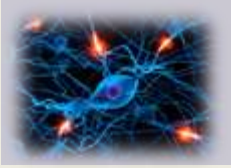
International Clinical Research Collaboration

To Impact Society Through Medical Innovation



France (IM2A) – Japan (LABSP)

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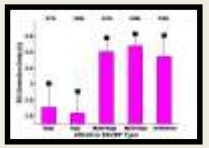
BRAIN SCIENCE INNOVATION AT RIKEN

LAB FOR ADVANCED BRAIN SIGNAL PROCESSING (Prof. Andrzej CICHOCKI)

BRAIN-COMPUTER INTERFACES: For Quadriplegic (Disabled) Patients and Healthy Users

Research Goals:

- Create reliable Brain-Computer interfaces (BCI) (using visual flicker stimulation) with high success rate (98-99%), high number of commands (8 to 12), short delays (1-3s), and no need for training before usage
- Achieve improvement of the BCI command performance by introducing emotional- instead of neutral stimuli (speed, reliability)
- Develop BCI using a multi-joint robotic arm for disabled users with 8 preset possible actions



Bakardjian H, Tanaka T, Cichocki A, Emotional faces boost up steady-state visual responses for brain-computer interface, NeuroReport 2011, 22(3):121-125.

HYPERSCANNING: Measuring Simultaneous Brain Activity in Multiple Human Subjects

Research Goals:

- Identify the common brain patterns & profiles in multiple subjects during a socially-engaging shared activity (e.g. emotionally engaging)
- Investigate the pulsed synchronization properties of simultaneous brain signals in all 3 subjects

HOBBY&ARTS: 3 SUBJECTS SINGING TOGETHER

EMPATHY: 3 SUBJECTS OBSERVING EMOTIONAL STIMULI TOGETHER:

MUSIC THERAPY: Long-Term Memory Enhancement in Dementia (Alzheimer's Disease)

Research goals:

- Study brain changes induced by music therapy in elderly dementia (using whole-head EEG recording (before, during, after therapy), psychological exams)
- Optimize music therapy using neurotechnology to prolong the positive effects and automate procedure for home settings

Keiichi Ishibashi Music Therapist

COLLABORATION IN ALZHEIMER'S DISEASE RESEARCH (IM2A / LABSP)

Preventive medicine facing the dementia challenge

PRECLINICAL ALZHEIMER'S DISEASE (AD) IN THE ELDERLY: MULTIMODAL CLINICAL BIOMARKERS FOR EARLY AD PREDICTION & THERAPY

GOALS

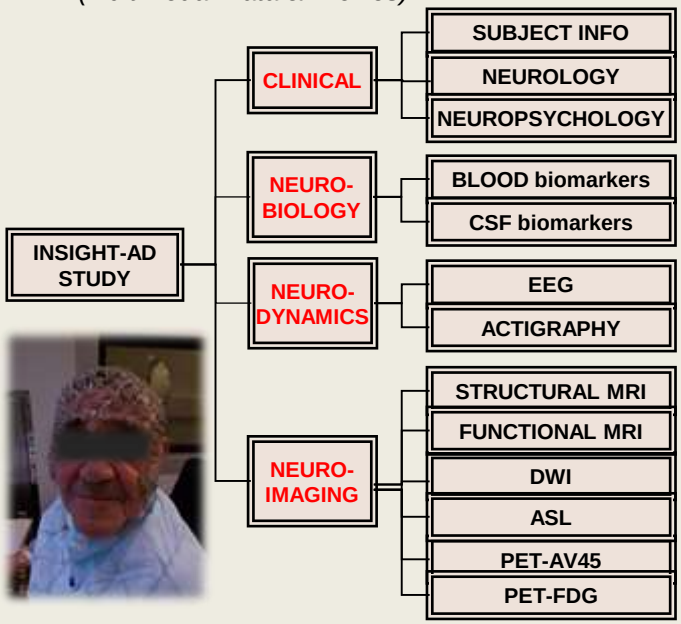
- **Detect Preclinical Alzheimer's Disease (PrAD) years/decades before clinical manifestation**
- **Create & validate clinical PrAD biomarkers for preventive and therapeutic trials**

