Minsu Kim, Ph.D.

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EDUCATION

Mar. 2019 – Feb. 2025	**Konkuk University** Department of Bioscience & Biotechnology *Integrated M.S. and Ph.D.* Program (Advisor: Dr. Yoon Kyung Choi)	Seoul, South Korea
Mar. 2013 – Feb. 2019	**Konkuk University** Department of Biomedical Science & Engineering	Seoul, South Korea

RESEARCH EXPERIENCES

1. Postdoctoral associate (Mar. 2025 – Apr. 2025)
2. Graduate student (Mar. 2019 – Feb. 2025)
   - Investigating **inflammatory changes after traumatic brain injury caused by infiltrated immune cells** (with a focus on mechanisms that may be influenced by spaceflight conditions).
   - Examining **astrocyte mitochondrial function in TBI models and its role in neuronal differentiation** (providing insights into neuroprotection strategies that could be relevant for long-duration space missions).
3. Undergraduate student (Jan. 2018 – Feb. 2019)

RESEARCH INTEREST [Space Biology – Microgravity – Cosmic Radiation – Brain]

- My primary research objective is to **identify the molecular mechanisms by which space environments—particularly microgravity and cosmic radiation—induce ferroptosis and oxidative stress in the brain.** By investigating how these space-related stressors disrupt iron homeostasis and trigger **astrocyte-specific ferroptotic signaling**, this research aims to define predictive markers and therapeutic targets relevant to long-duration space missions. Specifically, I focus on the interplay between astrocyte activation, iron metabolism, and neuronal vulnerability, with the ultimate goal of advancing our understanding of spaceflight-induced neurodegeneration and contributing to the development of neuroprotective strategies for future human space exploration.

TECHNICAL SKILLS

- **Controlled Cortical Impact**
  (Traumatic Brain Injury modeling)
- **Western Blot**
- **Immunohistochemistry**
- **Cell Culture**
- **Retro-Orbital Sinus Injection**
- **Rodents Handling**

COMPUTATIONAL SKILLS

- **R**
  - Fast Gene Set Enrichment Analysis
  - Data visualization
- **Python**
  - Statistical analysis
  - Data visualization
- **ImageJ**
  - Signal Intensity quantification
  - Cell Morphology analysis

PUBLICATIONS (SCI ONLY)

1. Hyungsu Kim, Sunhong Moon, **Minsu Kim**, Hyungkeun Oh, Jinhong Park, Suji Kim, Taehyung Yoo, Ji-Yoon Kim, Yonghee Kim, Young-Myeong Kim, Yoon Kyung Choi, "Upregulation of astrocytic mitochondrial functions via Korean red ginseng-induced CREB-BK**α**-HIF-1**α** axis through L-type Ca^{2+} channel subunits **α**1C and **β**4". *J Cereb Blood Flow & Metabolism,* May 2:271678X251332760 (2025).

2. Sunhong Moon, Jinseo Park, Sueun Kim, **Minsu Kim**, Hui Su Jeon, Hyungsu Kim, Young-Myeong Kim, ji-yoon Kim, Yoon Kyung Choi, "Korean Red Ginseng-induced astrocytic HIF-1α: A key regulator of neuroglobin derived from neural stem cell differentiation in physiologic retina and brain". *Journal of Ginseng Research,* Mar;49(2):189-196 (2025).

3. Eunyoung Jung, Ye Eun Kim, Hui Su Jeon, Myeongjong Yoo, **Minsu Kim**, Young-Myeong Kim, Seong-Ho Koh, Yoon Kyung Choi, "Chronic hypoxia of endothelial cells boosts HIF-1α-NLRP1 circuit in Alzheimer's disease". *Free Radical Biology and Medicine*, Aug 1;204:385-393 (2023).

4. Hui Su Jeon†, Chang-Hee Kim†, **Minsu Kim**, Sunhong Moon, Yoon Kyung Choi, "Korean red ginseng mediates mitochondrial membrane potential repair via the Tom22-Tom20-SIRT2 pathway in astrocytes". *Conditioning Medicine* Oct, 5(3), 105-111 (2022).

5. Sunhong Moon, Chang-Hee Kim, Jinhong Park, **Minsu Kim**, Hui Su Jeon, Young-Myeong Kim, Yoon Kyung Choi, "Induction of BVR-A Expression by Korean Red Ginseng in Murine Hippocampal Astrocytes: Role of Bilirubin in Mitochondrial Function via the LKB1-SIRT1-ERRα Axis". *Antioxidants (Basel)*, Sep 1;11(9):1742 (2022).

