



2009 ASA Annual Meeting

# The neuroscience of spirituality

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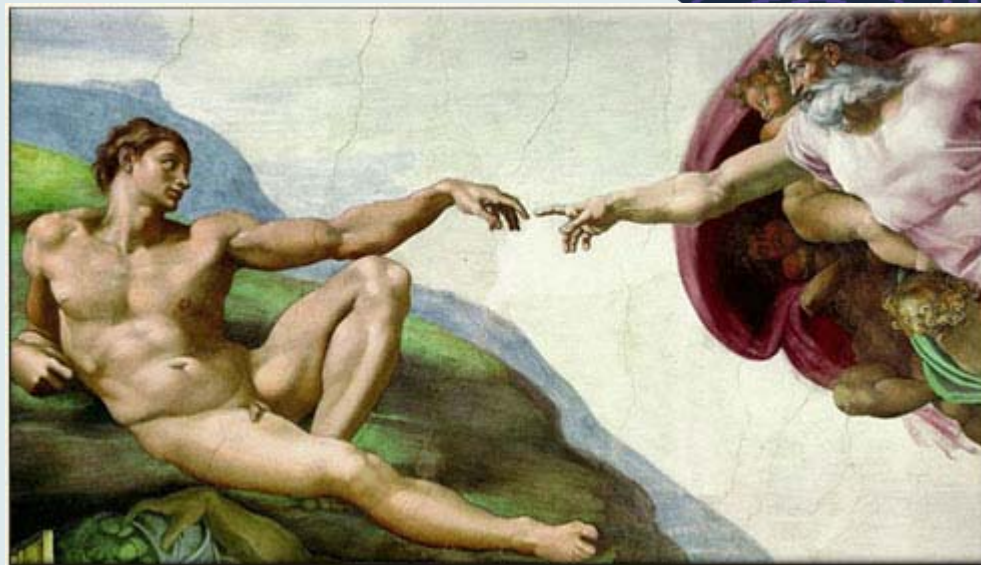
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Neuroscience Research Center  
University of Montreal

August 1, 2009

# Outline of the presentation

- I. The neuroscience of spirituality
- II. Metaphysical assumptions of mainstream neuroscience
- III. The "God spot" in the temporal lobes
- IV. Neural correlates of a mystical experience in Carmelite nuns
- V. Non-local mind
- VI. Conclusions

# I. The neuroscience of spirituality



# The neuroscience of spirituality

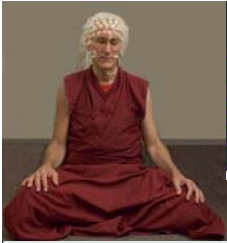
- Relatively new field of research at the crossroads of psychology, religion, and neurosciences
- Goal: to explore the neural correlates of religious/spiritual/mystical experiences (RSMEs)
- These experiences relate to a fundamental dimension of human existence and are frequently reported across all cultures
- RSMEs often lead to spiritual transformation
- Basic assumption: these experiences are mediated by the brain as is all other experiences (perception, emotion, memories, etc.)

To be mediated ≠ created by



# The neuroscience of spirituality

- Elucidating the neural correlates of RSMEs does not diminish or depreciate their meaning and value
- The external reality of God cannot be proved or disproved with the identification of the neural correlates of RSMEs



# A growing field

\* Work with Buddhist contemplatives

UC Davis



Cliff Saron



Alan Wallace

U Wisconsin, Madison

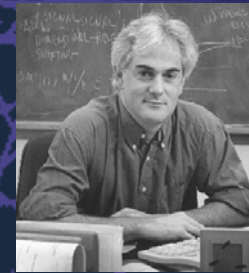


Richard  
Davidson



Antoine  
Lutz

Princeton



Jon Cohen



Brent  
Field

UCSF



Paul Ekman

U Pennsylvania



Andrew Newberg

Harvard

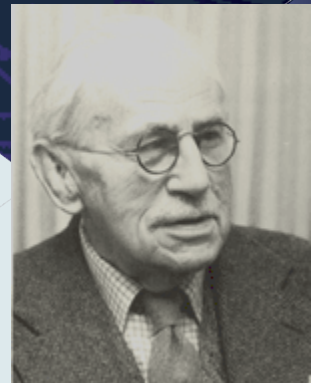


Stephen Kosslyn

# The Spiritual Nature of Man

(Alistair Hardy, 1979)

- Religious Experience Research Unit (RERU), Manchester College in Oxford
- Hardy collected data on RSMEs for a few decades
- He received over 4000 firsthand accounts of RSMEs from people of all socioeconomic levels (across UK)
- Hardy and his colleagues identified a variety of "triggers" for RSMEs
- Most common triggers:
  - › Depression or despair
  - › Prayer or meditation
  - › Natural beauty

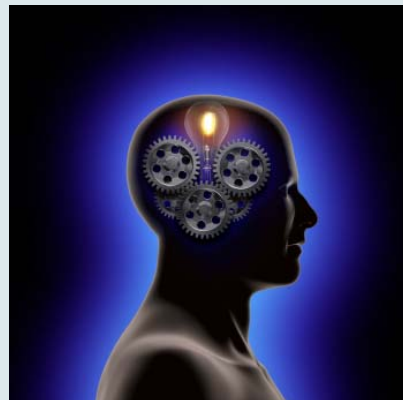


# Consequences of RSMEs

- Transcendence of the personal identity
- Enhanced sense of connection to and unity with others and the world
- Sense of purpose
- New meaning to life
- People reporting RSMEs score lower on psychopathology measures and higher on psychological well-being scales than people not reporting such experiences
- They are far less likely to engage in antisocial behavior
- They have lower rates of crime, excessive alcohol use, and drug addiction than other groups



