

# ประสาทศาสตร์ไทย อดีต ปัจจุบัน อนาคต

จรัส สุวรรณเวลา  
การประชุมสัมมนาวิชาการ ด้านวิทยาศาสตร์การแพทย์  
“การพัฒนาศาสตร์งานวิจัยเกี่ยวกับสมอง จิตใจ และพฤติกรรม”  
วช. และ สวรส.  
๒๑ กรกฎาคม ๒๕๕๗



**1957**  
University of Chicago

**Heinrich Klüver & Paul Bucy  
KLUVER-BUCY SYNDROME  
1939 1955**

Pacified  
Psychic blindness  
Altered feeding behavior  
Hypermetamorphosis  
Sexual perversion  
“not a monkey”

**SELECTIVE BILATERAL TEMPORAL LOBECTOMY**  
Visual discrimination  
Tactile discrimination

**Nathaniel Kleitman & Eugene Aserinsky  
SLEEP LABORATORY  
REM Sleep 1953**

**EXPERIMENTAL PSYCHOLOGY**

Jerzy Konorski: Type II Conditioned Reflex 1948  
Avoidance & Operant Conditioning  
(Ivan Pavlov: Type I Conditioned Reflex 1927)

**Wilder Penfield: Epilepsy surgery**  
Cortical stimulation in awake patients  
*Interpretive cortex – Brain Mapping*

**FUNCTIONAL NEUROSURGERY**  
**EXPERIMENTAL PSYCHOLOGY**

William Sweet: Neurosurgery of Pain 1954  
Melzack R. & Wall PD.: Gate-control Theory 1965

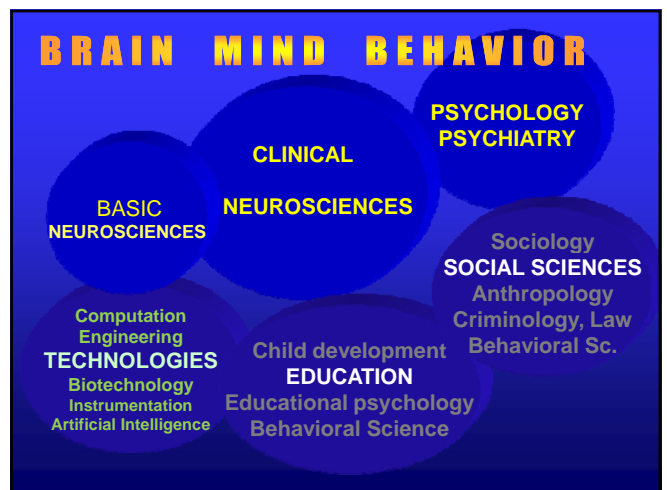
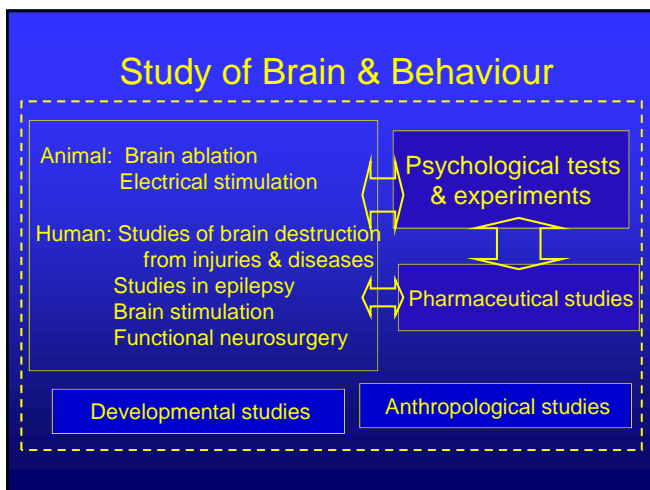
Neurochemistry Neurohormones  
Chemical neurotransmitters  
Sensory modulation

