Kejun "Albert" Ying

New Research Building, Harvard Medical School, Boston, MA, 02115
kying@g.harvard.edu albert-ying 0000-0002-1791-6176 kejunying.com

Studying aging at the intersection of biology and AI

Education

Harvard University Cambridge, MA
Ph.D., Biological Science in Public Health 2019 – Expected May 2025

- Advisor: Dr. Vadim Gladyshev, Harvard Medical School, Brigham and Women's Hospital
- Dissertation Advisory Committee: Dr. Brendan Manning, Dr. David Sinclair, Dr. Shamil Sunyaev
- Focused on understanding the mechanism of aging through multi-omic modeling & causal inference

Harvard University Cambridge, MA
M.S., Computational Science Engineering 2022 – 2024

- Secondary field during Ph.D. study

University of California, Berkeley Berkeley, CA
Visiting Student, Integrative Biology 2017 – 2018

Sun Yat-Sen University Guangzhou, China
B.S., Life Science 2015 – 2019

- Thesis: Screening for the Interactome of hTERC based on Molecular Fluorescence Complementation System in Living Cells
- Yat-Sen Honor School Program (Top 0.5%)
- National college admissions exam (Top 0.6%)

Grants

Using causal aging biomarkers and protein design to develop novel anti-aging interventions NIH/NIA
F99/K00, *Transition to Aging Research for Predoctoral Students* 2024 – 2028

- Award Document Number: FAG088431A (PI)
- Received a *perfect* Impact Score of **10**

Publications

† Corresponding author; * Co-first author; + Contributed as consortium author

Goeminne, L. J. E., Vladimirova, A., Eames, A., Tyshkovskiy, A., Argentieri, M. A., **Ying, K.,** Moqri, M., & Gladyshev, V. N. (2024). Plasma protein-based organ-specific aging and mortality models unveil diseases as accelerated aging of organismal systems. **Cell Metabolism**, https://doi.org/10.1016/j.cmet.2024.03.007

Ying, K.† (2024). Causal inference for epigenetic ageing. **Nature Reviews Genetics**, 1–1. https://doi.org/10.1038/s41576-024-00799-7

Ying, K., Castro, J. P., Shindyapina, A. V., Tyshkovskiy, A., Moqri, M., Goeminne, L. J. E., Milman, S., Zhang, Z. D., Barzilai, N., & Gladyshev, V. N. (2024). Depletion of loss-of-function germline mutations in centenarians reveals longevity genes. **Nature Communications**, *15*(1), 5956. https://doi.org/10.1038/s41467-024-50098-2

Lyu, YX.[*], Fu, Q.[*], Wilczok, D.[*], **Ying, K.***, King, A., ..., Bakula, D. (2024). Longevity biotechnology: Bridging AI, biomarkers, geroscience and clinical applications for healthy longevity. **Aging**, *16*(1), 1–25. https://doi.org/10.18632/aging.205397

Biomarkers of Aging Consortium[+], Herzog, C. M. S., Goeminne, L. J. E., Poganik, J. R., Barzilai, N., Belsky, D. W., Betts-LaCroix, J., Chen, B. H., Chen, M., Cohen, A. A., Cummings, S. R., Fedichev, P. O., Ferrucci, L., Fleming, A., Fortney, K., Furman, D., Gorbunova, V., Higgins-Chen, A., Hood, L., Horvath, S., ... Gladyshev, V. N. (2024). Challenges and recommendations for the translation of biomarkers of aging. **Nature Aging**, 1–12. https://doi.org/10.1038/s43587-024-00683-3

Castro, J. P., Shindyapina, A. V., Barbieri, A., **Ying, K.,** Strelkova, O. S., Paulo, J. A., Tyshkovskiy, A., Meinl, R., Kerepesi, C., Petrashen, A. P., Mariotti, M., Meer, M. V., Hu, Y., Karamyshev, A., Losyev, G., Galhardo, M., Logarinho, E., Indzhykulian, A. A., Gygi, S. P., Sedivy, J. M., Manis, J. P., & Gladyshev, V. N. (2024). Age-associated clonal B cells drive B cell lymphoma in mice. **Nature Aging**, *4*(8), 1–15. https://doi.org/10.1038/s43587-024-00671-7