## II. Metaphysical assumptions of mainstream neuroscience



# Metaphysical assumptions of mainstream neuroscience

## Determinism

- ◎ The future states of isolated systems can be predicted precisely from current states
- ◎ It is possible to predict human behavior by studying electrical and chemical processes in the brain

# Metaphysical assumptions of mainstream neuroscience

## Reductionism

- › Complex systems can be explained as the sum of their parts
- › Upward causation: causation only flows upward, from the simpler to the more complex
- › Mind emerges from brain, a highly complex system, and is controlled by neuroelectrical and neurochemical processes

# Metaphysical assumptions of mainstream neuroscience

## Materialism

- › Everything in the universe can ultimately be explained by in terms of fundamental particles and forces of physics
- › The brain is made up entirely of material elements
- › Higher mental functions (mind), consciousness, self and free will are produced by neuroelectric and neurochemical processes (neuronal man, synaptic self)



# Metaphysical assumptions of mainstream neuroscience

## Naturalism

- ⊙ All phenomena can be explained in terms of natural causes and laws
- ⊙ RSMEs are by-products of brain activity

# Francis Crick

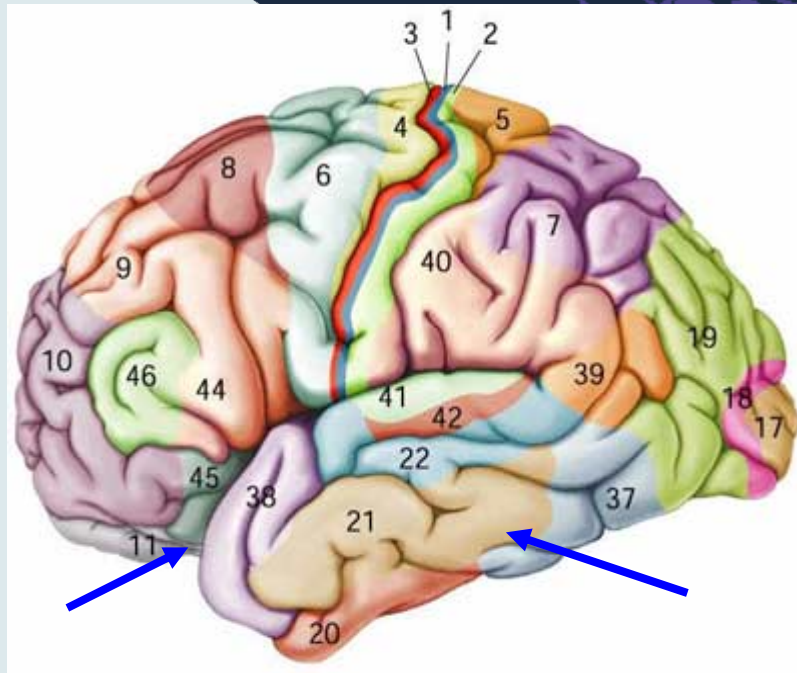


- ◎ "You," your joys and your sorrows, your memories and your ambitions, your sense of personal identity and free will, are in fact no more than the behavior of a vast assembly of nerve cells and their associated molecules.

