



Aula Magna  
Viale Aldo Moro, 30  
Bologna

VENERDI' 22 SETTEMBRE 2023

LA CHIRURGIA DELL'EPILESSIA  
IN REGIONE EMILIA- ROMAGNA  
2019-2022

UN INCONTRO TRA PROFESSIONISTI

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PROGETTI PER LO SVILUPPO DELLA RICERCA

Neuroimaging

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IRCCS Istituto delle Scienze Neurologiche di Bologna  
Ospedale Bellaria  
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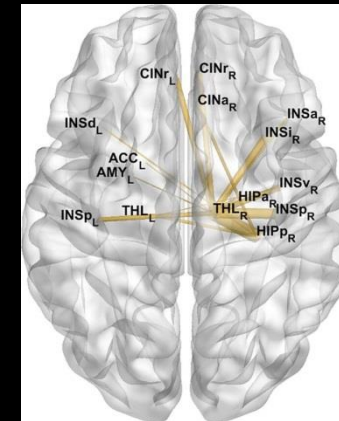
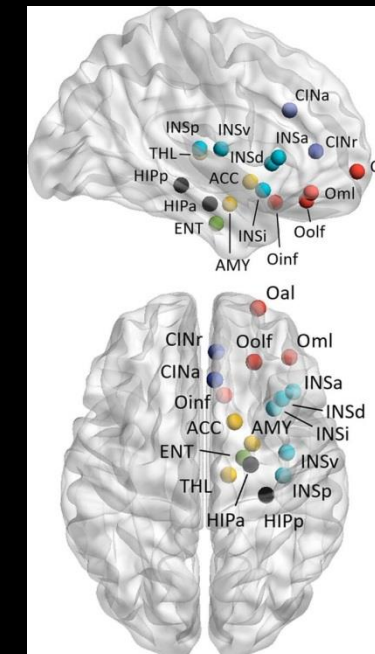
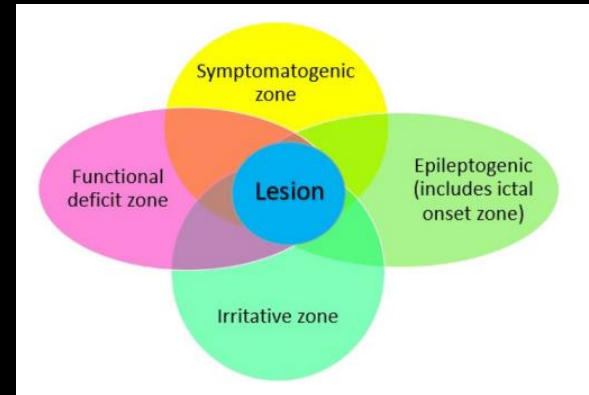
# DRE candidate for surgery: brain MRI protocol



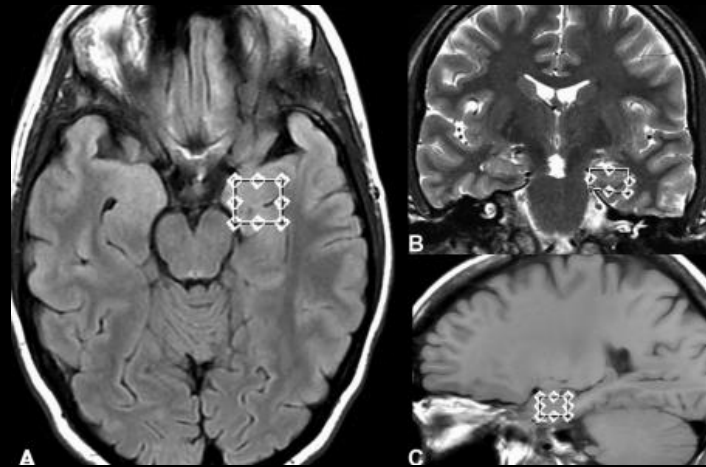
3T MR scanner  
64-channel head phased array coil



- HARNESS-MRI
  - Morphological/structural imaging
  - Proton MR spectroscopy (MRS)
  - Diffusion tensor imaging (DTI)
  - Functional MRI (task- and resting state fMRI)
  - EEG- fMRI