CHALLENGES

- **Difficult to distinguish normal heathy elderly subjects from clinically 'healthy' subjects with Preclinical Alzheimer's Disease**
- **AD mechanisms not fully understood**
- **Existing AD biomarkers reflect limited aspects of pathology and disease stage - new approaches are needed**

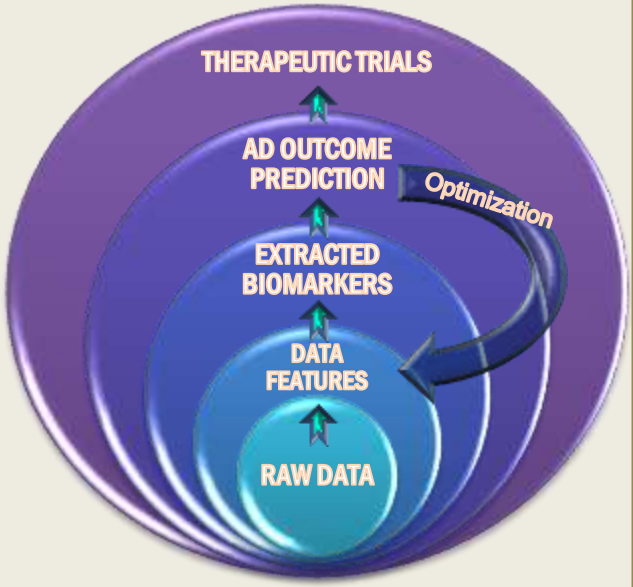
Step 1

(Multimodal Data & Profiles)



Step 2

(Biomarkers→Predictive algorithm→Application)



TARGETS

- **Addressing difficult challenges by integration of multidisciplinary expertise**

– LABSP: Extraction of hidden components from data using multimodal tensor decomposition

– IM2A: Clinically well-characterized elderly subject groups ; Selection and weighting of medical factors and exams for analysis ; Overall analysis of results

Innovative Joint Perspectives for Future Collaborative Research:

- Multidimensional component analysis to determine hidden risk- and diagnostic factors for AD
- Iterative retrospective optimization of the clinical PrAD biomarkers during the course of the longitudinal study (5-7 years with annual data points)
- Advanced data mining of the results of preventive and therapeutic trials

Japan - RIKEN – BSI : LABSP (Prof. Andrzej CICHOCKI)

QUESTIONS?

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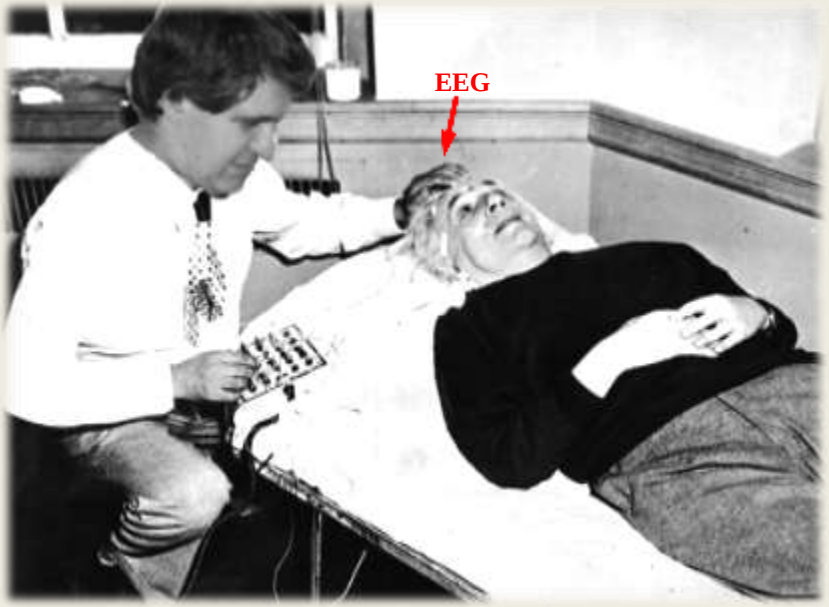

IM2A : *http://institut-memoire.aphp.fr*
LABSP **:** *http://www.bsp.brain.riken.jp*