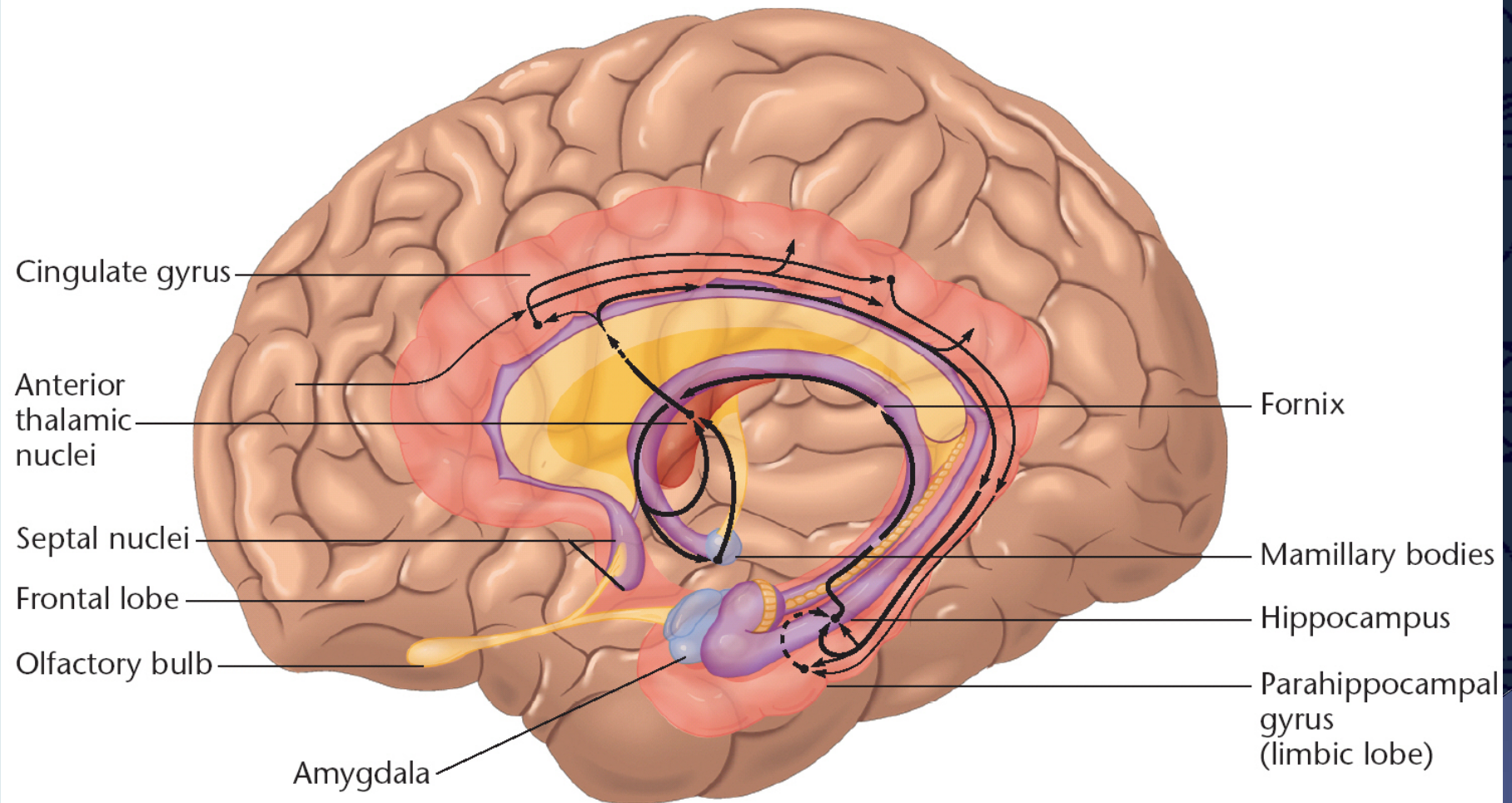
*The Astonishing Hypothesis*

- ◎ The belief in the existence of God might be due to mutant molecules called "theotoxins"

### III. The "God spot" in the temporal lobes



# The limbic system





# The "God spot" in the temporal lobes

- Hypotheses:
  - › Brain disorders trigger a sort of God spot (or module) in the temporal lobes
  - › Many great religious figures of the past may have displayed symptoms of temporal lobe epilepsy (TLE) (e.g., Paul the Apostle, Joan of Arc, Teresa of Avila, and Thérèse of Lisieux)
- Neurologist John R. Hughes has conducted detailed studies of these religious figures, based on the available evidence of symptoms
- Hughes concluded that there is no evidence that Paul the Apostle, Joan of Arc, Teresa of Avila, and Thérèse of Lisieux suffered from TLE
- Most people who have RSMEs are not epileptics
- Very few epileptics report RSMEs during seizures



# Vilayanur Ramachandran

- Two patients with TLE and a group of highly religious volunteers (1997)
- Lists of words: sexual, violent, religious or neutral
- Electrodermal response (EDR): sweat gland activity (a gauge for emotional arousal)
- Greater arousal in TLE patients in response to religious words
- Conclusion: There is a "God spot" in the temporal lobes which could underpin an evolutionary instinct to believe in religion

# Problems with Ramachandran's study

- No measure of brain activity while the two groups of subjects were exposed to the various categories of words: was the temporal lobe activated while the epileptic patients were seeing the religious words?
- Passive viewing of words did not induce deep mystical states in the subjects with TLE
- Sample size

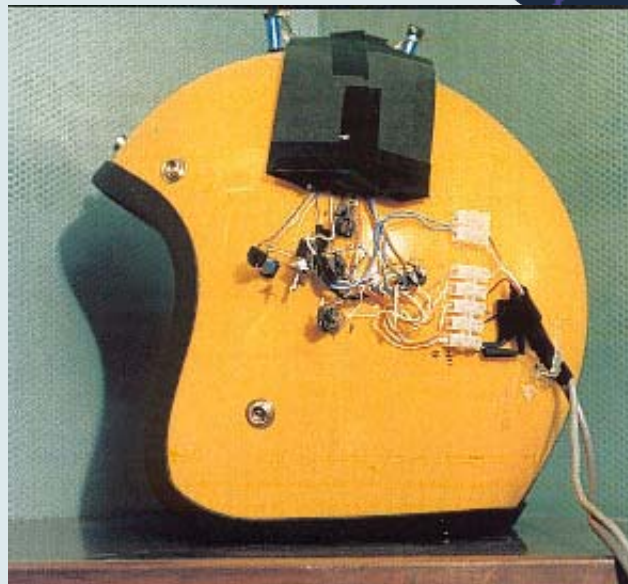


# Michael Persinger

- Religion is "a cognitive virus"
- Religious belief is an artifact of the brain
- 'Microseizures' in the temporal lobes can generate RSMEs, i.e., these experiences are delusions created by the brain
- It is possible to induce such experiences by electromagnetically stimulating the temporal lobes



