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Elucidating the vascular pathophysiology in the development of neurodegenerative diseases

Research Description

The brain is the center for the cognitive function and needs special means to protect itself from the peripheral insult and this entity of structural barrier of the vascular system is called blood brain barrier (BBB). It is unique in its structure delineating the vascular system of the CNS composed of the endothelial cells, pericyte, and astrocytes. Traditionally, BBB has been considered as a mere tight vascular integrity that has passive role just supporting the brain physiology. However, emerging studies show that it is not the case. Currently, we are studying the 1. Neurovascular coupling at the level of the BBB enhancing the molecular delivery to the brain and 2. Impact of BBB integrity in the progression of neurodegenerative diseases including Parkinson's Disease. In the future, we will enhance these topics toward CNS autoimmune diseases that will strengthen the understanding of the brain disease progression in a different view point. These studies will be done with our expertise on the BBB biology and collaboration with intra- and extramural experts from different fields.

Aim	Elucidating the role of blood brain barrier in neuroimmune responses in the Alzheimer's Diseases		
Tool	<i>In vitro</i> and <i>in vivo</i> BBB model+ Advanced Imaging + Mouse genetic model		
T A R G E T	BBB damage and Alzheimer's Disease (AD) <small>Neuron 2008</small>	Modulating neuro-immune responses in the AD <small>JCB 2017</small>	Neurovascular coupling dysfunction in AD <small>Nat Rev Neurosci 2017</small>

Professional Career

2016~Present : Principal Investigator, KBRI
 2015~2016 : Postdoctoral Associate,
 Cornell University, USA
 2008~2009 : Researcher, Korea Institute of
 Toxicology (KIT)

Academic Credential

2010~2015 : Ph.D., Cornell University, USA
 2000~2008 : D.V.M., Konkuk University

Awards/Honors/Memberships

2010~2015 : International Kwanjung Educational Foundation Scholarship for
 Study Abroad
 2016~Present : Member, Society for Neuroscience
 2018~Present : Member, Korea Society of
 Biochemistry and Molecular Biology
 2016~Present : Member, Korea Society of Vascular Biology

Research keywords

Blood brain barrier, Multi-Drug transporters, Drug delivery, Vascular dementia, CNS autoimmune disease, Brain endothelial cell metabolism,

Key techniques

3D vascular imaging, *In vitro* BBB modeling, FACS, Immunohistochemistry.

Research Interests/Topics

- Regulation of the permeability of the BBB by neurotransmitters and signaling molecules enhancing the drug delivery to the brain.
- Regulation of the CNS immune response by the disruption of the BBB.
- Impact of BBB function or integrity in the progression of the neurodegenerative diseases.

Research Publications (selected)

- Choi MG, Kim MJ, **Kim DG**, Yu R, Jang YN, Oh WJ. Sequestration of synaptic proteins by alpha-synuclein aggregates leading to neurotoxicity is inhibited by small peptide. *Plos One*, 13, 2018.
- Torres L*, Robinson SA*, **Kim DG***, Yan A, Cleland TA, Bynoe MS. Toxoplasma gondii alters NMDAR signaling and induces signs of Alzheimer's disease in wild-type, C57BL/6 mice. *J Neuroinflammation*, 15:57, 2018. (*Equal contribution)
- **Kim DG** and Bynoe MS. A2A adenosine receptor signaling regulates the trans-cellular permeability of the blood brain barrier. *J Clin Inv.*, 126:1717, 2016.
- **Kim DG**, Krenz A, Toussaint LE, Maurer KJ, Robinson SA, Yan A, Bynoe. Non-alcoholic fatty liver disease induces Alzheimer's disease (AD) in wild type mice and accelerates AD in an AD model. *J Neuroinflamm*, 13:1, 2016.
- **Kim DG** and Bynoe MS. A2A Adenosine Receptor Regulates the Human Blood-Brain Barrier Permeability. *Mol Neurobiol.*, 52:664, 2014.