Moqri, M., Cipriano, A., Simpson, D. J., Rasouli, S., Murty, T., de Jong, T. A., Nachun, D., de Sena Brandine, G., **Ying, K.,** Tarkhov, A., Aberg, K. A., van den Oord, E., Zhou, W., Smith, A., Mackall, C., Gladyshev, V. N., Horvath, S., Snyder, M. P., & Sebastiano, V. (2024). PRC2-AgeIndex as a universal biomarker of aging and rejuvenation. **Nature Communications**, *15*(1), 5956. https://doi.org/10.1038/s41467-024-50098-2

Tarkhov, A. E., Lindstrom-Vautrin, T., Zhang, S., **Ying, K.,** Moqri, M., Zhang, B., Tyshkovskiy, A., Levy, O., & Gladyshev, V. N. (2024). Nature of epigenetic aging from a single-cell perspective. **Nature Aging**, 1–17. https://doi.org/10.1038/s43587-023-00555-2

Moqri, M., Herzog, C., Poganik, J. R., **Ying, K.,** Justice, J. N., Belsky, D. W., Higgins-Chen, A. T., Chen, B. H., Cohen, A. A., Fuellen, G., Hägg, S., Marioni, R. E., Widschwendter, M., Fortney, K., Fedichev, P. O., Zhavoronkov, A., Barzilai, N., Lasky-Su, J., Kiel, D. P., ... Ferrucci, L. (2024). Validation of biomarkers of aging. **Nature Medicine**, 1–13. https://doi.org/10.1038/s41591-023-02784-9

Griffin, P. T., Kane, A. E., Trapp, A., Li, J., Arnold, M., Poganik, J. R., Conway, R. J., McNamara, M. S., Meer, M. V., Hoffman, N., Amorim, J. A., Tian, X., MacArthur, M. R., Mitchell, S. J., Mueller, A. L., Carmody, C., Vera, D. L., Kerepesi, C., **Ying, K.,** ... Sinclair, D. A. (2024). TIME-seq reduces time and cost of DNA methylation measurement for epigenetic clock construction. **Nature Aging**, 1–14. https://doi.org/10.1038/s43587-023-00555-2

Ying, K., Liu, H., Tarkhov, A. E., Sadler, M. C., Lu, A. T., Moqri, M., Horvath, S., Kutalik, Z., Shen, X., & Gladyshev, V. N. (2024). Causality-enriched epigenetic age uncouples damage and adaptation. **Nature Aging (Featured on the February Cover)**, 1–16. https://doi.org/10.1038/s43587-023-00557-0

Moqri, M., Herzog, C., Poganik, J. R., **Biomarkers of Aging Consortium**[+], Justice, J., Belsky, D. W., Higgins-Chen, A., Moskalev, A., Fuellen, G., Cohen, A. A., Bautmans, I., Widschwendter, M., Ding, J., Fleming, A., Mannick, J., Han, J.-D. J., Zhavoronkov, A., Barzilai, N., Kaeberlein, M., ... Gladyshev, V. N. (2023). Biomarkers of aging for the identification and evaluation of longevity interventions. **Cell**, *186*(18), 3758–3775. https://doi.org/10.1016/j.cell.2023.08.003

Liberman, N., Rothi, M. H., Gerashchenko, M. V., Zorbas, C., Boulias, K., MacWhinnie, F. G., **Ying, A. K.,** Flood Taylor, A., Al Haddad, J., Shibuya, H., Roach, L., Dong, A., Dellacona, S., Lafontaine, D. L. J., Gladyshev, V. N., & Greer, E. L. (2023). 18S rRNA methyltransferases DIMT1 and BUD23 drive intergenerational hormesis. **Molecular Cell**, *83*(18), 3268–3282.e7. https://doi.org/10.1016/j.molcel.2023.08.014