# The God helmet



# Problems with Persinger's approach

- ⊙ Subjects tested for suggestibility (often students)
- ⊙ No double-blind protocol used
- ⊙ No neuroimaging measure to verify whether temporal lobe activity is modulated by the electromagnetic stimulation
- ⊙ Very few RSMEs reported

# Problems with Persinger's approach

- ⊙ Replication study by Granqvist et al. (2004)
- ⊙ Double-blind protocol
- ⊙ No effect when the temporal lobes of the subjects were stimulated
- ⊙ The question of whether the temporal lobes are involved in RSMEs is still open

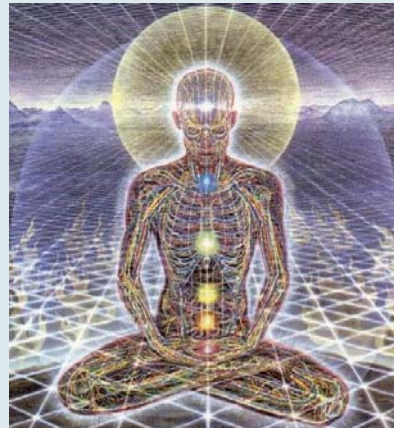
# IV. Neural correlates of a mystical experience in Carmelite nuns





# Mysticism (Stace, 1960)

- ◎ A mystical experience includes certainty of contact with a higher truth or a greater power underlying the universe



# Mysticism

- Mystical experiences are interpreted in a context
- Christian tradition: the Absolute is typically experienced as a Transcendent Personality, full of love and compassion, with whom one's personality becomes temporarily merged
- Buddhist tradition: the Absolute is considered impersonal
- Perennial philosophy: the view that mystics of all traditions perceive the divine ground of the universe that underlies mind and consciousness, but may interpret it differently

# The Mystical state

(Stace, 1960)

- Sense of union with God
- Sense of having touched the ultimate ground of reality
- Sense of the incommunicability of the experience
- Sense of union with humankind and the universe
- Experience of timelessness and spacelessness
- Feelings of positive affect, peace, joy and unconditional love

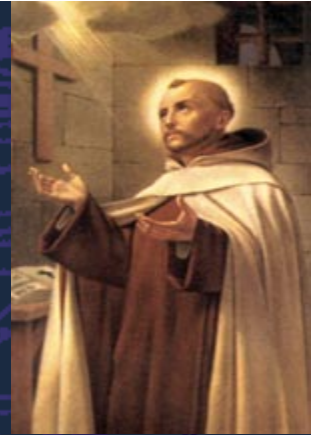
# Goal of the research project

- To identify the neural correlates of a mystical experience
- Two functional neuroimaging techniques:
  - › Functional magnetic resonance imaging (fMRI)
  - › Quantitative electroencephalography (QEEG)
- Brain activity was measured in a group of Carmelite nuns during a mystical state (sense of union with God)
- Mysticism Scale (Hood, 1975)





# The Carmelite order



- ◎ Roman Catholic order oriented toward mysticism by St. Theresa of Ávila and St. John of the Cross (16<sup>th</sup> century)
- ◎ Life of silent prayer (intimate encounter with God): permitted to talk to each other only during two 20-minute recreation periods (after lunch and after dinner)

# Participants

- Sample size: 15
- Mean age: 50 (Range: 23 - 64)
- No history of psychiatric or neurological disorder
- Mean duration of association with the Carmelite order: 19 years
- Total number of hours in prayer and contemplation: approximately 210,000

# FMRI experiment

## ◎ Goal

- › To identify the brain regions and circuits involved in the mystical state



# FMRI experiment – Results

## ◎ **Mysticism Scale**

- › I have had an experience in which something greater than my self seemed to absorb me
- › I have experienced profound joy
- › I have had an experience which I knew to be sacred

