Future of Neurology & EEG Basics

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1

Neural Enhancement

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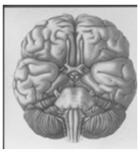
Fronto-Temporal Dementia

- **Temporal Lobe Variant :**
- **Anterior temporal lobe atrophy + orbitofrontal lobe atrophy.**
- **"Paradoxical facilitated function"**



Miller et al. Neurology, 1996.

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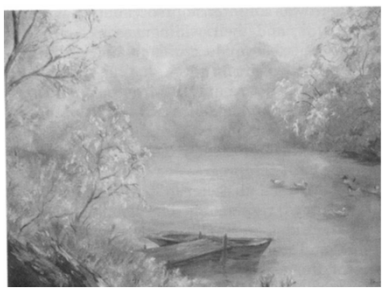

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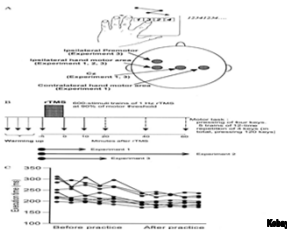
TMS Ipsilateral Motor Cortex – "↑ finger tapping"



Kobayashi et al, Neurology, 2004.

6

Paradoxical Functional Facilitation

- **Focal brain damage – facilitation of brain function**
- **"Sprague effect"** – recovery from cortical blindness by transecting the commissure of the superior colliculus.

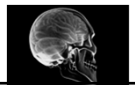
7

SAVANT Syndrome

8

Savant – 'Theories'

- Can we bypass the mind's conceptual thinking and gain conscious access to the raw, uninterpreted information of our basic perceptions? Can we shed the assumptions built into our visual processing system?
- All savant skills, whether in music, calculation, math, or spatial relationships, derive from a lightning-fast processor in the brain that divides things—time, space, or an object—into equal parts.
- Brain Development



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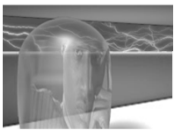
'Accidental Genius'



Orlando

10

'Accidental Savant'

- Orlando Serrell was hit on the head by a baseball at the age of 10. A few months later, he began recalling an endless barrage of license-plate numbers, calendar savant and weather reports.
- If someone can become an instant savant, Snyder thought, doesn't that suggest we all have the potential locked away in our brains.

11

Creative Urge – "Change of Mind"

nature

12

Art & Subarachnoid Hemorrhage

The artist's first drawings are suggestive of a left hemispatial neglect and would often exclude one half of the subject.

Poems, verbal IQ is normal and a new obsession with art.

Lythgoe, M. F.X. et al. Neurology 2005;64:397-398

13

'Induced Savant'

- Using transcranial magnetic stimulation on 17 volunteers, they inhibited neural activity in the frontotemporal area. This language and concept-supporting brain region is affected in patients with frontotemporal dementia and in the art savant whom Miller studied.
- In this altered state, 5 of 17 volunteers performed savant like tasks—horse drawing, calendar calculating, and multiplying.

Young et al. Neurocase.;10(3):215-22

14

TMS & the Brain !!

"Unraveling the Genius within."

15

Artificial Intelligence

- The theory and development of computer systems able to perform tasks that normally require human intelligence .

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AI -Medicine

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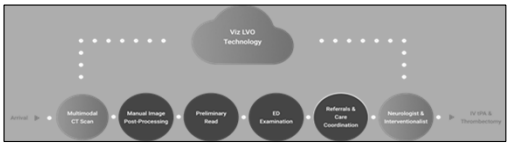
17

AI Nurse

- Sensely's "Molly" is an AI-powered nurse avatar being used by UCSF to interact with patients, ask them questions about their health, assess their symptoms, and direct them to the most effective care setting.