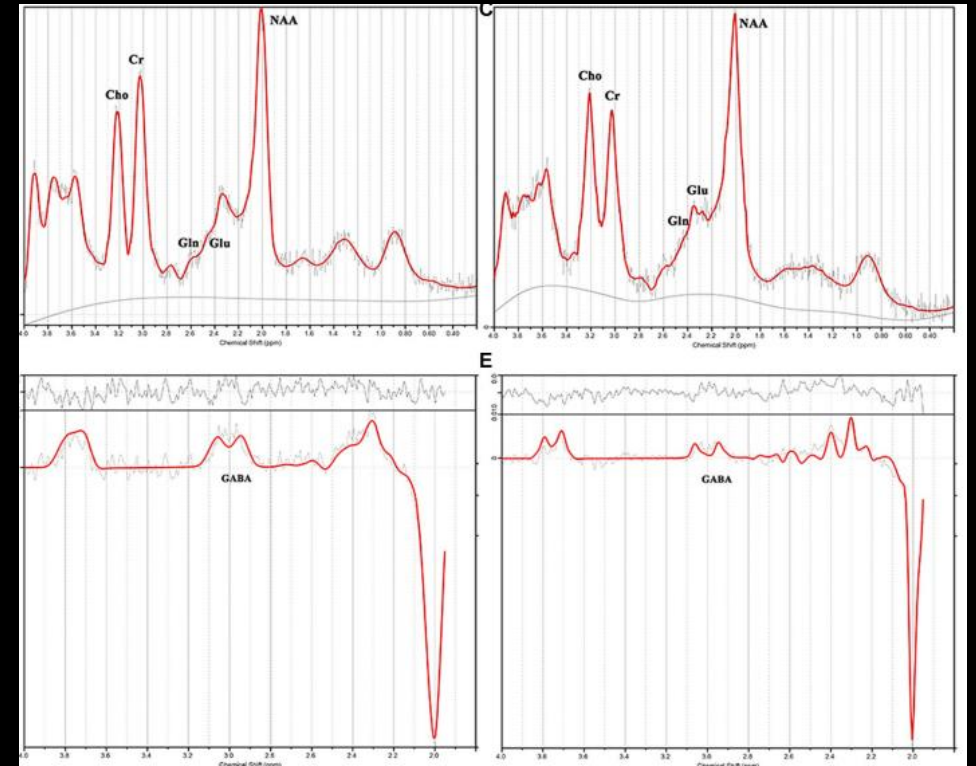
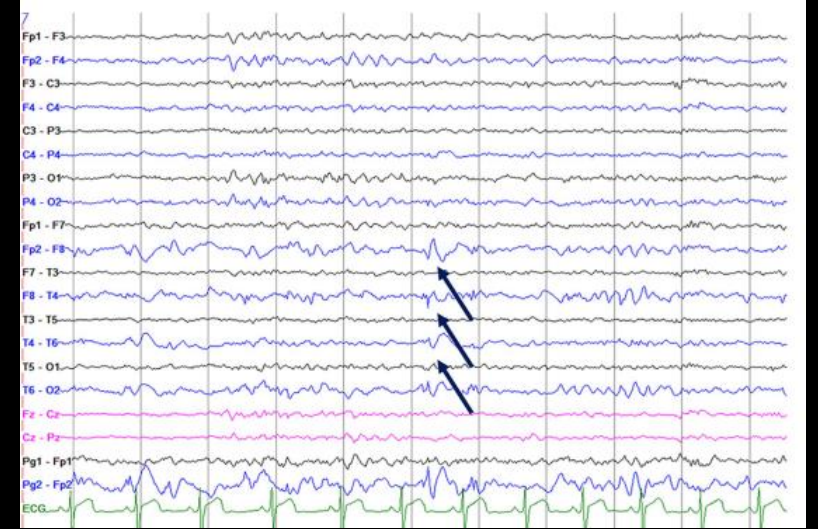


# Structural MRI-negative temporal lobe epilepsy



Proton MR Spectroscopy

MEGA PRESS



Oz et al., Radiology 2014- MRS Clinical Consensus  
Xu MJ, J Neuroimaging 2015  
Wu S et al., Front Neurosci 2023

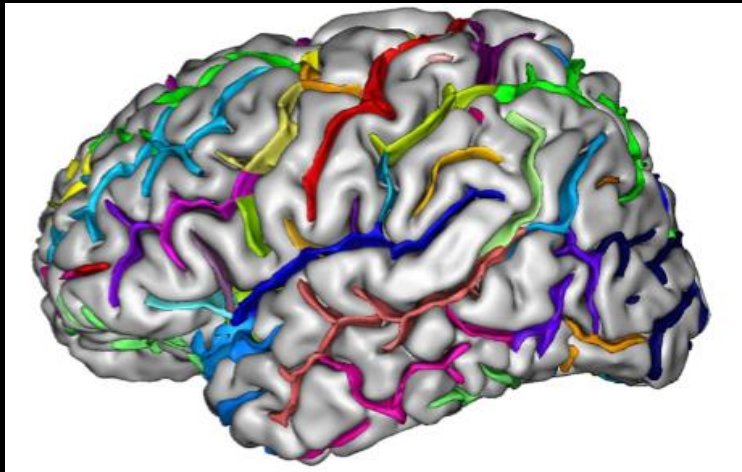


# Voxel-Based Morphometry (VBM)

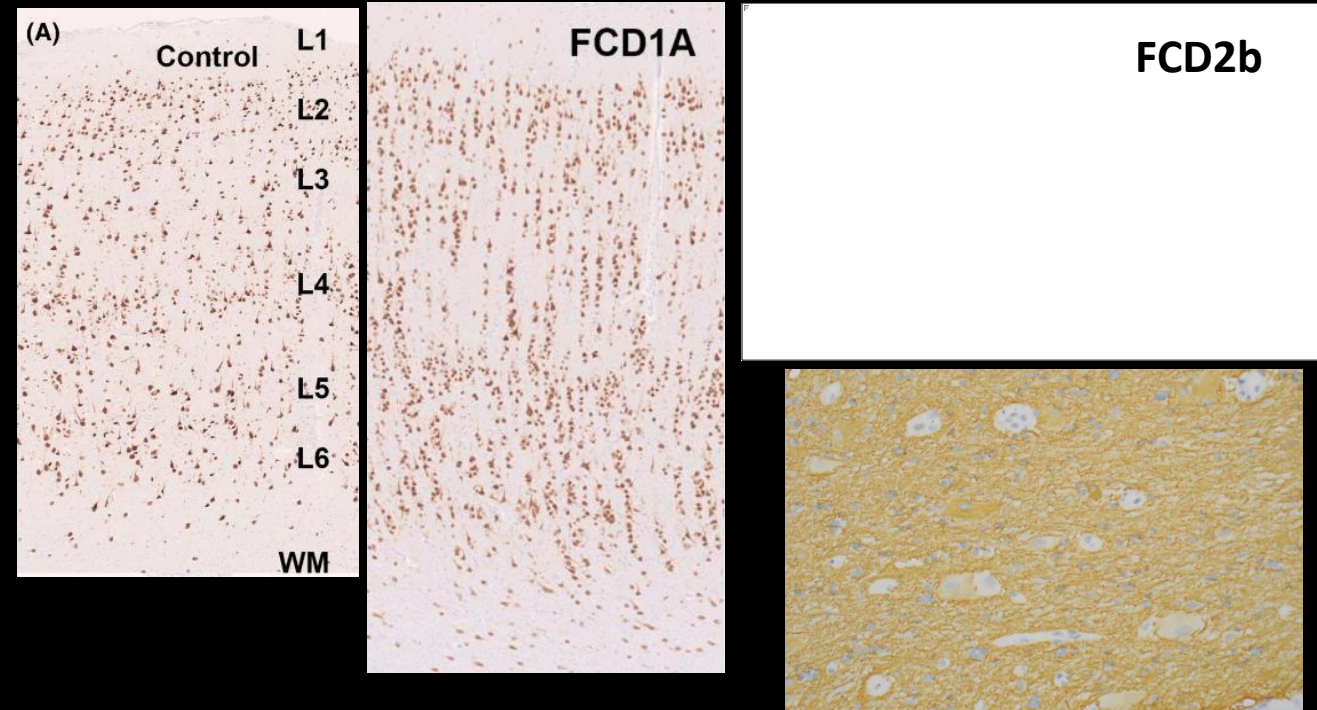
- Single voxel comparison of local gray matter density between two groups