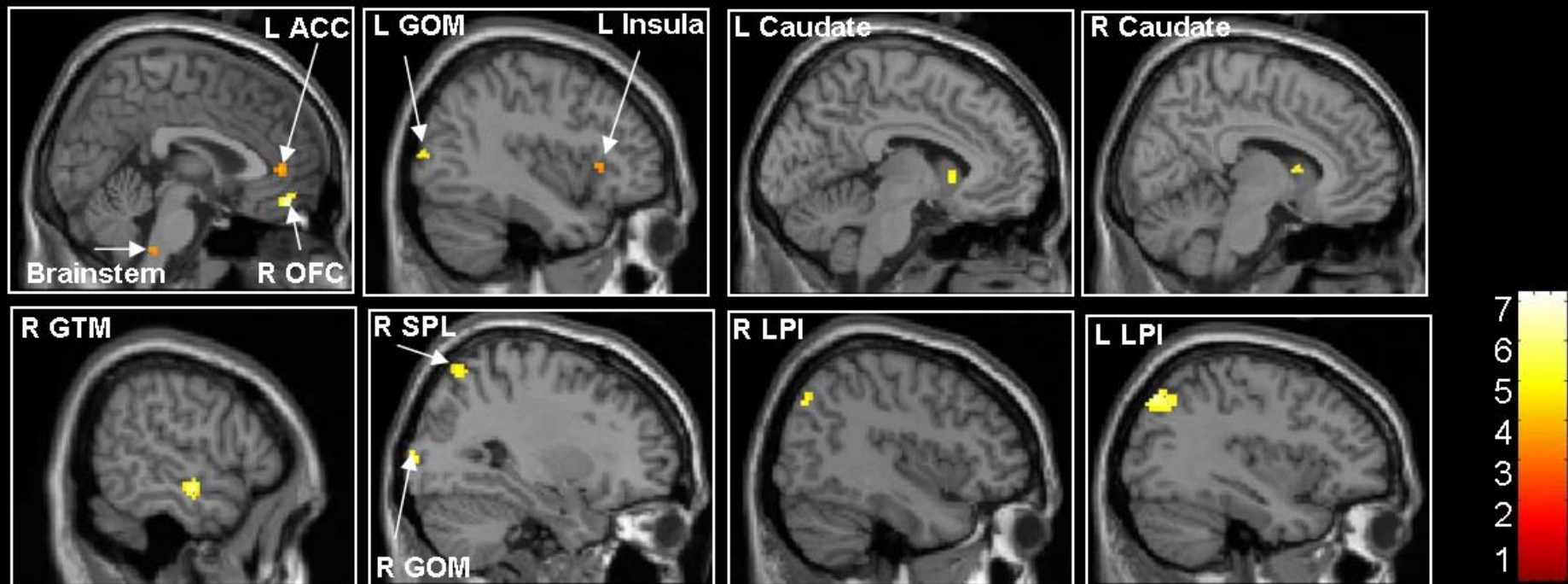


# FMRI experiment – Results

## ◎ Qualitative interviews

- › Several subjects mentioned that during the Mystical state they felt the presence of God, His unconditional and infinite love, as well as plenitude and peace

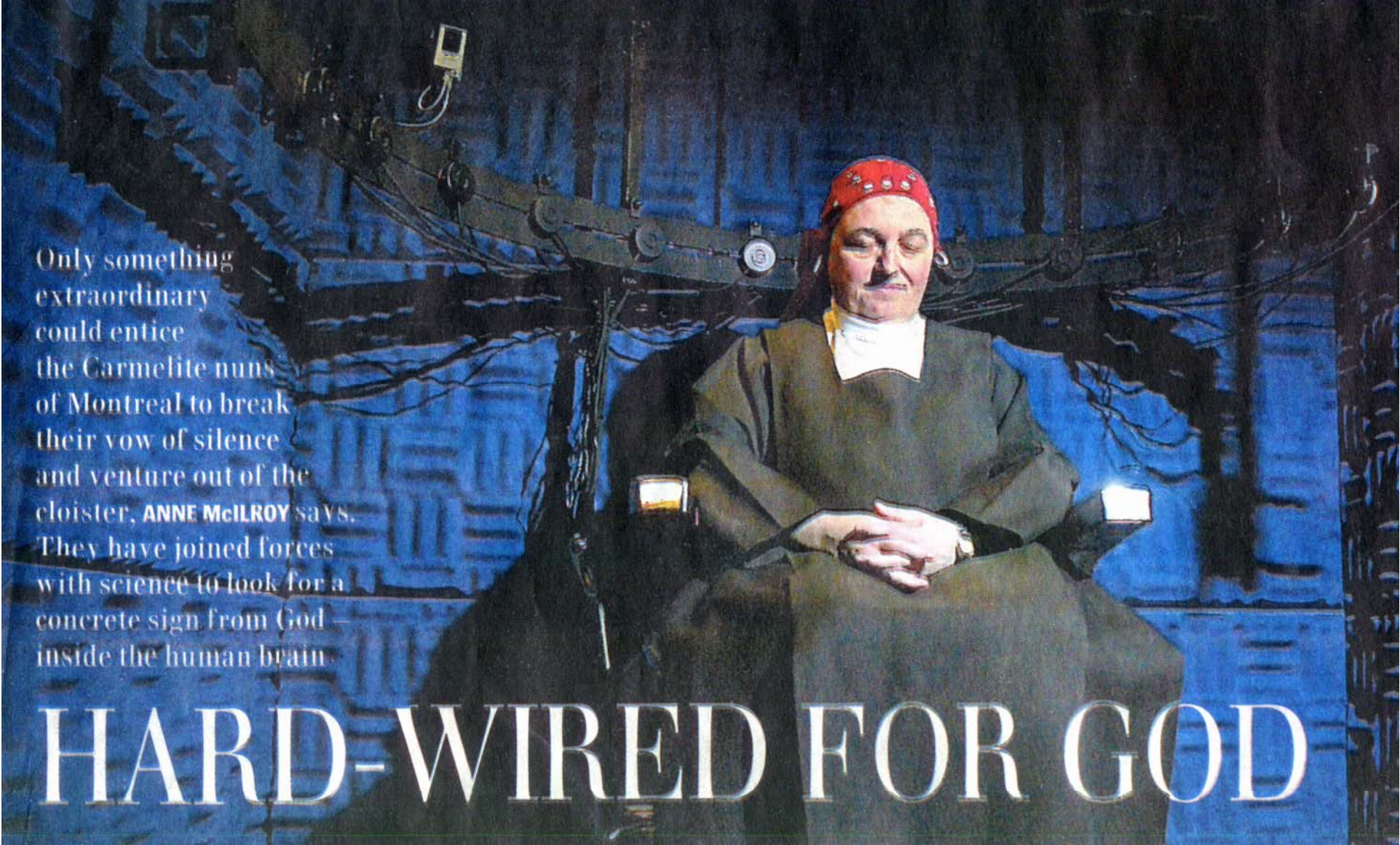
## Mystical > Baseline



Beauregard et al. (2006) Neurosci Letters



# EEG experiment



Only something extraordinary could entice the Carmelite nuns of Montreal to break their vow of silence and venture out of the cloister, **ANNE McILROY** says. They have joined forces with science to look for a concrete sign from God — inside the human brain.