18

AI in Stroke Care –VIZ.ai/RAPID



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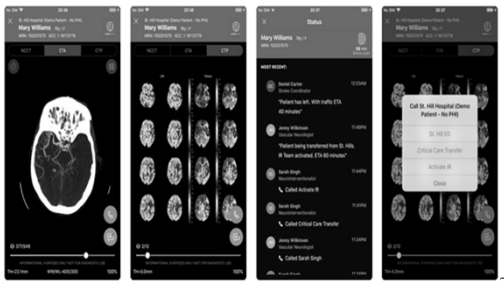

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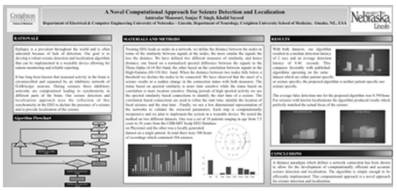
Artificial Intelligence in EEG &Epilepsy



Mansouri, A.; Singh, S.P.; Sayood, K. Online EEG Seizure Detection and Localization. *Algorithms* **2019**, *12*, 176.

A. Mansouri, S. Singh and K. Sayood, "Hierarchal online temporal and spatial EEG seizure detection," **2017** *IEEE International Conference on Electro Information Technology (EIT)*, Lincoln, NE, 2017, pp. 416-421

21

Microtesla MRI

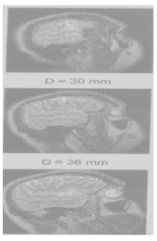
- **46μT microtesla MRI.**
- **Pre-polarized MRI**
- **SQUIDS**
- **MRI & MEG together!!!!!!!!!**
- Prepolarization of the nuclear spins and detection with a superconducting quantum interference device (SQUID) yield a signal that is independent of $B0$, allowing acquisition of high-resolution MRIs in microtesla fields.

Zotev et al. J. Magn. Reson. - 2008

McDermott R. et.al. PNAS 2004;101:7857-7861

22

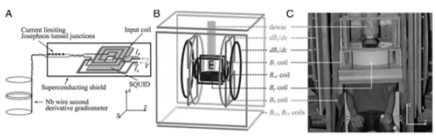
Microtesla MRI



Zotev et al. J. Magn. Reson. - 2008

23

MicroTesla MRI - System configuration.



Ben Inglis et al. PNAS 2013;110:48:19194-19201

PNAS

24

Portable MRI Brain

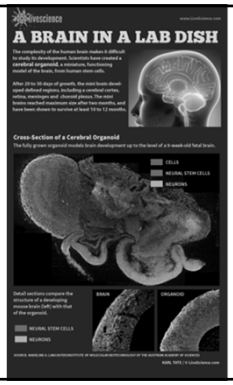
Advanced AI Applications automatically deliver deep learning-powered evaluation of brain injury from bedside Portable MR Imaging to support efficient clinical decision making.

25

"Brain in a Dish"

Cerebral Organoids

26



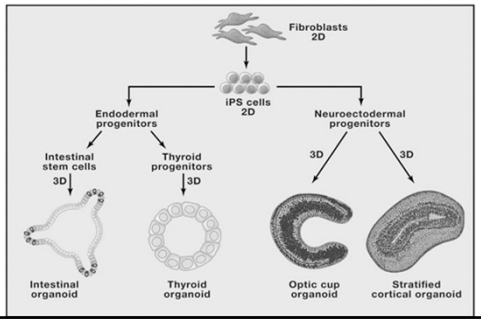
27

Cerebral Organoids

- Organoids are three-dimensional biological structures grown in vitro from different kinds of stem cells that self organise mimicking real organs with organ-specific cell types.
- The complexity of the human brain has made it difficult to study many brain disorders in model organisms, highlighting the need for an *in vitro* model of human brain development.

28

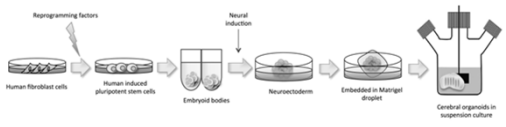
Cerebral Organoids model



29

Cerebral Organoid

An organoid as an in vitro 3D cellular cluster derived from primary tissue (lineage-restricted adult stem cells), embryonic stem cells (ESCs), or induced pluripotent stem cells (iPSCs), capable of self-renewal and self-organization, and exhibiting similar organ functionality as the tissue of origin.



30