

# High-density Electroencephalography in Disorders of Consciousness

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Cambridge Research into Impaired Consciousness

# EEG Networks in Disorders of Consciousness

VS Patient  
(TBI; CRS-R=7)  
Tennis -ve

VS Patient  
(TBI; CRS-R=7)  
Tennis +ve

Healthy  
adult

*Structured, small-world connectivity spanning large distances characterises consciousness*

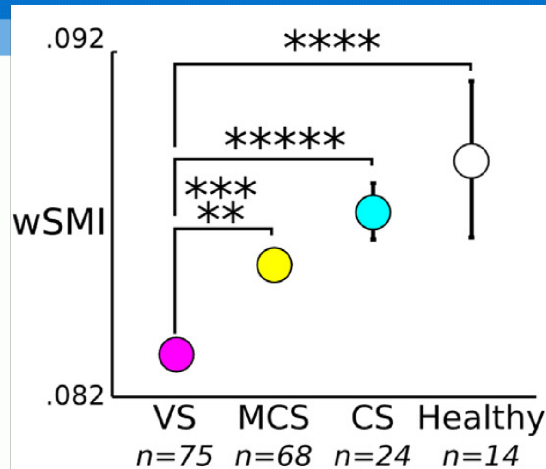
# Convergent Evidence



Healthy



Minimally Conscious

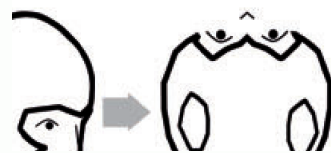
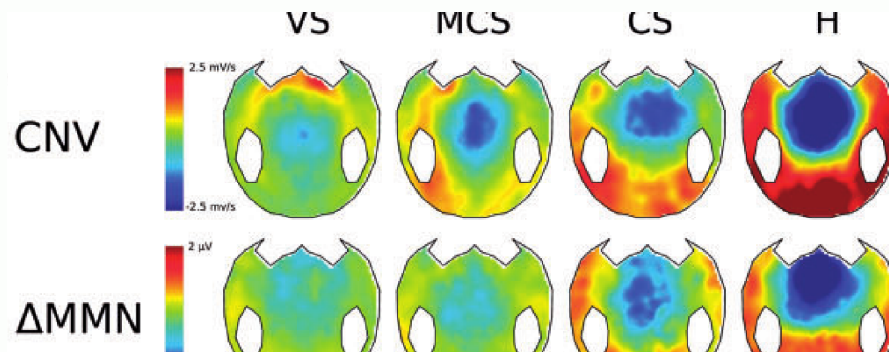


Vegetative

*Also shown in cohort of 181 patients*  
*Long-distance information sharing characterises consciousness*