## HARD-WIRED FOR GOD

# EEG experiment – Results

## ◎ **Mysticism Scale**

- › I have had an experience in which something greater than my self seemed to absorb me
- › I have experienced profound joy
- › I have had an experience which I knew to be sacred
- › I have had an experience which cannot be expressed with words
- › I have had an experience in which I felt that everything in this world is part of the same whole
- › I have had an experience which is impossible to communicate

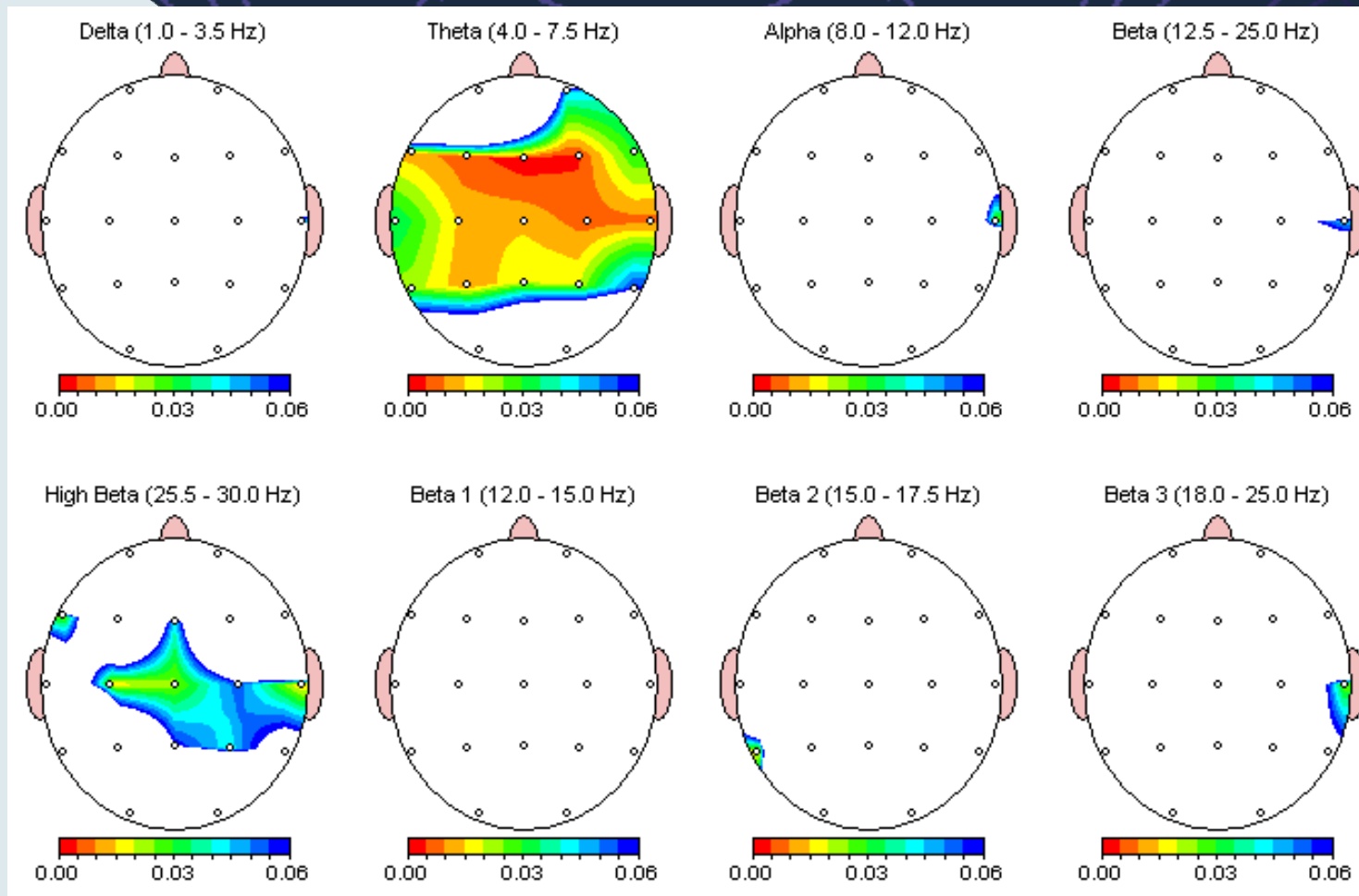


# EEG experiment – Results

## ◎ Qualitative interviews

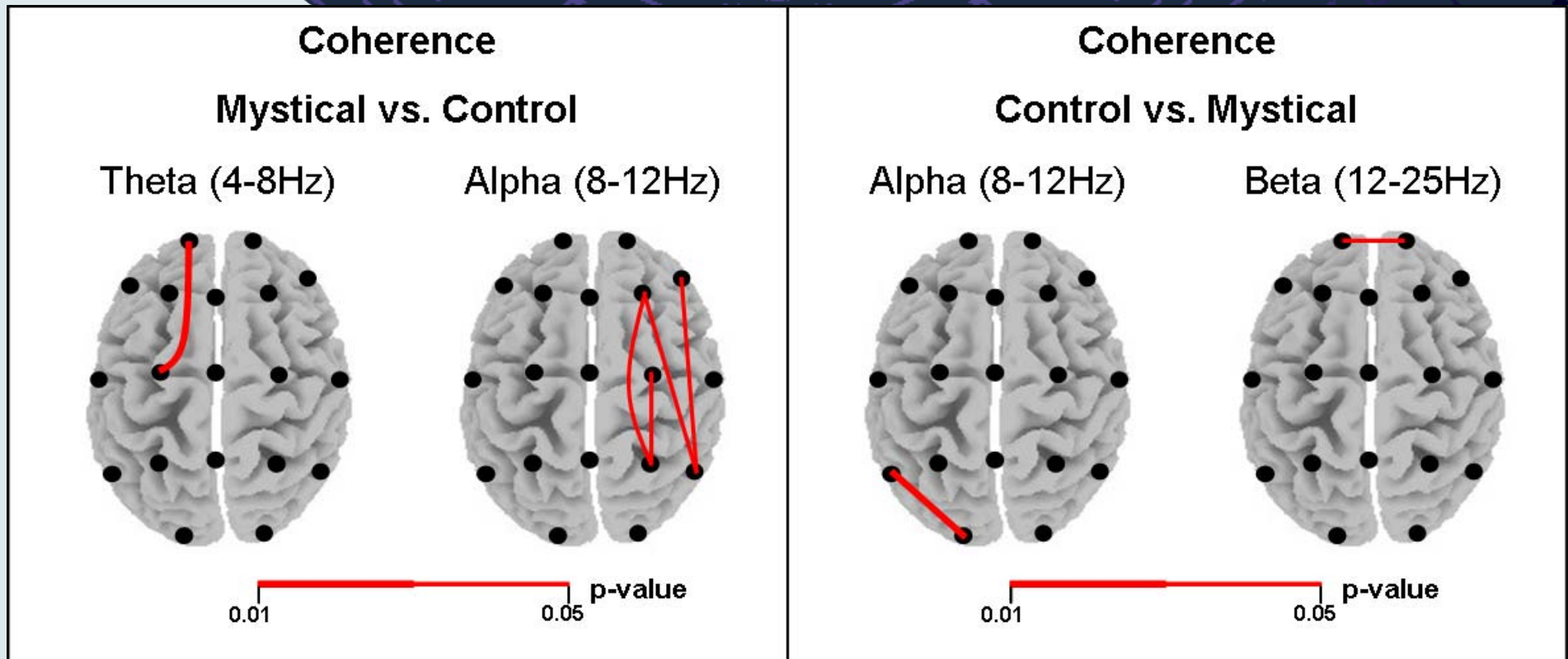
- › Presence of God, His unconditional and infinite love, plenitude and peace
- › Surrendering to God