## Sulci Segmentation



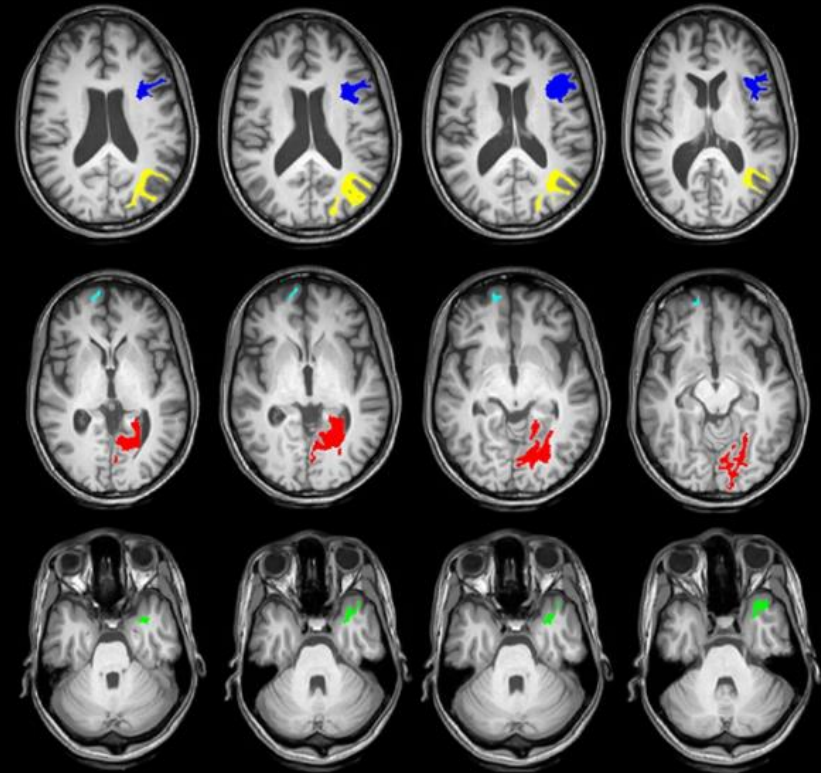
- Width
- Depth
- Length
- Surface



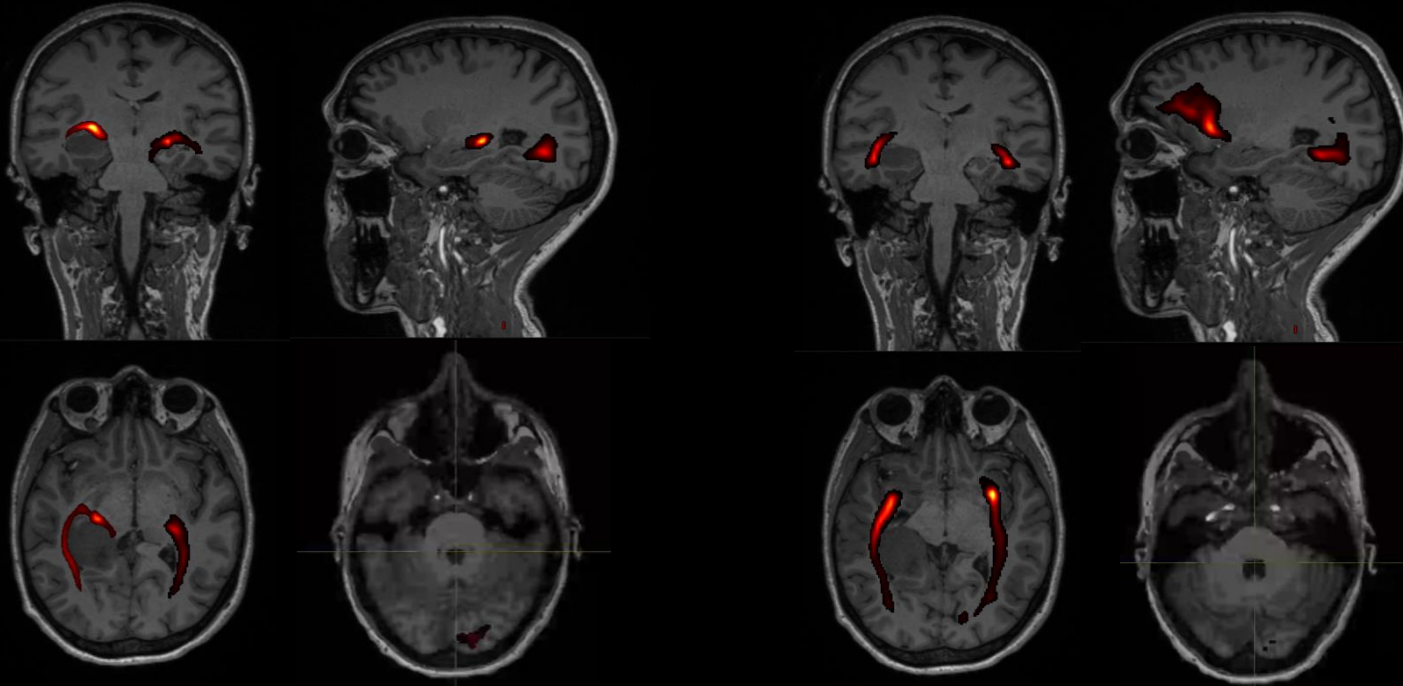
Courtesy of Prof Sofia Asioli, Bellaria Hospital