Bitto, A., Grillo, A. S., Ito, T. K., Stanaway, I. B., Nguyen, B. M. G., **Ying, K.,** Tung, H., Smith, K., Tran, N., Velikanje, G., Urfer, S. R., Snyder, J. M., Barton, J., Sharma, A., Kayser, E.-B., Wang, L., Smith, D. L., Thompson,

J. W., DuBois, L., ... Kaeberlein, M. (2023). Acarbose suppresses symptoms of mitochondrial disease in a mouse model of Leigh syndrome. **Nature Metabolism**, *5*(6), 955–967. https://doi.org/10.1038/s42255-023-00815-w

Emmrich, S., Trapp, A., Tolibzoda Zakusilo, F., Straight, M. E., **Ying, A. K.,** Tyshkovskiy, A., Mariotti, M., Gray, S., Zhang, Z., Drage, M. G., Takasugi, M., Klusmann, J.-H., Gladyshev, V. N., Seluanov, A., & Gorbunova, V. (2022). Characterization of naked mole-rat hematopoiesis reveals unique stem and progenitor cell patterns and neotenic traits. **The EMBO Journal**, *41*(15), e109694. https://doi.org/10.15252/embj.2021109694

Yang, Z., Macdonald-Dunlop, E., Chen, J., Zhai, R., Li, T., Richmond, A., Klarić, L., Pirastu, N., Ning, Z., Zheng, C., Wang, Y., Huang, T., He, Y., Guo, H., **Ying, K.,** Gustafsson, S., Prins, B., Ramisch, A., Dermitzakis, E. T., ... Shen, X. (2022). Genetic Landscape of the ACE2 Coronavirus Receptor. **Circulation**, *145*(18), 1398–1411. https://doi.org/10.1161/CIRCULATIONAHA.121.057888

Ying, K., Zhai, R., Pyrkov, T. V., Shindyapina, A. V., Mariotti, M., Fedichev, P. O., Shen, X., & Gladyshev, V. N. (2021). Genetic and phenotypic analysis of the causal relationship between aging and COVID-19. **Communications Medicine**, *1*(1), 35. https://doi.org/10.1038/s43856-021-00033-z

Li, T., Ning, Z., Yang, Z., Zhai, R., Zheng, C., Xu, W., Wang, Y., **Ying, K.,** Chen, Y., & Shen, X. (2021). Total genetic contribution assessment across the human genome. **Nature Communications**, *12*(1), 2845. https://doi.org/10.1038/s41467-021-23124-w

Zhu, J., Xu, M., Liu, Y., Zhuang, L., **Ying, K.,** Liu, F., Liu, D., Ma, W., & Songyang, Z. (2019). Phosphorylation of PLIN3 by AMPK promotes dispersion of lipid droplets during starvation. **Protein & Cell**, *10*(5), 382–387. https://doi.org/10.1007/s13238-018-0593-9

Preprints

Ying, K.†**,** Song, J., Cui, H., Zhang, Y., Li, S., Chen, X., Liu, H., Eames, A., McCartney, D. L., Marioni, R. E., Poganik, J. R., Moqri, M., Wang, B., & Gladyshev, V. N. (2024). MethylGPT: a foundation model for the DNA methylome. **bioRxiv**. https://doi.org/10.1101/2024.10.30.621013

Ying, K., Paulson, S., Reinhard, J., Camillo, L. P. L., Trauble, J., Jokiel, S., Biomarkers of Aging Consortium, Gobel, D., Herzog, C., Poganik, J. R., Moqri, M., & Gladyshev, V. N. (2024). An Open Competition for Biomarkers of Aging. **bioRxiv**. https://doi.org/10.1101/2024.10.29.620782

Ying, K., Tyshkovskiy, A., Chen, Q., Latorre-Crespo, E., Zhang, B., Liu, H., Matei-Dediu, B., Poganik, J. R., Moqri, M., Kirschne, K., Lasky-Su, J., & Gladyshev, V. N. (2024). High-dimensional Ageome Representations of Biological Aging across Functional Modules. **bioRxiv**. https://doi.org/10.1101/2024.09.21.570935