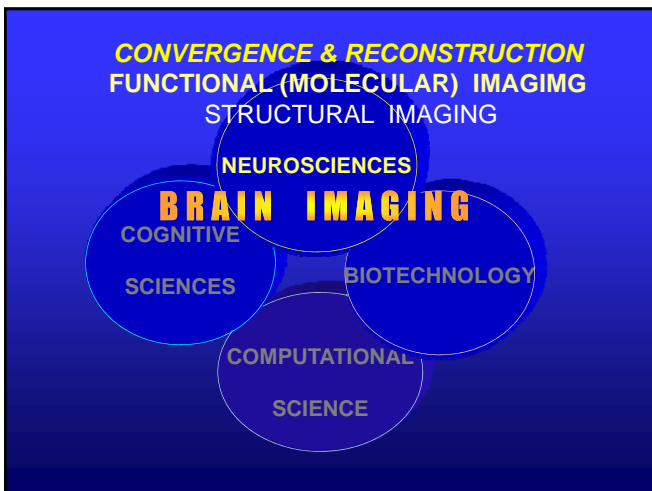
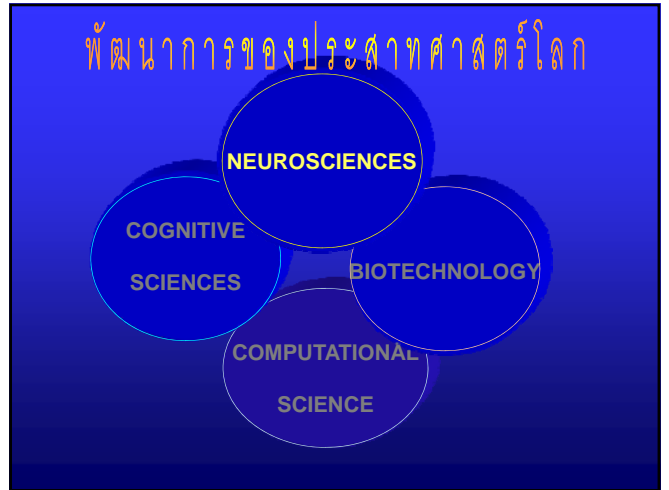
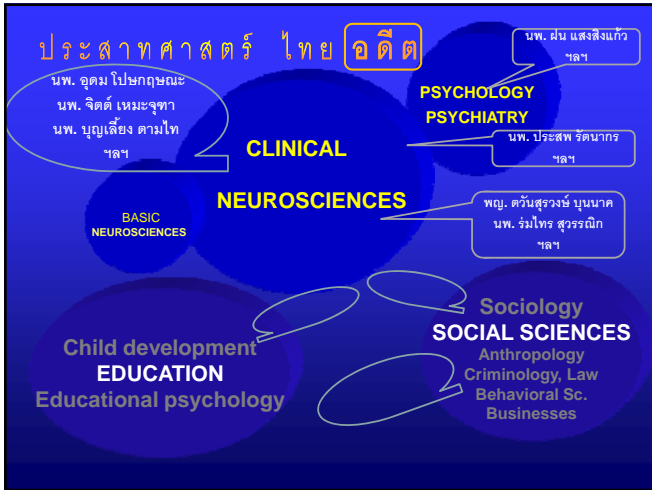
**SELF-STIMULATION EXPERIMENT**  
Amygdaloid Nucleus  
Unpleasant areas  
Pleasant areas  
Fear reaction

**Karl H. Pibram: Hierarchical studies 1953**  
Brain & Social behaviour

**PSYCHOSURGERY**  
Prefrontal lobotomy  
Walter Freeman & James Watt  
Egas Moniz 1936

**Surgery for Parkinsons' Dis.**  
Deep Brain Stimulation





## FUNCTIONAL BRAIN IMAGING

BROOKHAVEN LABORATORIES New York

Studies of brain functions,  
brain mapping and  
Molecular biochemical basis  
**ADDICTION  
BEHAVIOR**

Cyclotron & Positron Emission Tomography 1976

## Positron Emission Tomography **PET**

CYCLOTRON

F18 FDG  
C11  
N13  
O15

PET / CT SCANNER

PET RADIO-PHARMACEUTICALS

## Positron Emission Tomography ( PET )

NORMAL

**Alzheimer's Disease**  
\* Symmetric temporo-parietal hypoperfusion  
\* Decreased regional cerebral blood flow and glucose metabolic rate