# DRE candidate for surgery: brain MRI protocol

- Morphological/structural -HARNES MRI
- Proton MR spectroscopy
- Diffusion tensor imaging (DTI)
- Functional MRI (task- and resting state fMRI)
- EEG- fMRI

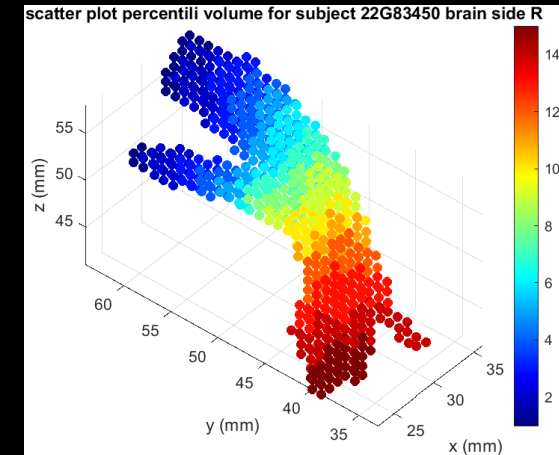


# Tractography- DTI based



Optic radiation

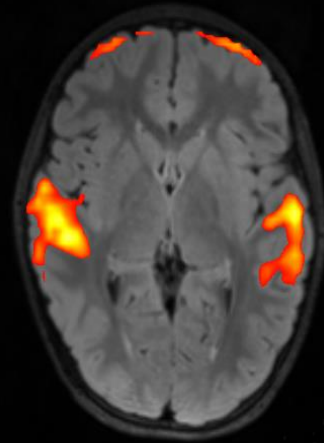
Inferior fronto-occipital fasciculus



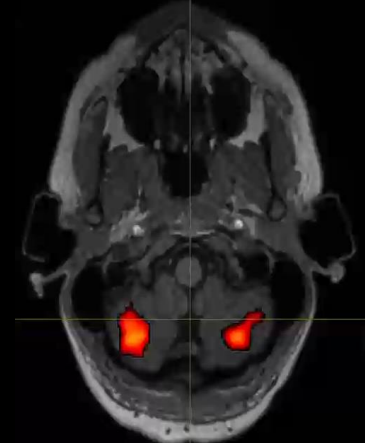
Along tract analysis

Corticospinal, cingulate, arcuate, aslant, inferior fronto-occipital, uncinate, optic radiations

# Task-based fMRI



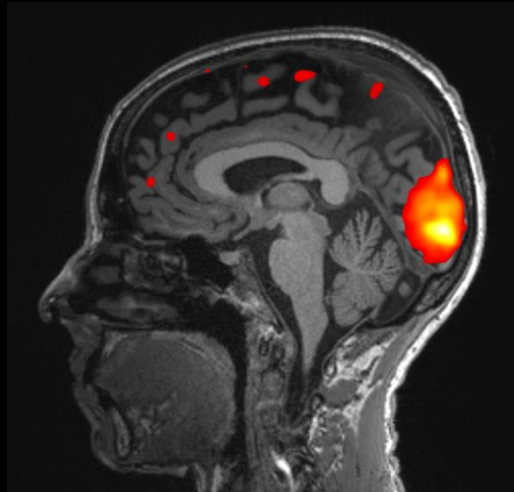
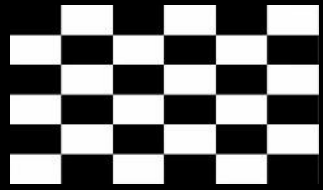
Comprehension



