Sungwon Han, PhD

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Molecular cell biologist & Project leader

- **SCIENTIFIC INVESTIGATION:** ***Experimental Design | Hypothesis Testing | Data Interpretation***
  - **Biological Mechanisms** – Designed and executed studies investigating cellular signaling and metabolic pathways, using models to uncover mechanisms underlying disease and therapeutic targets.
  - **Protein Trafficking** – Analyzed the movement of membrane proteins, including GPCRs and tetraspanins, utilizing immunofluorescence and biochemical assays to reveal functional roles in cellular communication.
  - **Gene Regulation** – Researched transcription factor activation mechanisms to understand gene expression control in pathological conditions, providing insights into regulatory networks.
- **TECHNICAL & LABORATORY:** ***Molecular Biology | Biochemical Assays | Cell Culture Models***
  - **Genetic Engineering** – Developed CRISPR-Cas9 modified models, including knock-in mice, to study gene function in physiological and disease contexts.
  - **Cell Line Development** – Established inducible expression systems for targeted protein studies, optimizing experimental control and reproducibility.
  - **Assay Development** – Designed and implemented biochemical assays such as sphingomyelinase enzyme activity tests, enabling quantitative analysis of lipid metabolism.
- **LEADERSHIP & COLLABORATION:** ***Mentorship | Team Development | Cross-Disciplinary Collaboration***
  - **Training & Mentorship** – Provided hands-on instruction to technicians and interns, ensuring mastery of laboratory techniques, data analysis, and scientific methodology.
  - **Scientific Communication** – Conveyed complex findings to diverse audiences, from research teams to broader scientific communities, facilitating knowledge exchange and innovation.
  - **Interdisciplinary Collaboration** – Worked across research areas, integrating molecular biology and bioinformatics to drive comprehensive experimental approaches.

Teaching Experience

- **Biology Lab Course;** Teaching Assistant, Dept. of Biology, Amherst College, Amherst, MA, TX
Sep 2002-Feb 2003
- **Biochemistry;** Teaching Assistant, Dept. of Biochemistry & Molecular Biology, University of Massachusetts, Amherst, MA, TX, Sep 2003 -Feb 2004
- **Comparative Anatomy, & Histology Lab Biology**; Teaching Assistant, Dept. of Biology, Hanyang University, Seoul, South Korea, Mar 1996 – Feb 1998

Professional Experience

Lead molecular cell biology projects to develop therapies for metabolic diseases like Alzheimer's, cancer, fibrosis, and lipodystrophy.

UT Southwestern Medical Center, Dept of Neuroscience, Gang Yu lab, Dallas, TX
Research Scientist **Sep 2023 – June 2025**

- **Neurodegenerative Disease Mechanisms:**

- **Gamma-Secretase Molecular Dissection:** Deployed advanced molecular biology and genetic techniques to dissect the intricate molecular mechanisms of the gamma-secretase complex in *in vivo* (nicastrin mutant mice and humanized App Knock-In mice) and *in vitro* (Ncstn V439G mutant cell lines) models of Alzheimer's disease, elucidating key regulatory pathways.
- **Lysosomal Dysfunction Characterization:** Pioneered the application of quantitative fluorescence microscopy with the LysoSensor Yellow/Blue probe to precisely map and characterize lysosomal pH dynamics in Alzheimer's disease model systems, revealing critical insights into lysosomal dysfunction as a potential therapeutic target.

Research Methodology & Technical Expertise:

- **High-Resolution Live Cell Imaging:** Implemented and optimized high-resolution live cell imaging protocols to visualize dynamic cellular events in neuronal cultures and transgenic animal models, generating multi-dimensional datasets for advanced kinetic analyses of disease-related processes.
- **Advanced Statistical Modeling & Bioinformatics:** Developed and applied sophisticated statistical models and bioinformatics tools to analyze complex multi-omics datasets, identifying statistically significant biomarkers and revealing novel correlations in Alzheimer's disease pathogenesis.

