**SL07**

# Cellular and Molecular Imaging Based on MRI

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An application of NMR for biomedical area is most clearly embodied as MRI, today the most important diagnostic tool, where the information obtained by NMR is presented in a visualized image. However, the MRI outlines only the structural information of internal organs and the areas of lesions. The properties in cellular and molecular levels are not obtainable directly with MRI techniques. Some elaborations have been devised so far to delineate the characters with an aid of cellular and molecular targeting and sensing agents, which lead to so-called Molecular Imaging (MI). One of the agents is paramagnetic nanoparticles, which can be loaded into living cells. The tagged cells transplanted into a living system are visualized with the paramagnetic effect on MRI. The nanoparticles are also utilized to sense and target cancer cells and possibly to deriver anti-cancer drags directly into tumor cells. Another example is an MR reporter with over- expressing ferritin, which also shows paramagnetic effect on MRI.

We have been studying with MRI living cells which are labeled with MRI contrast agent, superparamagnetic iron oxide (SPIO). Variety of cells, such as, embryonic stem cells, neuronal cells, glial cells, immune cells, and so on, were visualized and characterized with MRI. One of the advantages to employ MRI is to track the paramagnetically labeled cells *in vivo* for long period up to two months and to analyze the activity of them.

Clinical imaging in the future will not merely report on the success or failure of therapy several months after it has been initiated but will play a crucial role in detecting lesions based upon their molecular signatures, will characterize lesions in situ to aid in treatment decisions, and will help define successful therapeutic drug levels on an individual basis. The chemical aspect of NMR imaging technology presented in the talk shows examples of physiological probes and some example clinical-use paradigms for their implementation into practice. Treatment and screening approaches of number of cancers may benefit in the near future from these tools. In combination with newly emerged bioluminescence and fluorescence imaging techniques targeting specific molecule, an NMR technique in MI, in no doubt, continues to serve as a diagnostic imaging tool in biomedical field.