A close-up of a person smiling

Description automatically generatedOur mitochondrial stem cell research group is located at the Department of Clinical Medicine (K1), University of Bergen and is part of Neuro-SysMed, the Centre of Excellence for Clinical Research in Neurological Disorders, Department of Neurology at Haukeland University Hospital.

We are using stem cells transformed from a patient's own fibroblasts to study mitochondrial diseases caused by *POLG* mutations. The goal of our research group is to conduct iPSC-based in vitro model system studies to increase the understanding of mitochondrial diseases, identify the underlying mechanisms of this common mitochondrial diseases and develop an iPSC-based platform to test therapeutic agents.

We have established the capabilities and facilities required for the reprogramming and differentiation of iPSCs, enabling the study of neuronal cells from patients and healthy controls. Validated iPSCs can differentiate into neural stem cells (NSCs) and compartmentalized neuronal subtypes, as well as astrocyte/glial cell populations. We have also recently developed 3D brain organoids to study disease mechanisms and test treatments.

Our broad research aim is to determine the biological and pathological basis of neurodegenerative diseases associated with mitochondrial dysfunction, and we aim to develop this and conduct more in-depth molecular phenotyping studies. Since the group is also part of the Neuro-SysMed Center, we will use our model and stem cell approach to study other neurodegenerative diseases such as Parkinson's and Alzheimer's.

**See also our group website:**

[Mitochondrial Stem Cell Research | Mitochondrial Medicine & Neurogenetics (MMN) | UiB](https://www.uib.no/en/rg/mitochondrial_medicine/103070/mitochondrial-stem-cell-research)

**Relevant publications:**

* CK Kristiansen, A Chen, LE Høyland, M Ziegler, GJ Sullivan, LA Bindoff and KX Liang, Comparing the mitochondrial signatures in ESCs and iPSCs and their neural derivations, Cell Cycle. 2022 Jul 10:1-16. doi: 10.1080/15384101.2022.2092185.
* A Chen, CK Kristiansen, LE Høyland, M Ziegler, J Wang, GJ Sullivan, X L, LA Bindoff and KX Liang, POLG mutations lead to the abnormal mitochondria remodeling during neural differentiation of human pluripotent stem cells via inhibiting SIRT3/AMPK pathway, Cell Cycle. 2022 Jun;21(11):1178-1193. doi: 10.1080/15384101.2022.2044136.
* A Chen, CK Kristiansen, Y Hong, A Kianian, EF Fang, GJ Sullivan J Wang, X L, LA Bindoff and KX Liang, Nicotinamide riboside and metformin ameliorate mitophagy impairment in iPSC-derived astrocytes with POLG mutations, Front Cell Dev Biol. 2021 Sep 24;9:737304. doi: 10.3389/fcell.2021.737304.
* KX Liang, A Chen, CK Kristiansen, LA Bindoff. Flow Cytometric Analysis of Multiple Mitochondrial Parameters in Human Induced Pluripotent Stem Cells and Their Neural and Glial Derivatives. J Vis Exp. 2021 Nov 8;(177). doi: 10.3791/63116.
* KX Liang, A Kianian, A Chen, CK Kristiansen, Y Hong, J Furriol, LE Høyland, M Ziegler, T Kråkenes, C Tzoulis, GJ Sullivan, LA. Bindoff, Stem cell derived astrocytes with POLG mutations and mitochondrial dysfunction including abnormal NAD+ metabolism is toxic for neurons. Preprint in bioRxiv (2020), Molecular Neurodegeneration (in review), doi: https://doi.org/10.1101/2020.12.20.423652.
* KX Liang, GH Vatne, CK Kristiansen, O Ievglevskyi, E Kondratskaya, JC. Glover, A Chen, GJ

Sullivan, LA Bindoff, N-acetylcysteine amide ameliorates mitochondrial dysfunction and reduces oxidative stress in hiPSC-derived dopaminergic neurons with POLG mutation, Exp Neurol. 2021 Mar;337:113536. doi: 10.1016/j.expneurol.2020.113536

* KX Liang, CK Kristiansen, S Mostafavi, GH Vatne, GA Zanting, A Kianian, C Tzoulis, LE Høyland, M Ziegler, RM Pered, J Furriol, Z Zhang, N Balafkan, Y Hong, R Sillerg, GJ Sullivan and LA Bindoff, Disease-specific phenotypes in iPSC-derived neural stem cells with POLG mutations. EMBO Mol Med. 2020 Oct 7;12(10):e12146. doi: 10.15252/emmm.202012146.
* N Balafkan, S Mostafavi, M Schubert, R Siller, KX Liang, G Sullivan, LA. Bindoff, Method for differentiating human induced pluripotent stem cells toward functional cardiomyocytes in 96-well microplates, Sci Rep. 2020 Oct 28;10(1):18498. doi: 10.1038/s41598-020-73656-2.
* X Liang, CK Kristiansen, GH Vatne, Y Hong, LA Bindoff, Patient-specific neural progenitor cells

derived from induced pluripotent stem cells offer a promise of good models for mitochondrial disease. Cell Tissue Res. 2020 Apr;380(1):15-30. doi: 10.1007/s00441-019-03164-x.