Mentorship: Advanced Microscopy & Data Analysis Training:

- Designed and delivered comprehensive training modules on advanced live cell imaging techniques and quantitative data analysis workflows for summer research interns, fostering their technical proficiency and contributing to the lab's research output.

UT Southwestern Medical Center, Center of Alzheimer & Neurodegenerative Disease, Dallas, TX
Research Scientist **Oct, 2022 – Aug, 2023**

Therapeutic approach for neurodegenerative diseases

- Constructing and engineering yeast nanobody surface display expression vector library for screening pathogenic Tau protein reactive nanobodies

Senior Research Scientist,
Dpt. of Molecular Genetics, University of Texas Southwestern Medical Center, Dallas, TX **Sep, 2014 – Oct, 2022**

Tetraspanin protein response to ceramide mechanisms:

- Investigated ceramide effects on membrane proteins trafficking.
- Examined TM4SF20 protein trafficking; developed doxycycline inducible cell line to prove hypothesis.
- Investigated ceramide effects on the GPCR, tetraspanin (CCR5, TM4SF20) protein trafficking by immunofluorescence and immunoblot using transfection system or stable cell line.
- Revealed new functions of tetraspanin proteins as an adhesion molecule.

Fibrosis disease model

- Investigated membrane bound transcription factor CREB3L1 activation mechanism in lung fibrosis for mouse model.
- Establish bleomycin delivery method by an osmotic minipump implantation for chronic lung fibrosis mice model

Kidney Cancer model

- Analyzed cholesterol metabolism using the kidney cancer (ccRCC) model
- Established Xenograft model for ccRCC model system

Research Methodology & Technical Expertise:

- Generated knock-In mice to study in vivo model using Crispr-Cas9 gene editing tool.
- Established in vitro sphingomyelinase enzyme assay
- Applied human kidney cancer xenograft model for cancer research

Mentorship:

- Trained mouse facility technicians, summer research intern students

Postdoc fellow,
Dept. of Pharmacology, University of Texas Southwestern Medical Center, Dallas, TX **July, 2009 – Aug 2014**

- **Lipid droplet biogenesis and lipodystrophy metabolism**
  - Conducted a study on functional analysis of seipin during lipid droplet biogenesis in yeast.
  - Executed FRAP analysis and oversaw subcellular localization of phosphatidic acids using protein lipid/protein sensors.
  - Discovered metazoan homolog in lipid activation pathway and homologous genes for human metabolic diseases (original paper for identifying new genes).

Graduate Student,
Dept of Biology/ Dept. of Biochemistry and Molecular Biology, University of Massachusetts, Amherst, MA, USA, Sep 2008- Jun 2009
Lab of Dr. Jeff Blanchard & Lab of Dr. Danny J. Schnell

- **Signal Peptide Peptidase functional study using transgenic plants**
  - Study of T-DNA insertional mutants of Signal peptide peptidase in *Arabidopsis thaliana* (PhD dissertation project)
  - Characterization of RNA silencing phenotype of signal peptide peptidase in Arabidopsis thaliana
  - Biochemical analysis of Signal peptide peptidase
- **Biofuel project**
  - Understanding of cellulose catabolism in *Clostriduim phytofermentas (C. phy*) as a biofuel model organism

Reproductive Biologist,
Reproductive Medical Research, IVF Center, Medical Science Institute, Eulji Medical Center, Seoul, Korea, Mar 1998- Feb 2001

- **Conducted ART (assisted reproductive technology) such as IVF, ICSI and cryopreservation of human embryo.**
- **Managed IVF clinic lab, quality control of IVF procedures**

Education

Doctor of Philosophy in Molecular & Cellular Biology
University of Massachusetts, Amherst, MA
Dissertation: The Roles of Signal Peptide Peptidase-like proteases in Arabidopsis thaliana

Master of Science in Biology
Hanyang University, Seoul, Korea
Thesis: The effect of uterine environment during peri-implantation period on the ultrastructure of zona pellucida in mouse oocytes and embryos

Bachelor of Science in Biology
Hanyang University, Seoul, Korea

Publications

1. Wang J, **Han S (co-author)**, Ye J (2023) Topological regulation of a transmembrane protein by luminal-to-cytosolic retrotranslocation of glycosylated sequence. Cell Report 42(4): 112311

2. Deng Y, You L; Lu Y; **Han S**; Wang J; Vicas N; Chen C, Jin Ye J (2021) Identification of TRAMs as sphingolipid-binding proteins using a photoactivatable and clickable short-chain ceramide analog. *J Biol Chem 297(6):*101415.

