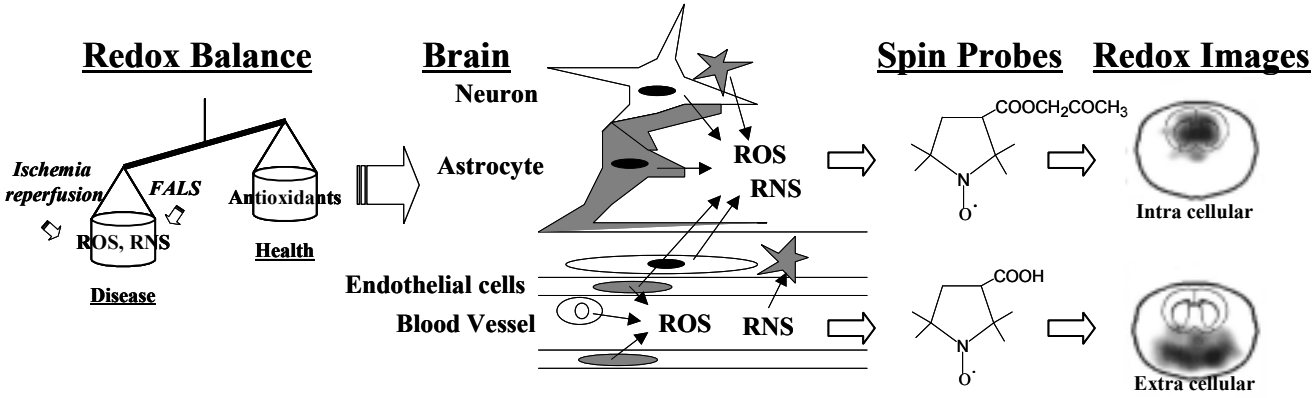
Session D: Non-invasive imaging of brain function

Technical Subject:

Development of ESRI/MRI co-registration system for functional brain imaging under oxidative stress

Corresponding Applicant: **Kenichi Yamada *(Kyushu University)***

Co-researcher: Ichiro Koshiishi, Akira Monji, Mayumi Yamato *(Kyushu University),* Hiroshi Hirata *(Yamagata University)*, Kenichiro Matsumoto *(Showa College of Pharmaceutical Sciences)*, Toshiki Masumizu *(JEOL Ltd.)*, Hiroaki Sano *(Daiichi Radioisotope Laboratories)*



Goal:

Reactive oxygen spices (ROS) are suspected of being the cause and perpetuating factor in the various diseases including brain disorder. We will construct to develop ESRI/MRI co-registration system. This system can provide the information of free radical reactions (redox status) with the anatomical structure in brain. This technique might become useful for determining how redox status relates to the diagnosis and prognosis of oxidative stress in brain.

Approach:

1. To minimize the sample motion noise, automatic tuning control and automatic coupling control technique will apply on 300 MHz ESR resonator.
2. To obtain the high resolution and spatial information of free radical image, we will construct to develop a new nitroxyl probe with high retention in brain tissue or blood vessel.
3. To analyze free radical reaction (redox status) in brain disorder, we will construct to co-registration image between redox status and anatomical structure using ESRI/MRI co-imaging system.

ESRI/MRI Co-Imaging System

Introduction:

Electron spin resonance (ESR) methods (both spectroscopy and imaging) are being evaluated for its capability to provide the information of free radical reactions in small animals and potentially in humans using a spin probe such as nitroxyl radicals. ESR 2-D images reconstruct using a reduction rate of spin probe within each pixels, which are used as indicators of redox status, were used to provide redox mapping of interested organs.

However, ESR imaging experiment may not resemble the accurate anatomical structures similar to that produced by MRI experiments. This is due to the larger linewidth of spin probe as compared with the typical NMR linewidth that are responsible for worsening the spatial information. In contrast, magnetic resonance imaging (MRI) is a well-established modality, which gives superior anatomical information. By employing MRI to define the anatomical structure, co-registration of ESRI with MRI at brain will enable one to provide free radical distribution (redox status) and the precise anatomical position. This technique is in real-time and non-invasive, and will become applicable to determination of free radical reactions in relation to diagnosis.