6. Jinhong Park, Minjae Lee, **Minsu Kim**, Sunhong Moon, Seunghee Kim, Sueun Kim, Seong-Ho Koh, Young-Myeong Kim, and Yoon Kyung Choi, "Prophylactic role of Korean Red Ginseng in astrocytic mitochondrial biogenesis through HIF-1α". *Journal of Ginseng Research*, May;46(3):408-417 (2022).

7. **Minsu Kim**, Sunhong Moon, Hui Su Jeon, Sueun Kim, Seong-Ho Koh, Mi-Sook Chang, Young-Myeong Kim, Yoon Kyung Choi, "Dual Effects of Korean Red Ginseng on Astrocytes and Neural Stem Cells in Traumatic Brain Injury: The HO-1-Tom20 Axis as a Putative Target for Mitochondrial Function". *Cells* Mar 4;11(5):892 (2022).

8. **Minsu Kim**, Joohwan Kim, Sunhong Moon, Bo Young Choi, Sueun Kim, Hui Su Jeon, Sang Won Suh, Young-Myeong Kim, Yoon Kyung Choi, "Korean Red Ginseng Improves Astrocytic Mitochondrial Function by Upregulating HO-1-Mediated AMPKα-PGC-1α-ERRα Circuit after Traumatic Brain Injury". *International Journal of Molecular Sciences*, Dec 3;22(23):13081 (2021).

9. **Minsu Kim**, Hyejung Mok, Woon-Seok Yeo, Joong-Hoon Ahn, and Yoon Kyung Choi, "Role of ginseng in the neurovascular unit of neuroinflammatory diseases focused on the blood-brain barrier". *Journal of Ginseng Research*, Sep;45(5):599-609 (2021).

INTERNATIONAL CONFERENCE

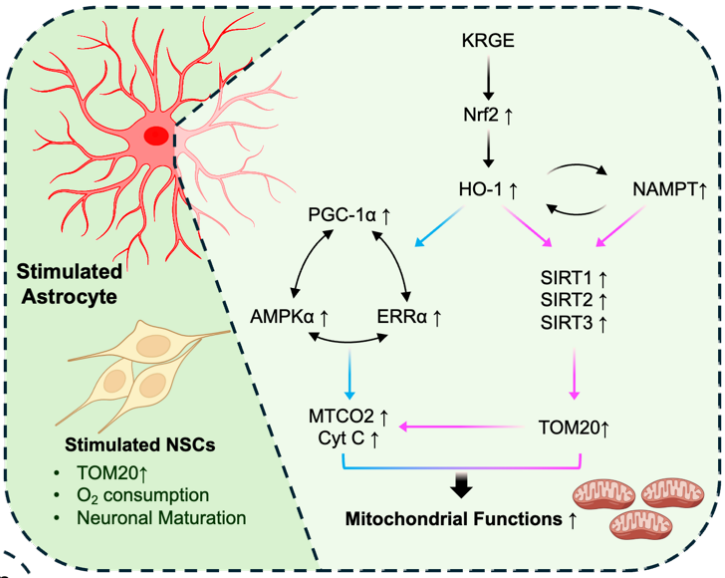
1. **Minsu Kim**, "Astrocyte Ferroptosis in the Brain After Long-Term Spaceflight: Insights from NASA GeneLab RNA-seq Data". *American Society of Gravitational and Space Research.* Dec 3-6, 2025, Phoenix, AZ, USA. (Oral Presentation)

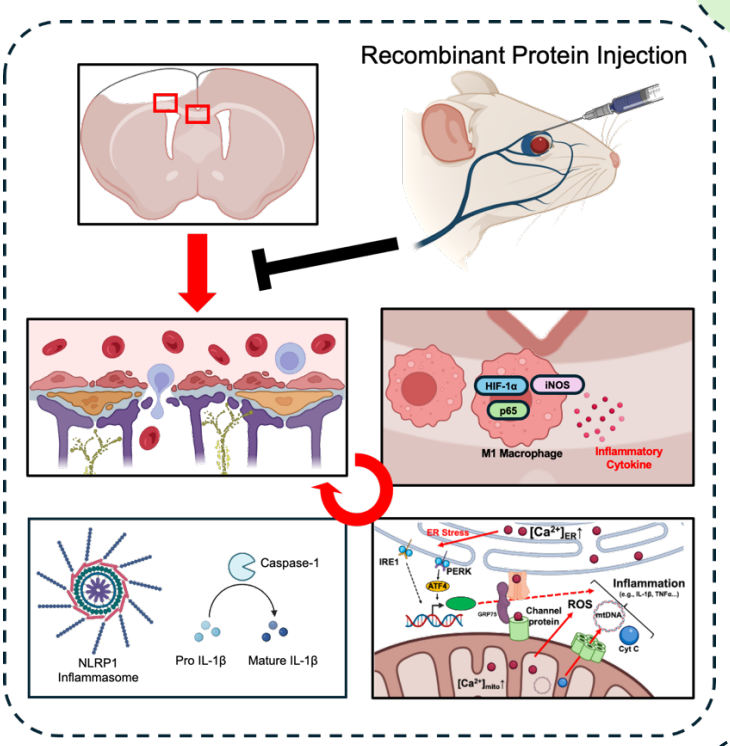
RESEARCH SUMMARY

Two HO-1–Dependent Pathways That Enhance Mitochondrial Function in Damaged Astrocytes