**Multi-infarct Dementia**  
Asymmetrical hypoperfused areas  
\* Decreased perfusion and glucose metabolic rate

## SPECT

Single Photon Emission Computed Tomography

Cerebral Infarction

Measurement of CBF  
Tracer: Tc-99 HMPAO

## SPECT in EPILEPSY

Ictal

Interictal

Ictal

Interictal

Ictal

Interictal

## BOLD

Blood Oxygen Level Dependent

Finger tapping

Visual stimulation

### BOLD Blood Oxygen Level Dependent

seeing

hearing

speech

### 3D RECONSTRUCTION BOLD

VISION

MEMORY

### Motor Mapping

Foot movement—magenta, Finger—green, Hand—red

Jay Pillai, MD Johns Hopkins

Jay Pillai, MD Johns Hopkins

### Language Mapping

Jay Pillai, MD Johns Hopkins

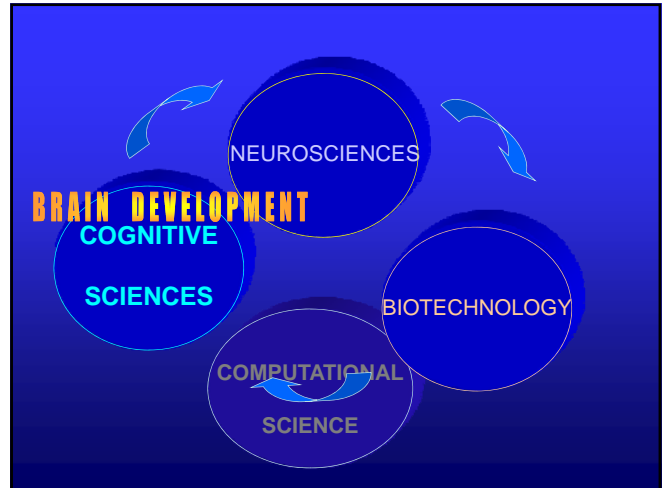
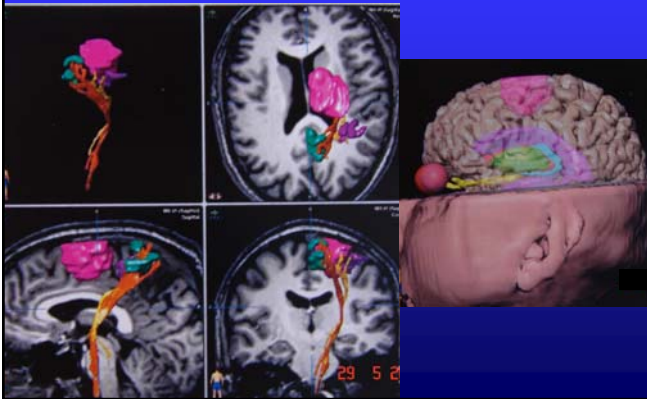
### Diffusion Tensor Imaging (DTI)

A, B, C, D, E, F, G, H, I, J

Brain as Art  
David M. Yousem, Johns Hopkins

Brain as Art  
David M. Yousem, Johns Hopkins

## Advanced Image Analysis



## BRAIN DEVELOPMENT LEARNING

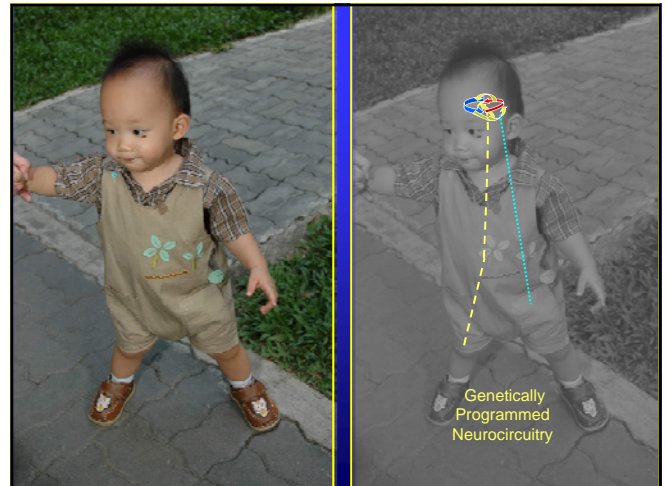
3 week fetus: gene-regulated cell metamorphosis.  
250,000 cells / min. at peak

AT BIRTH: 100,000,000,000 neurones.  
Stop multiplying at birth.  
Each neurone connects to 10 – 10,000 neurones,

AT 3 YEARS: 15,000 synapses per neurone.  
Twice as active as adults.