Galkin, F., Naumov, V., Pushkov, S., Sidorenko, D., Urban, A., Zagirova, D., Alawi, K. M., Aliper, A., Gumerov, R., Kalashnikov, A., Mukba, S., Pogorelskaya, A., Ren, F., Shneyderman, A., Tang, Q., Xiao, D., Tyshkovskiy, A., **Ying, K.,** Gladyshev, V. N., & Zhavoronkov, A. (2024). Precious3GPT: Multimodal Multi-Species Multi-Omics Multi-Tissue Transformer for Aging Research and Drug Discovery. **bioRxiv**. https://doi.org/10.1101/2024.07.25.605062

Ying, K., Paulson, S., Eames, A., Tyshkovskiy, A., Li, S., Perez-Guevara, M., Emamifar, M., Martínez, M. C., Kwon, D., Kosheleva, A., Snyder, M. P., Gobel, D., Herzog, C., Poganik, J. R., Biomarker of Aging Consortium, Moqri, M., & Gladyshev, V. N. (2024). *A Unified Framework for Systematic Curation and Evaluation of Aging Biomarkers*. **bioRxiv**. https://doi.org/10.1101/2023.12.02.569722

Tyshkovskiy, A., Kholdina, D., **Ying, K.,** Davitadze, M., Molière, A., Tongu, Y., Kasahara, T., Kats, L. M., Vladimirova, A., Moldakozhayev, A., Liu, H., Zhang, B., Khasanova, U., Moqri, M., Van Raamsdonk, J. M.,

Harrison, D. E., Strong, R., Abe, T., Dmitriev, S. E., & Gladyshev, V. N. (2024). Transcriptomic Hallmarks of Mortality Reveal Universal and Specific Mechanisms of Aging, Chronic Disease, and Rejuvenation. **bioRxiv**. https://doi.org/10.1101/2024.07.04.601982

Rothi, M. H., Sarkar, G. C., Al Haddad, J., Mitchell, W., **Ying, K.,** Pohl, N., Sotomayor-Mena, R. G., Natale, J., Dellacono, S., Gladyshev, V. N., & Greer, E. L. (2024). The 18S rRNA Methyltransferase DIMT-1 Regulates Lifespan in the Germline Later in Life. **bioRxiv**. https://doi.org/10.1101/2024.05.15.570935

Moqri, M., Poganik, J. R., Herzog, C., **Ying, K.,** Chen, Q., Emamifar, M., Tyshkovskiy, A., Eames, A. W., Mur, J., Matei-Dediu, B., Goeminne, L., Mitchell, W., McCartney, D. L., Marioni, R. L., Lasky-Su, J. A., Snyder, M., & Gladyshev, V. N. (2024). Integrative epigenetics and transcriptomics identify aging genes in human blood. **bioRxiv**. https://doi.org/10.1101/2024.05.30.596713

Ying, K., Tyshkovskiy, A., Trapp, A., Liu, H., Moqri, M., Kerepesi, C., & Gladyshev, V. N. (2023). *ClockBase : A comprehensive platform for biological age profiling in human and mouse*. **bioRxiv**. https://doi.org/10.1101/2023.02.28.530532

Zhang, B., Tarkhov, A. E., Ratzan, W., **Ying, K.,** Moqri, M., Poganik, J. R., Barre, B., Trapp, A., Zoller, J. A., Haghani, A., Horvath, S., Peshkin, L., & Gladyshev, V. N. (2022). *Epigenetic profiling and incidence of disrupted development point to gastrulation as aging ground zero in Xenopus laevis*. **bioRxiv**. https://doi.org/10.1101/2022.08.02.502559