Intake of Korean Red Ginseng Extract increases the expression of Heme Oxygenase 1 of astrocytes in the brain of TBI mouse model. HO-1 then increases the circuit of three proteins (AMPKα-PGC-1α-ERRα) or increases SIRT protein levels by interacting with NAMPT. Increased TOM20 expression by SIRTs and the circuit induces mitochondrial protein (MTCO2, Cytochrome C). These two independent pathways are dependent on HO-1 activity, as demonstrated by treatment with SnPP (HO-1 activity inhibitor).

Int J Mol Sci. 2021, 10.3390/ijms222313081.
Cells. 2022, 10.3390/cells11050892.





Protecting Blood-Brain Barrier Integrity Limits Immune Cell Infiltration and Inflammation After Traumatic Brain Injury.

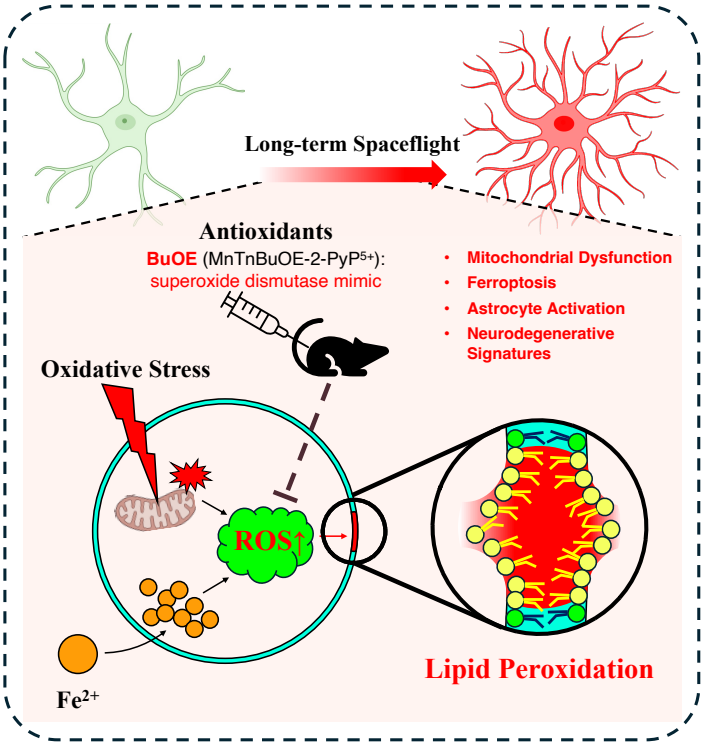
After traumatic brain injury (TBI), immune cells that recognize damage signals infiltrate brain tissue through the blood-brain barrier (BBB), become activated and polarized, and acquire pro-inflammatory functions. These cells spread along white matter regions and are exposed to hypoxia, releasing cytokines that amplify inflammation in neighboring cells. Stressed mitochondria contribute to this process by upregulating inflammatory proteins and mitochondrial channel proteins. This study aims to characterize how a specific recombinant protein, delivered via retro-orbital injection after TBI, preserves BBB integrity and limits immune cell infiltration by suppressing inflammation at the molecular level.

2025, Draft Manuscript in Preparation.

Astrocyte Ferroptosis in the Brain After Long-Term Spaceflight: Insights from NASA GeneLab RNA-seq Data

Using transcriptomic datasets from NASA GeneLab (OSD-682, 685, 698, 699), which include spatial transcriptomics after 35 days aboard the ISS, I investigated region-specific molecular responses to long-duration spaceflight. Preranked fast GSEA and single-sample GSEA revealed a strong ferroptosis-related signature in the hippocampus—particularly within the dentate gyrus—driven by elevated intracellular iron, oxidative stress, and OXPHOS-associated ROS production. These stress-response pathways also correlated with Alzheimer's disease–related pathways, suggesting that ferroptosis may contribute to neurodegenerative signaling during spaceflight. Integrating these findings with prior imaging data, astrocytes emerged as a plausible cellular source of this ferroptosis-like response.

2025, Draft Manuscript in Preparation



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