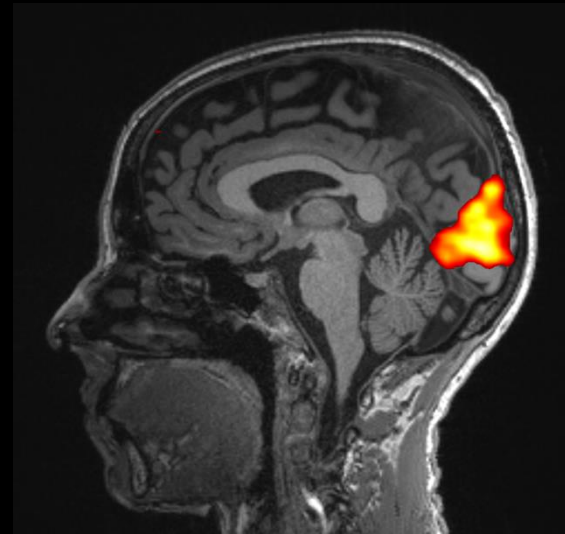
Semantic fluency



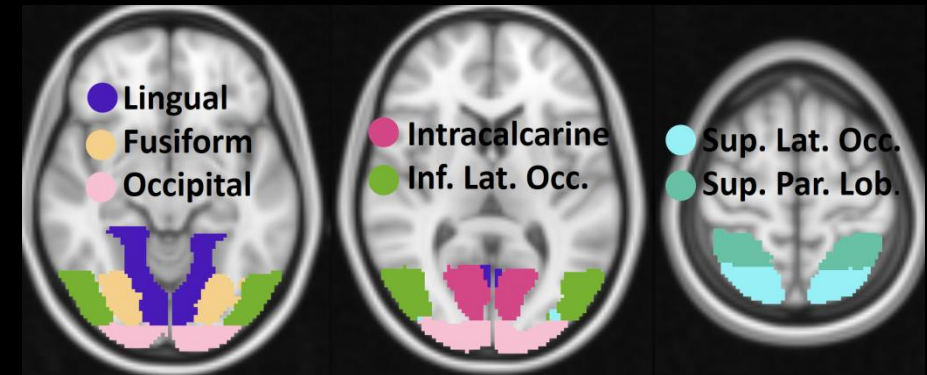
# Visual task



Task-based  
fMRI

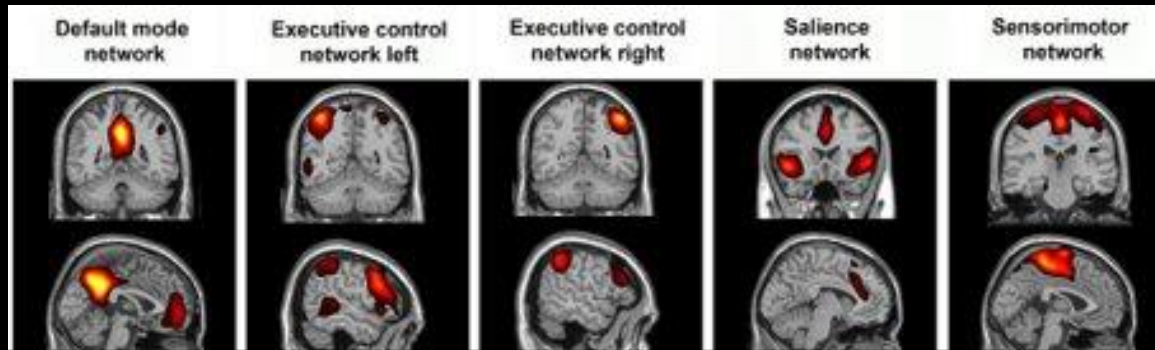


Resting-state  
fMRI





# Resting-state fMRI



9th International IEEE EMBS Conference on Neural Engineering  
San Francisco, CA, USA, March 20 - 23, 2019

## Cross-modal Consistency of Epileptogenic Network in SEEG and Resting-state fMRI

Tong Zhao<sup>1</sup>, Haixiang Wang<sup>2</sup>, Kang Wang<sup>1</sup>, Xiaojiao Yang<sup>1</sup>, Wenjing Zhou<sup>2</sup>, and Bo Hong<sup>1</sup>

BRAIN CONNECTIVITY  
Volume 7, Number 7, 2017  
Mary Ann Liebert, Inc.  
DOI: 10.1089/brain.2016.0479

## Correlating Resting-State Functional Magnetic Resonance Imaging Connectivity by Independent Component Analysis-Based Epileptogenic Zones with Intracranial Electroencephalogram Localized Seizure Onset Zones and Surgical Outcomes in Prospective Pediatric Intractable Epilepsy Study

Varina L. Boerwinkle<sup>1,2,\*</sup>, Deepankar Mohanty<sup>2,1</sup>, Stephen T. Foldes<sup>3</sup>, Danielle Guffey<sup>4</sup>, Charles G. Minard<sup>4</sup>, Aditya Vedantam<sup>5</sup>, Jeffrey S. Raskin<sup>5</sup>, Sandi Lam<sup>5</sup>, Margaret Bond<sup>2</sup>, Lucia Mirea<sup>5</sup>, P. David Adelson<sup>1,7</sup>, Angus A. Wilfong<sup>1,2,1</sup>, and Daniel J. Curry<sup>5</sup>



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Clinical Neurophysiology

journal homepage: [www.elsevier.com/locate/clinph](http://www.elsevier.com/locate/clinph)



## Individual localization value of resting-state fMRI in epilepsy presurgical evaluation: A combined study with stereo-EEG

Yingying Tang<sup>a,b</sup>, Joon Yul Choi<sup>b</sup>, Andreas Alexopoulos<sup>b</sup>, Hiroatsu Murakami<sup>b</sup>, Masako Daifu-Kobayashi<sup>b</sup>, Qin Zhou<sup>b</sup>, Imad Najm<sup>b</sup>, Stephen E Jones<sup>c</sup>, Zhong Irene Wang<sup>b,\*</sup>

<sup>a</sup>Department of Neurology, West China Hospital of Sichuan University, Chengdu, Sichuan, China