3. Kim JY, Thompson B , **Han S** , Lotan Y, McDonald JG , Ye J. (2019) Uptake of HDL-cholesterol contributes to lipid accumulation in clear cell renal cell carcinoma. Biochim Biophys Acta Mol Cell Biol Lipids. 2019 Dec;1864(12):158525

4. Denard B, **Han S**, Kim JY, Ross EM, Ye J. (2019) Regulating G Protein-Coupled Receptors by Topological Inversion. *eLife*. 2019 Mar 5;8. pii: e40234

5. Chen Q, Denard B, Lee CE, **Han S**, Ye JS, Ye J. (2016) Inverting the topology of a transmembrane protein by regulating the translocation of the first transmembrane helix. *Mol Cell* 63(4): 567-578.

6. **Han S**, Binns DD, Chang Y-F, Goodman J. (2015) Dissecting seipin function: the localized accumulation of phosphatidic acid at ER/LD junctions in the absence of seipin is suppressed by Sei1p$^{\Delta Nterm}$ only in combination with Ldb16p. *BMC Cell Biol*. 16:29

7. Cartwright BR, Binns DD, Hilton CL, **Han S**, Gao Q, Goodman JM. (2015) Seipin performs dissectible functions in promoting lipid droplet biogenesis and regulating droplet morphology. *Mol Cell Biol* 26(4):726-39.

8. **Han S**, Bahmanyar S, Zhang P, Grishin N, Oegema K, Crooke R, Graham M, Reue K, Dixon JE, Goodman JM. (2012) Nuclear envelope phosphatase 1-regulatory subunit 1 (formerly TMEM188) is the metazoan Spo7p ortholog and functions in the lipin activation pathway. *J Biol Chem* 27;287(5): 3123-37.

9. **Han S**, Green LS, Schnell DJ (2009) The Signal Peptide Peptidase is required for pollen function in Arabidopsis. *Plant Physiol* 149 (3): 1289-301.

10. Yang H, **Han S**, Kim H, Choi YM, Hwang KJ, Kwon HC, Kim SK, Cho DJ (2002) Expression of integrins, cyclooxygenases and matrix metalloproteinases in three-dimensional human endometrial cell culture system. *Exp Mol Med* 31; 34 (1): 75-82.

11. Kwon HC, Park WI, Kim SY, Park DW, Kim MR, **Han SW**, Kim DW, Lee HJ, Hong SY, Park JY, Kim SK, Cho DJ (2001) Establishment of three dimensional in-vitro culture system with human endometrial cells: Induction of differentiation by sex steroid hormone & characterization. *Korean Journal of Obstetrics & Gynecology* 44 (1): 65-73.

12. Kim DH, Kang HG, Kim MK, **Han SW**, Chi HJ, Lee HJ, Lee HT, Chung KS (2000) Developmental capacity of mouse oocytes within preantral follicles cultured in medium supplemented with gonadotrophins, *Korean J Animal Reprod* 24 (4): 395-406.

13. **Han S**, Chung HS, Kang HG, Lee HJ, Gye MC, Kim SR, Kim MK (1999) The effect of uterine environment during peri-implantation period on the ultrastructure of zona pellucida in mouse oocytes and embryos. *Kor J Fertil Steril* 26 (3): 345-353.

