慶應義塾大学

論理と感性のグローバル研究センター

Global Research Centre for Logic and Sensibility

Open Evening Seminar

Diffusion MRI: What water tells us about the brain

Dr. Denis Le Bihan, M.D. Ph.D.

Member of the Institut de France, Academy of Sciences
Founding Director of NeuroSpin, CEA Saclay, France
Graduate School of Medicine, Kyoto University, Japan

(Everyone is welcome)

公開イブニング・セミナー

拡散核磁気共鳴画像手法からわかる 脳について水が教えてくれること

(参加自由)

日時: **2014年6月5日(木) PM 18:15~19:45 Thu. 5th June, 2014**

場所: 慶應義塾大学 三田キャンパス 南館 地下4階 ディスタンス・ラーニング・ルーム
Distance Learning Room, South Building B4F, Mita Campus, Keio Univ.
(http://www.keio.ac.jp/en/maps/mita.html) #13 Building on the map

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核磁気共鳴画像法(MRI)を用いた脳画像解析研究の世界的権威であるデニ・ルビアン博士をお招きし 拡散強調画像法の基本的理解から 様々な応用例をご紹介頂きます。 さらにMRI研究の将来的方向性を含め より高い時空間分解能で脳と思考の関係を明らかにする可能性を秘めた脳内水分子の重要性をわかりやすくお話頂きます。

(The full English abstract will be found at the end)

挨拶 **岡田光弘**(慶應義塾大学 論理と感性のグローバル研究センター センター長)

講演 **デニ・ル ビアン博士**
(フランス科学アカデミー会員・仏サクレー研究所脳機能画像研究施設ニューロスピン創始者兼所長
京都大学大学院医学研究科 客員教授)

質疑応答

司会 **皆川泰代**(慶應義塾大学 文学部心理学専攻 准教授)

＊英語(通訳なし) Language used: English ・参加費無料 Fee: Free 事前登録不要 No advance registration required

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共催:新学術領域「予測と意思決定」慶應義塾大学三田キャンパス研究班、慶應義塾大学日吉キャンパス心理学教室
後援:慶應義塾大学 論理と感性のグローバル研究センター,

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Diffusion MRI: What water tells us about the brain

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In the mid 1980s it was shown that water diffusion in the brain could be imaged using Magnetic Resonance Imaging (MRI). During their random displacements water molecules probe tissue structure at a microscopic scale, thus providing unique information on the functional architecture of tissues. A dramatic application of diffusion MRI has been acute brain ischemia, following the discovery that water diffusion drops immediately after the onset of an ischemic event, when brain cells undergo swelling through cytotoxic edema. With its unmatched sensitivity water diffusion MRI provides patients with the opportunity to receive suitable treatment at a stage when brain tissue might still be salvageable, thus avoiding them terrible handicaps. On the other hand, it was found that water diffusion is anisotropic in white matter, because axon membranes limit molecular movement perpendicularly to the fibers. This feature can be exploited to produce stunning maps of the orientation in space of the white matter tracks and brain connections in just a few minutes, as well as to provide information on white track microstructure and integrity. With water diffusion MRI it has been shown that some psychiatric disorders, such as schizophrenia might result from faulty brain connection. Diffusion MRI has also the potential to give clues on the cellular organization within brain cortex on an individual basis, a step forward to segregating brain areas at mesoscale level, which could reveal a neural code, as there is a genetic code. More recently, it has been shown that diffusion MRI could even be used to detect brain activation. Functional neuroimaging has emerged as an important approach to study the brain and the mind. Surprisingly, although they are based on radically different physical approaches both positron emission tomography (PET) and MRI make brain activation imaging possible through measurements involving water molecules. So far, PET and MRI functional imaging have relied on the principle that neuronal activation and blood flow are coupled through metabolism. However, a new paradigm has emerged to look at brain activity through the observation with MRI of the molecular diffusion of water. In contrast with the former approaches diffusion MRI has the potential to reveal changes in the intrinsic water physical properties during brain activation, which could be more intimately linked to the neuronal activation mechanisms and lead to an improved spatial and temporal resolution. Recent data on the physical properties of water and on the status of water in biological tissues, suggest that the biophysical mechanisms of brain activation have to be reassessed to reveal their intimacy with the physical properties of water, which could, some day, be regarded as the 'molecule of the mind'?