Synapse count highest at adolescence.

Effects of sensory deprivation  
Effects of environment, stimulation.



## Acquired Neural Circuitry



Central Pattern Generator (CPG)

## BRAIN DEVELOPMENT LEARNING

Ability to learn second language decreases from age of 7 years  
"CRITICAL PERIOD FOR LEARNING".

Japanese children have equal capacity to distinguish R and L  
after birth until 6 – 12 months. Connection then eliminated to L.  
"WINDOW OF OPPORTUNITY"

Music talent highest before age of 3 years.

DEVELOPMENT disturbed by  
Maternal malnutrition  
Drug abuse  
Viral infection  
Etc.

# BRAIN PLASTICITY

*"Cortical reorganization"* after intense training  
Motor system, cognitive system

Treatment of developmental disorders – autism, CP  
Rehabilitation after focal brain damage – stroke, injuries

Genes, Proteins, Hormones, Food, Life experiences

Brain enhancement

# BRAIN ENHANCEMENT

## IMPROVEMENT OF HUMAN PERFORMANCE

Enhanced skills & abilities in sensory, motor, cognition etc.

Mnemonic Entraining Technology, Mental gymnastics

EDUCATION: MEMORY, LANGUAGES, CALCULATION etc  
COMPLEX MOTOR PATTERNS (SPORTS)  
MOOD ENHANCEMENT  
GROWTH ENHANCEMENT

# COGNITIVE SCIENCES TECHNOLOGY

เทคโนโลยีกลไกทางปัญญา

Intelligence, Memory, Learning  
Sensory perception  
Motor pattern generation  
Emotion, Personality  
Aggression, Addiction  
Sleep, etc.

NEUR

Example:  
Savant Syndrome

COGNITIVE  
SCIENCES

BIOTECHNOLOGY

COMPUTATIONAL  
SCIENCE

ATTENTION  
INHIBITION  
COMPULSION  
AROUSAL  
DECISION MAKING  
RISK-TAKING

# COGNITIVE SCIENCES TECHNOLOGY

Intelligence, Memory, Learning

Mo  
E  
A

EXAMPLE:  
Anterior cingulate gyrus  
Subcallosal cortex  
Left postcentral gyrus

CIENCES

INHIBITION (no go) for  
addiction

BIOTECHNOLOGY

COMPUTATIONAL  
AROUSAL  
DECISION MAKING  
RISK-TAKING

# GENETIC TECHNOLOGIES

## GENOMIC TECHNOLOGIES

NEUROSCIENCES

Genomics  
Proteomics

COGNITIVE  
SCIENCES

BIOTECHNOLOGY

360 different genes -- activate by electrical impulses

Example: candidate plasticity genes (CPGs)

COMPUTATIONAL  
SCIENCE

Nedivi E (MIT) – glass window

## mRNA activities

fetus  
In utero

50 – 70 years

Genes for building brain cells

Apoptosis-Linked Genes (ALG)

Genes for linking up nerve cells

Candidate Plasticity Genes

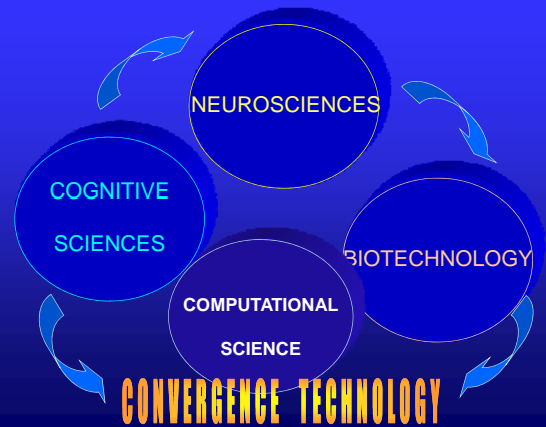
Alcohol abuse in pregnant women

### Apoptosis-Linked Genes

Anti-apoptosis gene products – Bcl-2, Bcl-x  
 Pro-apoptosis gene products -- Bax