Castro, J. P., Shindyapina, A. V., Barbieri, A., **Ying, K.,** Strelkova, O. S., Paulo, J. A., Tyshkovskiy, A., Meinl, R., Kerepesi, C., Petrashen, A. P., Mariotti, M., Meer, M., Hu, Y., Karamyshev, A., Losyev, G., Indzhykulian, A. A., Gygi, S. P., Sedivy, J. M., Manis, J. P., & Gladyshev, V. N. (2021). *Integrative analyses uncover mechanisms by which aging drives B cell lymphoma*. **bioRxiv**. https://doi.org/10.1101/2021.02.23.432500

Patents

V. N. Gladyshev, **K. Ying**, "High-dimensional measurement of biological age" (2024). *Provisional Patent Application*

V. N. Gladyshev, **K. Ying**, "Mapping CpG sites to quantify aging traits" (2024). *WO2024039905A2*

Software and Database

Biolearn (2024) https://bio-learn.github.io/

ClockBase (2023) https://www.clockbase.org/

Presentations

Oral Presentations

Biomarkers of Aging Symposium Boston, MA
Standardization of aging biomarkers and BoA challenge 2024

Harvard GRIP Presentations Boston, MA
Causal Aging Biomarker enpowers Unbiased Anti-Aging Therapy Screening 2024

4th TimePie Longevity Forum Shanghai, China
Causal Aging Biomarker as a Tool for Unbiased Anti-Aging Therapy Screening 2023

Global Congress on Aesthetic and Anti-Aging (GCAA2023) Singapore
Causal Aging Biomarker as a Tool for Unbiased Anti-Aging Therapy Screening 2023

10th Aging Research and Drug Discovery conference (ARDD2023) Copenhagen, Denmark
Causal Epigenetic Age Uncouples Damage and Adaptation 2023

AGE 2023 51st Annual Meeting Oklahoma City, OK
Causal Epigenetic Age Uncouples Damage and Adaptation 2023

Broad Institute MPG Retreat Cambridge, MA
Causal Epigenetic Age Uncouples Damage and Adaptation 2023

Harvard GRIP Presentations Boston, MA
Causal Epigenetic Age Uncouples Damage and Adaptation 2022

Targeting Metabesity 2022, 'Honorable Mention' Virtual Conference
Causal Epigenetic Age Uncouples Damage and Adaptation 2022

GSA 2021 Annual Scientific Meeting Virtual Conference
Genetic and phenotypic evidence for causal relationships between aging and COVID-19 2021

Poster Presentations

CHSL Mechanisms of Aging Meeting Cold Spring Harbor, NY
A unified framework for systematic curation and evaluation of aging biomarkers 2024
Causal epigenetic age and transcriptomic clock facilitate systemic anti-aging therapy screening 2024
Depletion of loss-of-function germline mutations in centenarians reveals novel longevity genes 2024
High-dimensional representations of biological aging in functional modules 2024

Biomarker of Aging Symposium Novato, CA
Causal Aging Biomarker as a Tool for Unbiased Anti-Aging Therapy Screening 2023

Gordon Research Conference, Systems Aging Maine, MA
Causal Epigenetic Age Uncouples Damage and Adaptation 2022

Invited Talks

BioAge Seminar, hosted by Dr. Robert Hughes & Dr. Paul Timmers Boston, MA
Ageome: Biological age with higher-dimensionality 2024

MRC Integrative Epidemiology Unit Seminar Bristol, UK
Epigenetic Clocks and Mendelian Randomization 2024

NIA EL Projects Joint Meeting, National Institute on Aging Online Webinar
Aging Clocks 2024

Biomarkers of Aging Challenge, Foresight Institute Online Webinar
Update Webinar with Foresight 2024

Everything Epigenetics, podcast hosted by Hannah Went Online Podcast
Causal Epigenetic Age Uncouples Damage and Adaptation 2024

Chinese University of Hong Kong, hosted by Dr. Xin Wang Hong Kong, China
Causal Aging Biomarker as a Tool for Systemic Anti-Aging Therapy Screening 2024

Everything Epigenetics, podcast hosted by Hannah Went Online Podcast
Causal Epigenetic Age Uncouples Damage and Adaptation 2023

