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The NO-Age and NO-AD Seminar Series 052

'In vivo ^{31}P magnetic resonance spectroscopy based NAD assay for noninvasively studying brain NAD metabolism and redox state during aging and neurodegeneration' (tentative)

by

Prof. Wei Chen
Department of Radiology, University of Minnesota, USA

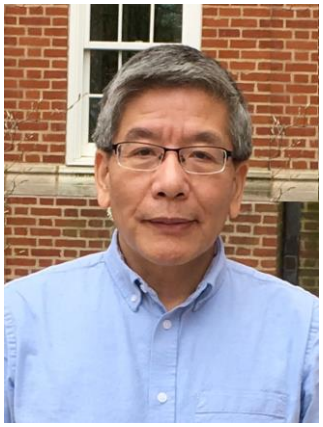
at

14:00-15:15 (CET), Monday, 08th Nov. 2021

Register in advance:
https://uio.zoom.us/webinar/register/WN_Sb1Hl94kQdOT3QfDGPNb3Q

Organizers:
Evandro F. Fang (UiO), Jon Storm-Mathisen (UiO), Lene Juel Rasmussen (KU), W.Y. Chan (CUHK)

Queries: e.f.fang@medisin.uio.no
Previous recorded talks are available here: https://noad100.com/videos-previous-events/



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Speaker: Wei Chen

Title: In vivo ^{31}P magnetic resonance spectroscopy based NAD assay for noninvasively studying brain NAD metabolism and redox state during aging and neurodegeneration **(tentative)**

Abstract:
Nicotinamide adenine dinucleotide (NAD) exists in oxidized (NAD^+) or reduced (NADH) form in all living cells. The NAD^+/NADH redox state mediates ATP energy production. NAD^+ also modulates metabolic signaling *via* regulating the activities of NAD^+-dependent enzymes; thus, participates in many important cellular processes including aging, neurodegeneration and cell death. We have developed a novel phosphorus-31 (^{31}P) magnetic resonance spectroscopy (MRS)-based *in vivo* NAD assay for noninvasively measuring and quantifying NAD^+ and NADH contents and the NAD^+/NADH redox ratio in animal and human brains across a wide range of magnetic field strength from 4 to 16.4 Tesla (Lu et al. Magn Reson Med 2014;71(6):1959-1972; NMR Biomed 2016;29(7):1010-1017). Our work provides first-hand information on the cellular NAD levels and redox state in the healthy human brains and their age-dependences: intracellular NADH increases and decrease in NAD^+, total NAD contents and NAD^+/NADH redox ratio with aging (Zhu et al. PNAS 2015;112(9):2876-2881). The finding provides direct evidence of declined mitochondrial function and altered NAD homeostasis accompanying with the normal aging. The decline of NAD^+ as well as impaired energy metabolism have also been observed in the visual cortex of patients with mild-moderate Parkinson's disease (Zhu et al. Metabolites 2021;11(3); doi: 10.3390/metabo11030145). Moreover, our new study has indicated that the administration of endogenous NAD^+ could significantly increase the cellular NAD^+ level and boost ATP production rate in the rat brain. Together, these findings demonstrate the merits and promise of the newly developed NAD assay for noninvasively studying the NAD metabolism and redox state, and mitochondrial functionality in normal, aging and neurodegenerative brains *in situ*, and potentially for monitoring the efficacy of therapeutic treatment.

Biography:
Dr. Wei Chen is a professor in the Departments of Radiology and Biomedical Engineering at the University of Minnesota (UMN). He received his B.S. degree at Fudan University in Shanghai in 1981, and his Ph.D. degree at Washington University in St. Louis in 1990. He spent three years as a postdoctoral fellow and research associate at Yale University Medical School before joining the Center for Magnetic Resonance Research (CMRR) at UMN in 1994, and became a full professor in 2002. His research focuses on the development of novel magnetic resonance imaging (MRI)/spectroscopy (MRS) imaging (MRSI) methodologies for noninvasively studying cellular metabolism, bioenergetics, function and dysfunction of the brain and other organs. He is one of the pioneers in the development of the in vivo ^{31}P MRS/MRSI – based NAD assay for noninvasively studying human brain aging and neurodegeneration. He has published > 150 peer-reviewed papers and has been a principal investigator for a large number of NIH grants including two active BRAIN Initiative grants. He has served as a grant reviewer for many NIH study sections as well as other funding organizations, and is a member of the editorial boards of imaging journals. Dr. Chen is a fellow of International Society of Magnetic Resonance in Medicine (ISMRM) and American Institute for Medical and Biological Engineering (AIMBE).