, since 2023

Journal Reviewer

- Clinical and Translational Metabolism (IF: 7.9), Lipids in Health and Disease (IF: 3.9), Journal of Orthopaedic Surgery and Research (IF: 2.5), Scientific Reports (IF: 3.8), Journal of Big Data (IF: 7.8), Clinical Proteomics (IF: 3.3), PeerJ Life & Environment (IF: 2.7), npj Digital Medicine (IF:15.1)
- Abstract Reviewer for the 2026 American Society for Bone and Mineral Research Annual Meeting

References

- **Dr. Qing Wu**

Professor, Department of Biomedical Informatics, The Ohio State University
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- **Dr. Dongjun Chung**

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Email: Dongjun.Chung@osumc.edu

- **Dr. Andy Ai Ni**

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- **Dr. Eben Kenah**

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