# Most Discriminative Measures

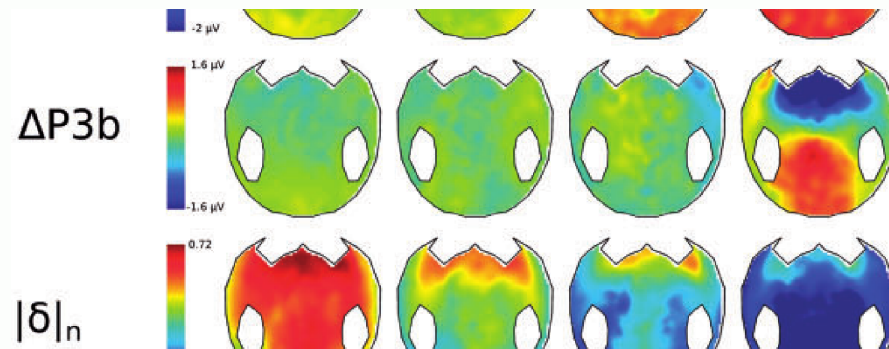
Event Related Potential



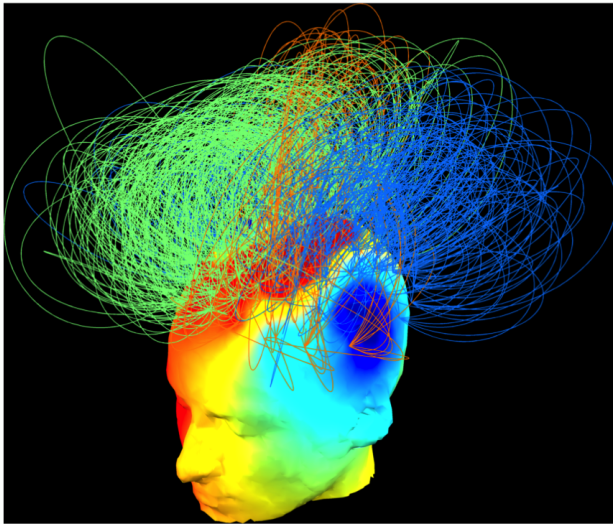
Contrast      Regression



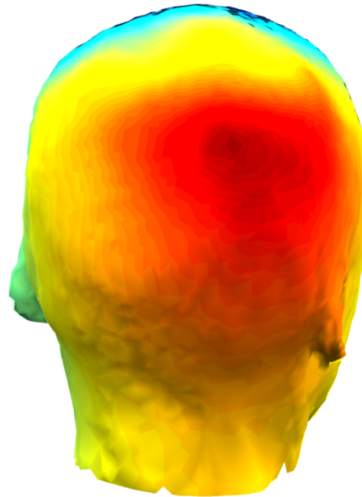
Frequency Power



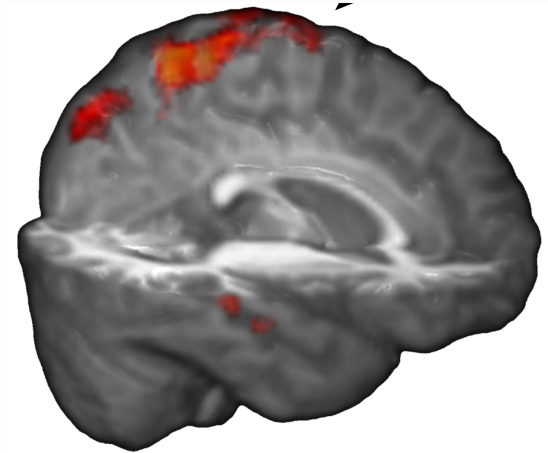
# Convergence between EEG and fMRI



Robust Small-world  
networks



P300  
b



Tennis imagery

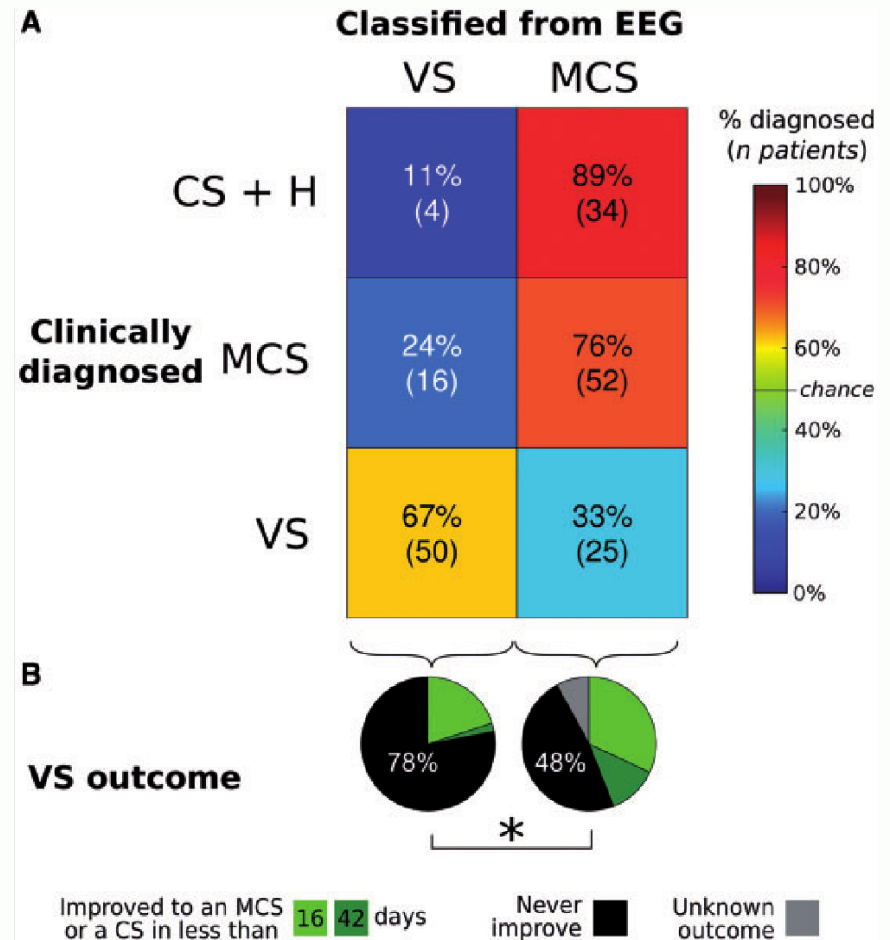
**Promising convergent evidence in a vegetative patient who was**

discharged on 23<sup>rd</sup> September 2011. He was in coma throughout his stay at Addenbrooke's and his neurological state on discharge was again coma with a Glasgow Coma Score of E1, VT, M3.

**but made a behavioural recovery to full consciousness within a year!**

# Current Challenges

- Significant **divergence** due to
  - Arousal variation
  - Motivation and cognitive state
  - Signal quality and reliability
- A current research challenge
  - Fundamental requirement for clinical utility
  - And **bedside deployment** alongside clinical assessment





# Thanks!



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