# EEG experiment Mystical vs. Control



- Greater theta power at F3, C3, P3, Fz, Cz and Pz
- Greater gamma1 power at T4 and P4

# EEG experiment – Results



- FP1-C3 pair of electrodes: greater coherence for theta band
- F4-P4, F4-T6, F8-T6 and C4-P4 pairs of electrodes: greater coherence for alpha band

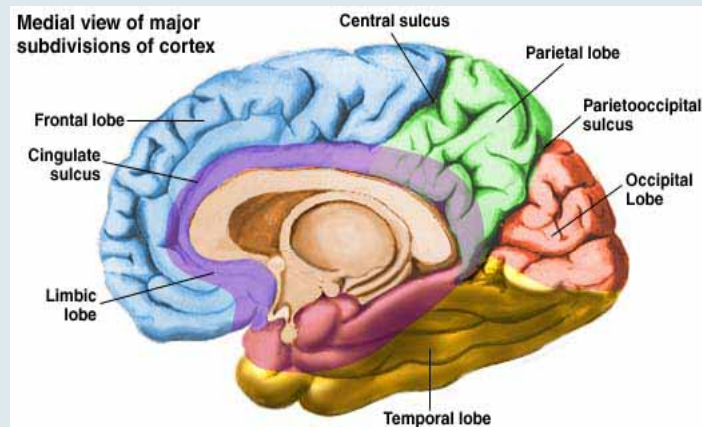
Beauregard and Paquette (2008) Neurosci Letters

# Conclusions – fMRI experiment

- The results do not support the hypothesis that the neural circuitry mediating RSMEs is localized solely in the temporal lobe
- Mystical states are complex and multidimensional, i.e., they involve changes in perception, cognition, and emotion
- Several brain regions appear to mediate the various aspects of mystical states (at least, in a Christian perspective)