<sup>b</sup>Epilepsy Center, Cleveland Clinic, Cleveland, OH, USA

<sup>c</sup>Imaging Institute, Cleveland Clinic, Cleveland, OH, USA

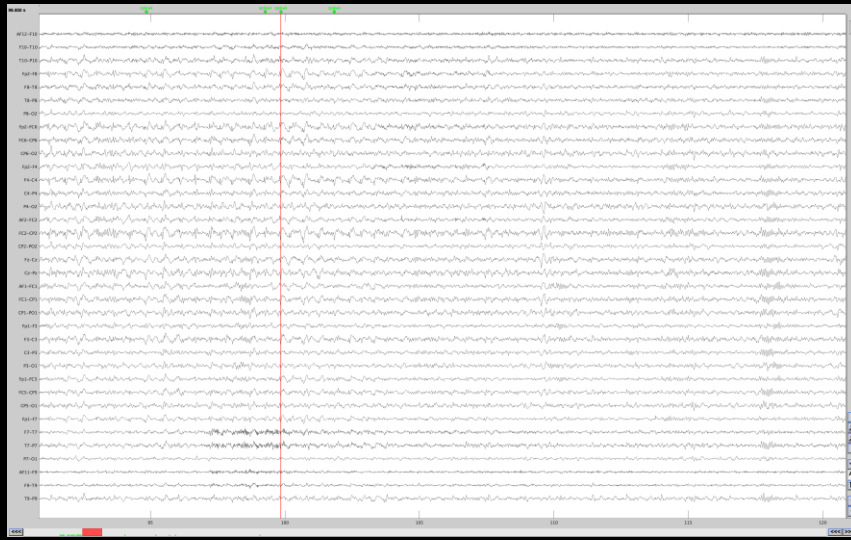
(x=13, y=80, z=1)

(x=1, y=50, z=-14)