### Disease-associated genes

Schizophrenic gene  
 Autism gene  
 Attention deficit hyperactive disorder (ADHD)



## 3D - GIS of the Brain



- Structures
- + Connectivity
- + Neurochemistry
- + Metabolic
- + Electromagnetic
- + Genetic

### DIAGNOSTIC & THERAPEUTIC TOOLS

#### SOCIAL APPLICATIONS

Brain Finger Printing  
 Lie-detectors, Personality Assessment Predicting other's thinking

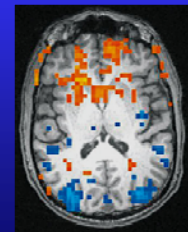
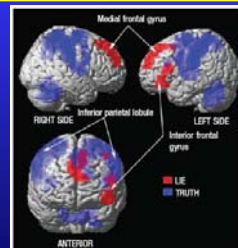
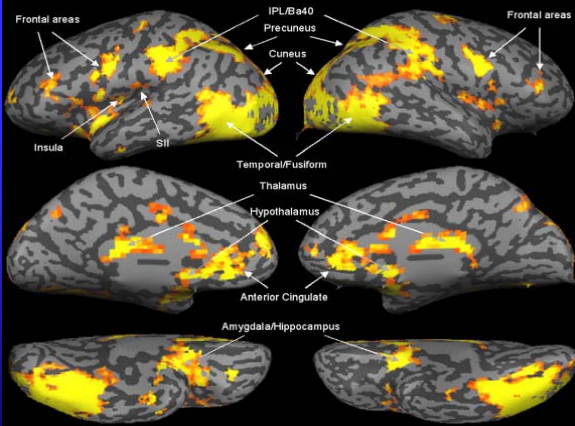


Image showing average brain activation for 22 individuals during modified Galin Knowledge Test. Red areas represent brain regions more active during lie condition and blue areas represent brain regions more active during truth condition. (Provided by K. Rippl and D. Langshlem, University of Pennsylvania)



Dynamics of male sexual arousal: distinct components of brain activation revealed by fMRI  
 Ferretti, A et al. NeuroImage Volume 26, Issue 4 2005 1096 - 1096

### GRAND CHALLENGES IN NEUROSCIENCE:

#### 1. THE SUSTAINABLE BRAIN

1.1 NEURODEGENERATIVE DISORDERS  
 BRAIN REPAIR (Commonalities across disorders)

#### 2. COMPLETE ANATOMICAL CONNECTIVITY MAP OF THE BRAIN

A Blue Sky Vision for the Future of Neuroscience  
 (NINDS Workshop of invited expert panel 2007)

[www.ninds.nih.gov/about\\_ninds/plans/strategic\\_plan/blue\\_sky\\_vision.htm](http://www.ninds.nih.gov/about_ninds/plans/strategic_plan/blue_sky_vision.htm)  
 Updated May 5, 2009

## A Blue Sky Vision for the Future of Neuroscience

(NINDS and NIH Workshop 2006)

- **Access** through telemedicine, artificial intelligence-guided diagnostic alerts
- Develop new **therapeutic strategies**
- Develop **neuroprosthetic devices**
- **Endovascular devices** to restore blood flow to the brain

[www.ninds.nih.gov/about\\_ninds/plans/strategic\\_plan/blue\\_sky\\_vision.htm](http://www.ninds.nih.gov/about_ninds/plans/strategic_plan/blue_sky_vision.htm)  
Updated May 5, 2009

## A Blue Sky Vision for the Future of Neuroscience

(NINDS and NIH Workshop 2006) Cont'd

- **Neurosurgery with minimal collateral damage** (e.g., robotics, remote targeting, nanoscale deep brain stimulation)
- Techniques or vehicles to **deliver therapeutics** into the brain and target particular cells or regions
- **Gene therapy** strategy
- Accelerate the process of therapy development
- Synergistic effects of combination therapies
- **Clinical trials become a routine option for patients**