Chinese University of Hong Kong, hosted by Dr. Xin Wang — Hong Kong, China
Causal Aging Biomarker as a Tool for Systemic Anti-Aging Therapy Screening — 2023

Peking University, hosted by Dr. Jingdong Han — Beijing, China
Causal Aging Biomarker and ClockBase — 2023

Chinese Academy of Sciences, hosted by Dr. Xuming Zhou — Beijing, China
Causal Epigenetic Age Uncouples Damage and Adaptation — 2022

Foresight Institute, hosted by Allison Duettmann — Online Seminar
Genetic Variation, Aging & Relationship to COVID-19 | Joris Deelen, Albert Ying — 2020

Research Experience

Harvard Medical School, Brigham and Women's Hospital — Boston, MA
Biological Aging *Graduate Researcher, Vadim Gladyshev's Lab* — 2020 – Present

Harvard Medical School, Boston Children's Hospital — Boston, MA
RNA Modifications *Rotation Student, Eric Greer's Lab* — 2020

Harvard Medical School — Boston, MA
IPSC Reprogramming & DNA methylation *Rotation Student, David Sinclair's Lab* — 2019L

Harvard T. H. Chan School of Public Health — Boston, MA
mTORC1 *Rotation Student, Brendan Manning's Lab* — 2019

Sun Yat-Sen University — Guangzhou, China
Telomere & Telomerase *Undergraduate Researcher, Zhou Songyang's Lab* — 2018 – 2019

University of Edinburgh — Edinburgh, UK
Population genetics *Undergraduate Researcher, Xia Shen's Lab* — 2018

University of Washington — Seattle, WA
Acarbose & Rapamycin *Undergraduate Researcher, Matt Kaeberlein's Lab* — 2018

Buck Institute for Research on Aging — Novato, CA
Senolytics *Undergraduate Researcher, Judith Campisi's Lab* — 2018

University of California, Berkeley — Berkeley, CA
SIRT7 *Undergraduate Researcher, Danica Chen's Lab* — 2017

Sun Yat-Sen University — Guangzhou, China
Telomere & DNA Methylation *Undergraduate Researcher, Yikang Rong's Lab* — 2015 – 2017

Honors

Best Poster Award, Inaugural Biomarker of Aging Symposium — 2023

Best Poster Award, Gordon Research Conference, Systems Aging — 2022

Hackathon Winner, Longevity Hackathon, VitaDAO — 2021

Yan-Sen Honor School Program, Sun Yat-Sen University — 2016 – 2019

Yan-Sen Scholarship, Sun Yat-Sen University — 2016 – 2019

Professional Experience

Service & Leadership

President, Harvard Interdisciplinary Discussion on Disease and Health — 2024 – Present

Organizer, Biomarker of Aging Challenge — 2024 – Present

Organizing Committee Member, Biomarker of Aging Symposium 2024 — 2024

Organizing Committee Member, Biomarker of Aging Symposium 2023 — 2023

Teaching & Mentoring

Mentor, Yuanpei Young Scholars Program — 2023 – 2024

Instructor, Harvard Public Health Symposium For Young Generation — 2023

Students Supervised

Predoctoral Students: Ali Doga Yucel, Siyuan Li, Hanna Liu, Han Weng

Journals Reviewed

Nature Aging, *Nature Communications*, *BMC Nephrology*, *Lipids in Health and Disease*, *Clinical Proteomics*, *Evidence-Based Complementary and Alternative Medicine*, *Scientific Report*

References

Dr. Vadim Gladyshev, Dissertation Advisor — vgladyshev@bwh.harvard.edu
Professor of Medicine, Harvard Medical School

Dr. Steve Horvath, Collaborator — shorvath@mednet.ucla.edu
Professor of Human Genetics, UCLA

Dr. David Sinclair, Dissertation Advisory Committee — david_sinclair@hms.harvard.edu
Professor of Genetics, Harvard Medical School

Dr. Matt Kaeberlein, Advisor — kaeber@uw.edu
Professor of Pathology, University of Washington