14. Kim DH, Lee MS, Kang HG, **Han SW**, Kim MK, Park WI, Lee HT, Chung KS, Lee HJ (1999) Use of non-contact type diode laser on assisted hatching of mouse embryos. *Kor. J. Fertil. Steril.* 26 (2): 185-192.

15. Kim DH, Chi HJ, Kang HG, **Han SW**, Lee HT, Chung KS, Lee HJ (1999) Effects of gonadotrophins on in vitro growth and maturation of mouse preantral follicles. *Korean J Animal Reprod* 23(1): 53-61.

16. Kang HG, Kim MK, Kim DH, **Han SW**, Lee HJ, Kim SR, Kim MK (1999) Effects of reactive oxygen species on acrosome reaction, lipid peroxidation and fertilization in mouse spermatozoa: (1) Effects of superoxide anion and hydroxyl radicals. *Dev Reprod* 3 (2): 177-184.

17. Kim JW, Lee YH, Kang SH, **Han SW**, Jeon IK, Kim SR, Kim MK (1998) Expression of DNA methyltransferase transcripts in the oocytes and preimplantation embryos in mouse. *Dev Reprod* 2 (2): 197-203.

Presentations

1. Han S, Chang Y-F, Cartwright B, Binns D, Goodman JM. Involvement of Seipin in Directing Localized PA for lipid droplet formation. The 2013 ASBMB annual meeting (Experimental Biology), Boston, USA. April 20-24, 2013. 585.10 (#4335).

2. Binns DD, Cartwright BR, Hilton CL, Han S, Goodman JM. Seipin promotes lipid droplet assembly. *The 2012 Annual meeting of the American Society for Cell Biology*, Philadelphia, USA, Dec 15-19, 2012.

3. Han S, Bahmanyar S, Adeyo O, Binns D, Grishin N, Dixon J and Goodman J. A human Spo7 candidate that forms a phosphatase complex with CTDNEP1(formerly Dullard) to activate lipin. The The 50th *annual meeting of the American Society for Cell Biology*, Philadelphia, USA, Dec 11-15, 2010.

4. Han S, Green LS and Schnell DJ. The Signal Peptide Peptidase is required for pollen function in Arabidopsis. The 48th *annual meeting of the American Society for Cell Biology*, San Francisco, USA, Dec 13-17, 2008. T-L106

5. Han S, Green LS and Schnell DJ. Analysis of an apparent female gametophyte defect caused by mutation of a signal peptide peptidase in *Arabidopsis thaliana*. *The American Society of Plant Biologists*, Northeastern Sectional Meeting, April 8-9th, 2006.
6. Kang HG, Kim DH, Kim MK, Han SW, Lee HJ, Kim MK. Effects of reactive oxygen species on DNA stability in human spermatozoa. *The 34th annual meeting of the Society for the Study of Reproduction*, Ottawa, Ontario, Canada, July 28th-August 1st, 2001, #515.
7. Han S, Kim MK, Kim DH, Kang HG, Park WI, Kwon HC, Lee HJ. The Influence of the maturity of retrieved oocytes and developmental velocity of embryo on IVF-ET outcome. *The 56th annual meeting of the American Society for Reproductive Medicine*, San Diego, California, October 21-26th, 2000, P-225.

Awards & Honors

- Postdoctoral Travel Award, American Society for Biochemistry & Molecular Biology (ASBMB)
- Best Poster Presentation Award, MCB Program, University of Massachusetts
- Excellent Scholarship | Honor Scholarship | Top Scholarship, Department of Biology, Hanyang University

Affiliations

- Korean-American Scientist & Engineers Association (KSEA), Member, 2009 – Present
- American Heart Association (AHA), Trainee Member, 2013
- American Society for Biochemistry & Molecular Biology (ASBMB), Postdoctoral Member, 2013
- American Society for Cell Biology (ASCB), Postdoctoral Member, 2008 – 2014

Community Affiliations and Activities

- Chairman, Korean Student Association in University of Massachusetts, Amherst, 2005-2007
- Chairman, Korean Scientist Association in UT Southwestern Medical Center, Sep, 2010 – Aug 2012