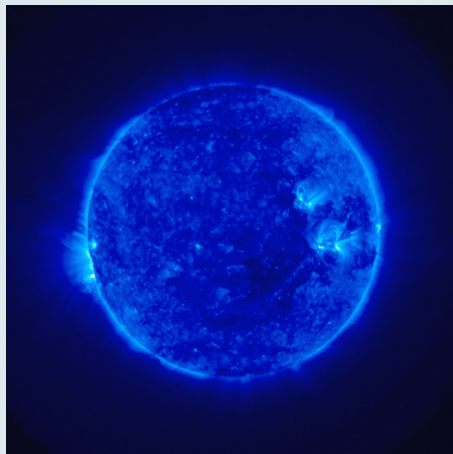
# Conclusions – EEG experiment

- The presence of theta activity in the Mystical state is consistent with previous EEG studies showing increased medial frontal theta power during Zen meditation, and increased theta power in anterior frontal and medial frontal cortex during a blissful state in meditation





# V. Non-local mind

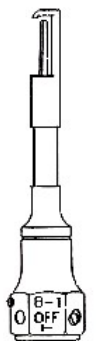




# The case of Pam Reynolds



- 1991: hypothermic cardiac arrest to remove a giant basilar artery aneurysm in her brain (Barrow Neurological Institute, Phoenix AZ - Dr. Robert Spetzler)
- "Standstill " : body temperature lowered to 58°, heartbeat and breathing stopped, brain waves flattened, blood drained from the head
- Duration of clinical death: one hour
- Out-of-body experience: description of the surgical tools and procedures associated with the surgery/dialogues between surgeons and nurses
- Pam's consciousness floated out of the operating room and traveled down a tunnel/Deceased relatives and friends at the end of this tunnel
- Presence of a brilliant, wonderfully warm and loving Light
- Pam realized that her soul was part of God, and that everything in existence was created from the Light, the essence of God





# The case of Pam Reynolds



- ◎ This case and other similar cases suggest that:
  - › Mind and consciousness can continue when the brain does not function anymore
  - › RSMEs can happen when the brain is apparently not functioning

# Conscious mental processes during hypothermic cardiac standstill

- ◎ Goal: to test the possibility of veridical perception during hypothermic cardiac standstill (clinical death)
- ◎ Emotionally laden pictures presented on a video monitor (7 feet above the ground)







# Entangled minds



- ◎ **Psi:** a stable, *low-level* effect, typically a little too high to be chance
- ◎ **Telepathy:** a meta-analysis of 2,550 ganzfeld (sensory deprivation) telepathy studies: odds against chance of a million billion to one!
- ◎ **RNG:** In a typical experiment, random spikes of electronic noise occurring several thousand times per second / The clock's state when interrupted will produce either 1 or 0 / The experimental subject is asked to influence the RNG's output by "wishing" for 1's or 0's
- ◎ **Micropsychokinesis:** a meta-analysis looking at 832 RNG studies: odds against chance beyond a trillion to one!



# Entangled minds



- ◎ **Grinberg-Zylberbaum**
- ◎ Pairs of subjects in the same room attempting to reach union during a meditative state
- ◎ After 20 minutes, one of the subjects is sent to another room
- ◎ The other subject is exposed to photic stimuli
- ◎ EEG activity is measured in the two subjects at the same time
- ◎ Simultaneous identical responses to the visual stimuli are recorded for 25% of the trials in the subjects not exposed to the stimuli (EEG potential transfer)

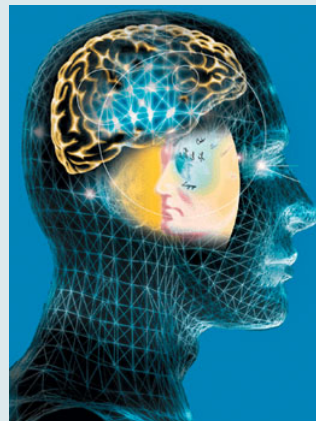
# Mental influence on living systems (Bio-PK)

- ◎ William Braud and Marilyn Schlitz (Mind Science Foundation)
- ◎ Targets:
  - › In humans: electrodermal response (in vivo), hemolysis (breakage of the red blood cell's membrane in vitro), enzymes (in vitro)
  - › Plants: growth rate
  - › Microorganisms : bacterias, protozoans

# Entangled minds



- ◎ Psi phenomena suggest that the mind is less tightly bound in space than has been supposed, and that its effects are not limited within the confines of the brain and the body
- ◎ Mind and matter are not radically separated (contra Descartes)



# VI. Conclusions



# The brain mediates but does not produce RSMEs

- ◎ The psychological realm (Psyche) cannot be reduced to the physical realm (Physis)
- ◎ Psyche and Physis are two manifestations of the same underlying principle
- ◎ Our brains do not produce mind and consciousness but rather act as "reducing valves", allowing us the experience of only a narrow portion of perceivable reality  
Henri Bergson, William James, Aldous Huxley
- ◎ The brain normally limits our experience of the spiritual world
- ◎ Alterations of the mind/brain coupling (prayer, meditation, clinical death)



# A non-materialist view of mind and RSMEs

- Several of the metaphysical assumptions of classical science are not valid
- Humans are not biological robots totally controlled by their brains
- Mind and consciousness are fundamental and irreducible/  
They can operate exosomatically (outside the body)
- There is a basic unity and interconnectedness between everything in the universe (including both Physis and Psyche)

Thank you for your attention!