EEG fMRI

64- and 128- channel  
MR compatible EEG cap

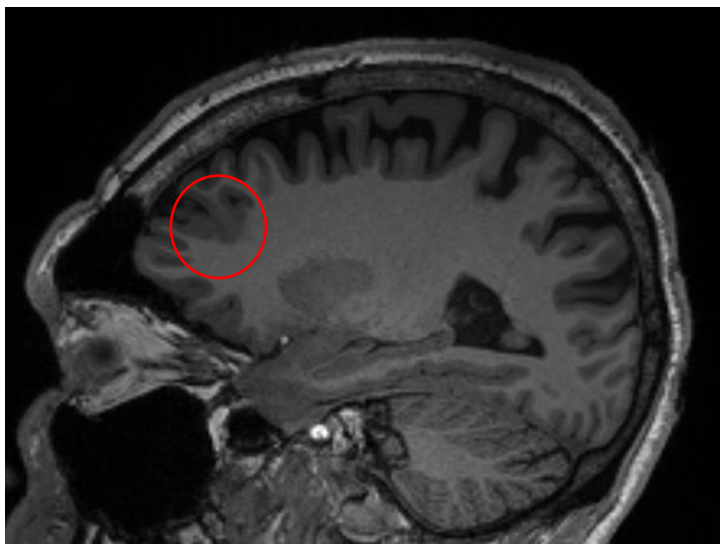


FCD dx

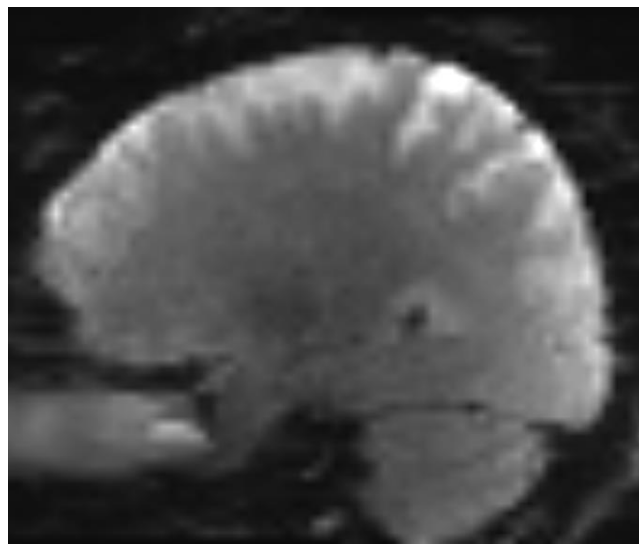
M, 36yo, right frontal FCD

Functional connectivity

T1

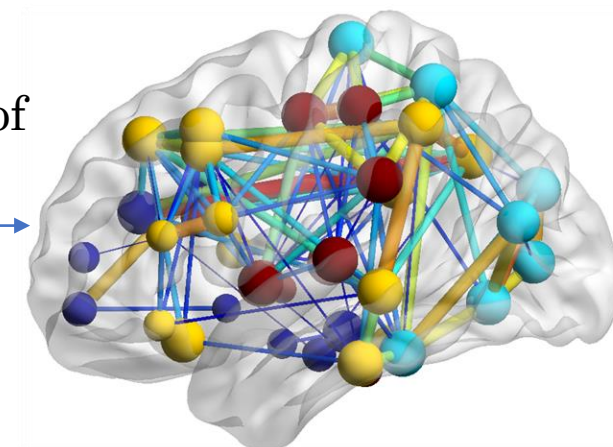


rs-fMRI

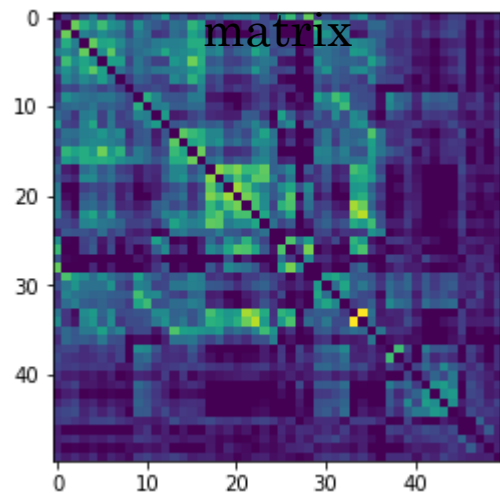


Create a functional network model of the brain

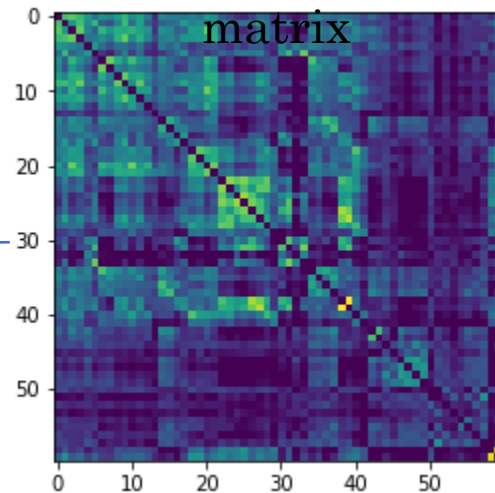
Connectome



Predicted FC matrix



Original FC matrix



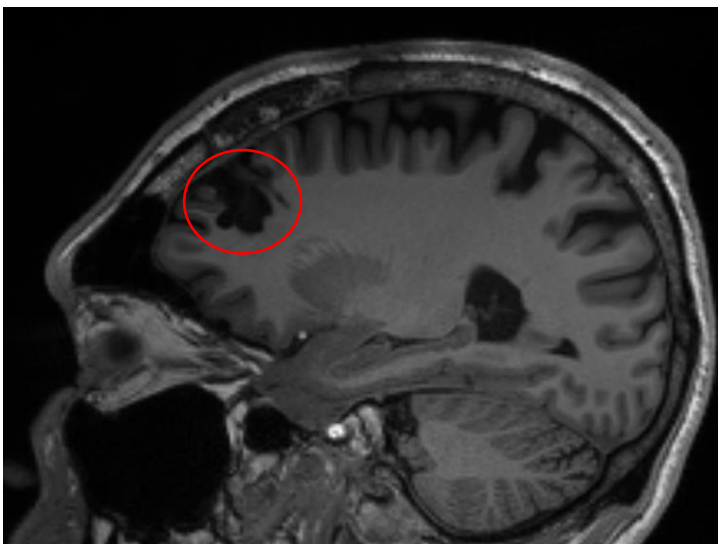
Targeted attack

Simulate network properties after targeted attack (removal) of lesioned/surgically removed nodes

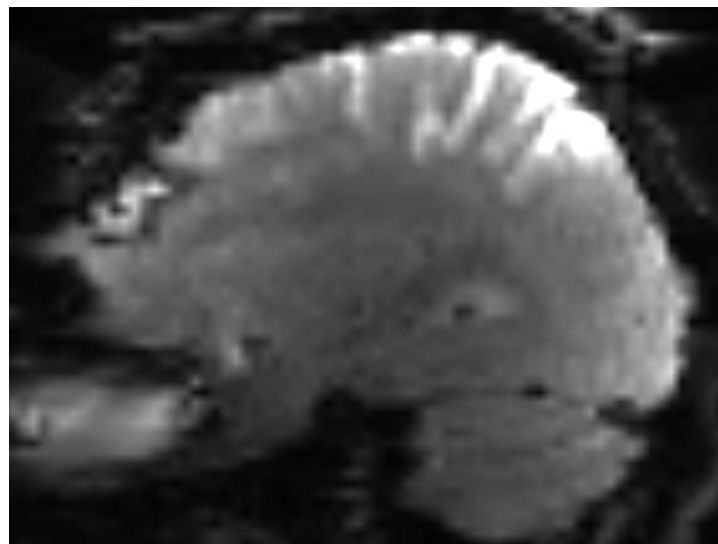
M, 36yo, right frontal FCD – post-lesionectomy

Functional connectivity

Post-surgical T1

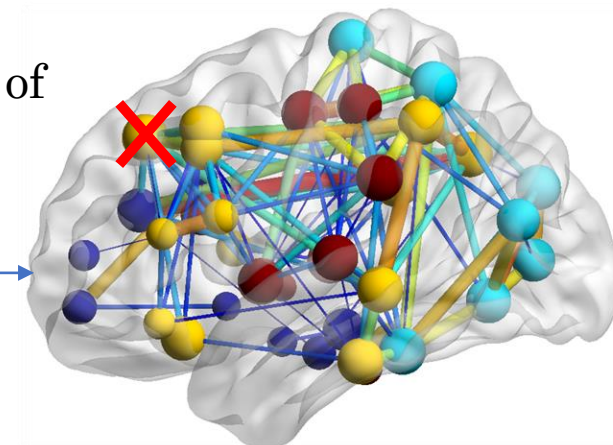


Post-surgical rs-fMRI

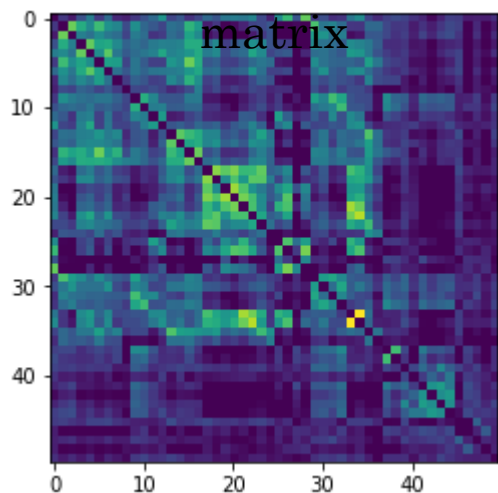


Re-create a functional network model of the brain

Connectome

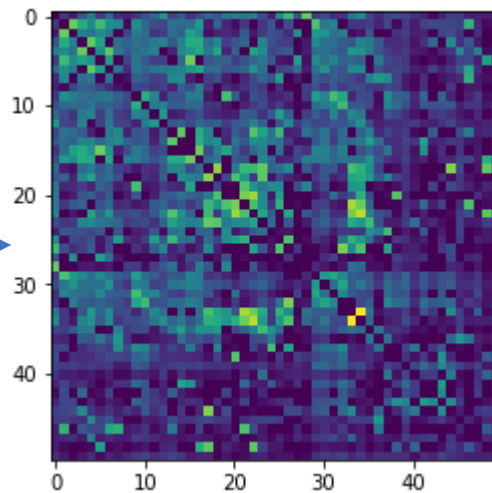


Predicted FC



matrix

Post-surgical FC matrix



Correlation

Generate actual post-surgical network for comparison with the predicted connectivity