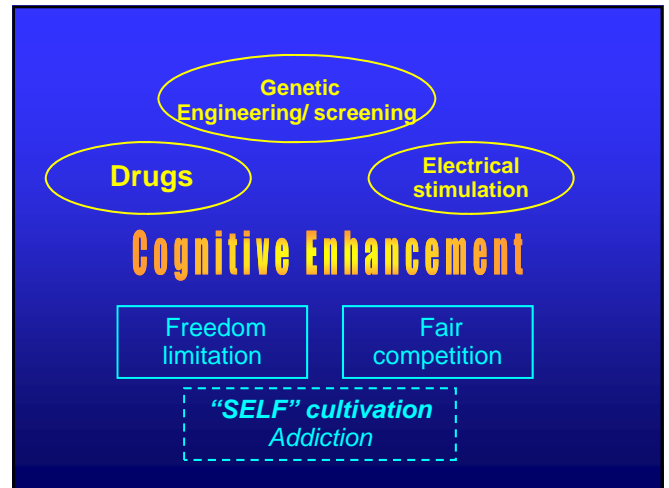
[www.ninds.nih.gov/about\\_ninds/plans/strategic\\_plan/blue\\_sky\\_vision.htm](http://www.ninds.nih.gov/about_ninds/plans/strategic_plan/blue_sky_vision.htm)  
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## A Blue Sky Vision for the Future of Neuroscience

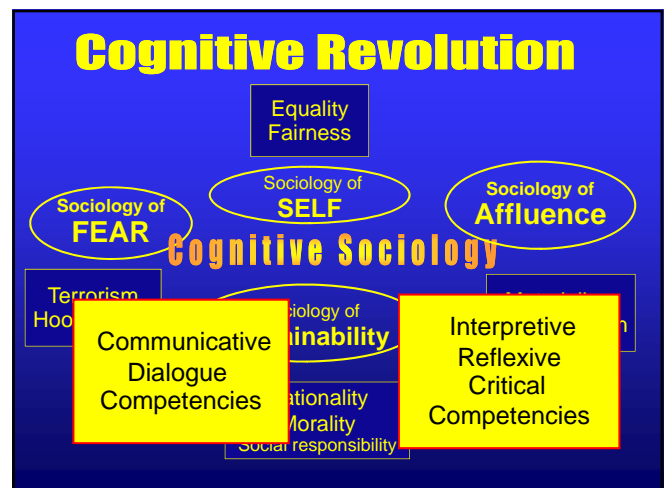
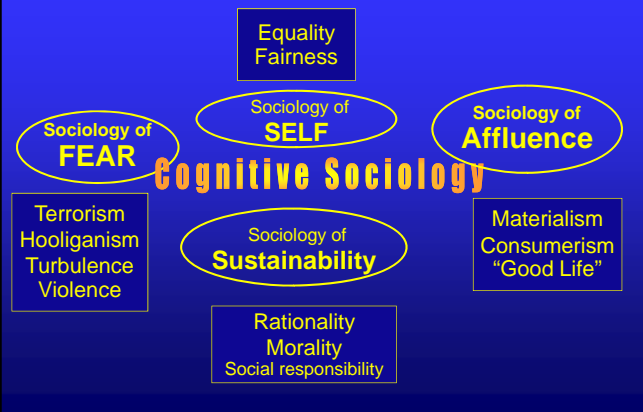
(NINDS and NIH Workshop 2006) Cont'd

- Enable early and routine **diagnosis** of neurological conditions
- **Risk** for neurological disorders based on genomic markers, gene expression
- Diagnostic technologies to detect at **early stages** when intervention is most promising
- Surrogate **markers** for disease progression and responsiveness to therapies

[www.ninds.nih.gov/about\\_ninds/plans/strategic\\_plan/blue\\_sky\\_vision.htm](http://www.ninds.nih.gov/about_ninds/plans/strategic_plan/blue_sky_vision.htm)  
Updated May 5, 2009



## Cognitive Revolution





ประสาทศาสตร์ ไทยอนาคต  
ยุทธศาสตร์งานวิจัย

บทบาทการวิจัยในประเทศกำลังพัฒนา

การวิจัยเพื่อ  
การแข่งขันของชาติ

ESSENTIAL NATIONAL RESEARCH  
การวิจัยที่จำเป็น  
ในการแก้ปัญหา  
ของชาติ

การวิจัย  
เป็นเครื่องมือ  
ในการศึกษา

การวิจัยเพื่อ  
การพัฒนาประเทศ

การวิจัย  
เป็นเครื่องมือ  
ในการสร้างพลัง

Essential National Research

วิจัยที่จำเป็นในการแก้ปัญหา และการพัฒนา

Knowledge & Technology Transfer  
Technology Assessment

System Research  
วิจัยสภาพเฉพาะตน  
ความเป็นไทย สมรรถนะไทย  
สภาพในพื้นที่เฉพาะ

Orphan Problems  
ปัญหา และ  
โรคเฉพาะถิ่น

Operational Research  
วิจัยการปฏิบัติ  
วิจัยประเมินผล

วิจัยเพื่อการแข่งขันของชาติ

STRATEGIC RESEARCH

ESOPVS's Tortoise & Hare

Me-too

Prof. Lee Yoon Wu's  
CONTEMPORARY VERSION

MANIPULATION of the MIND  
MIND ENHANCEMENT

ทุกขกริยา  
สมาธิ

4th Congress of  
ACADEMIA EURASIANA NEUROCHIRURGICA  
Bangkok, 1986

Theme: CONSCIOUSNESS

Session on Meditation

A 12 Expert Meditators ( $\alpha < 0.05$ )

B 12 Age-Matched Novices ( $\alpha < 0.05$ )

Rest Meditation

Rest Meditation

Emergers Novices

Richard J Davidson  
William James and Vilas Professor of Psychology and Psychiatry  
Director, [Walshman Laboratory for Brain Imaging and Research](#)  
Director, [Laboratory for Affective Neuroscience](#)  
Founder & Chair, [Center for Investigating Healthy Minds at the University of Wisconsin-Madison](#)

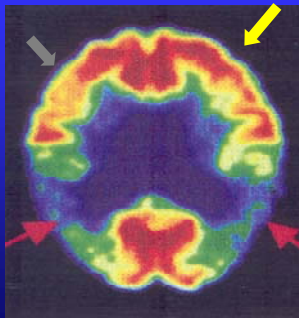
MEDITATION

Dalai Lama

Richard Davidson  
Time 100 Most-influential Men 2006

Studies of brain in Tibetan meditation  
EEG., fMRI, MR SPECT, PET

# MEDITATION

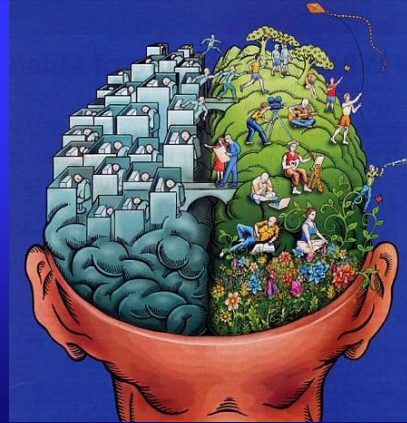


Left prefrontal cortex  
light up

Posterior parietal cortex  
quiet down

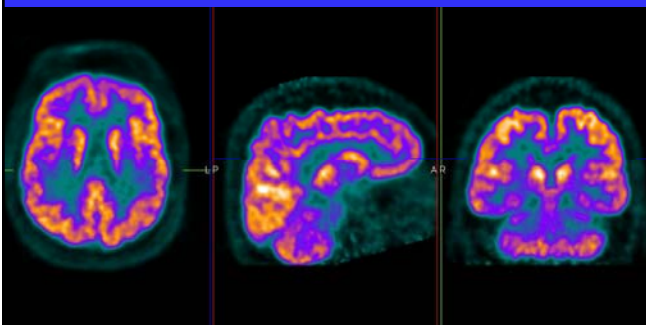
Amygdala  
quiet down

Andrew Newberg at University of Pennsylvania



<http://www.mademan.com/five-surprising-myths-about-the-brain/2>

# Positron Emission Tomography



Charas Suwanwela



Brain boosters  
Brain enhancers  
Brain-based learning  
Deep profound learning  
Superbrain  
etc.

*Brain & Behaviour Manipulated Society*

# HUMAN IN THE FUTURE NEUROMYTHS