# □ Optimization and harmonization of “advanced” MRI protocols in neuroimaging multi-site studies

## □ Istituto Nazionale Virtuale Epilessia



### Quantitative MRI Harmonization to Maximize Clinical Impact: The RIN–Neuroimaging Network

Anna Nigri<sup>1\*</sup>, Stefania Ferraro<sup>1,2\*</sup>, Claudia A. M. Gandini Wheeler-Kingshott<sup>3,4,5\*</sup>, Michela Tosetti<sup>6\*</sup>, Alberto Redolfi<sup>7\*</sup>, Gianluigi Forloni<sup>8\*</sup>, Egidio D'Angelo<sup>3,5\*</sup>, Domenico Aquino<sup>1</sup>, Laura Biagi<sup>9</sup>, Paolo Bosco<sup>4</sup>, Irene Carne<sup>4</sup>, Silvia De Francesco<sup>7</sup>, Greta Demichelis<sup>1</sup>, Ruben Gianeri<sup>1</sup>, Maria Marcella Lagana<sup>10</sup>, Edoardo Micotti<sup>4</sup>, Antonio Napolitano<sup>11</sup>, Fulvia Palesi<sup>3,5</sup>, Alice Pirastru<sup>10</sup>, Giovanni Savini<sup>12</sup>, Elisa Alberici<sup>9</sup>, Carmelo Amato<sup>13</sup>, Filippo Arrigoni<sup>14</sup>, Francesca Baglio<sup>10</sup>, Marco Bozzali<sup>15</sup>, Antonella Castellano<sup>16</sup>, Carlo Cavaliere<sup>17</sup>, Valeria Elisa Contarino<sup>18</sup>, Giulio Ferrazzi<sup>19</sup>, Simona Gaudino<sup>20</sup>, Silvia Marino<sup>21</sup>, Vittorio Manzo<sup>22</sup>, Luigi Pavone<sup>23</sup>, Letterio S. Politi<sup>12,24</sup>, Luca Roccatagliata<sup>25,26</sup>, Elisa Rognone<sup>3</sup>, Andrea Rossi<sup>26,27</sup>, Caterina Tonon<sup>28</sup>, Raffaele Lodi<sup>28</sup>, Fabrizio Tagliavini<sup>29</sup>, Maria Grazia Bruzzone<sup>11</sup> and The RIN–Neuroimaging

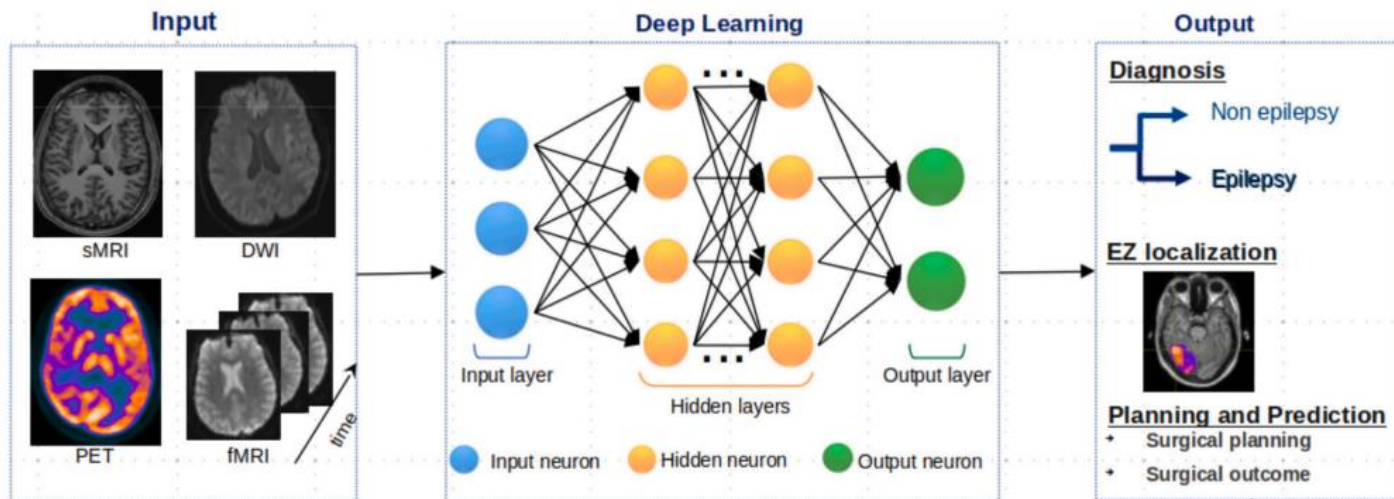
<sup>1</sup>U.O. Neuroradiologia, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan, Italy; <sup>2</sup>MOE Key Laboratory for Neuroinformatics, School of Life Science and Technology, University of Electronic Science and Technology of China, Chengdu, China; <sup>3</sup>Unità di Neuroradiologia, IRCCS Mondino Foundation, Pavia, Italy; <sup>4</sup>NMR Research Unit, Department of Neuroinflammation, Queen Square MS Centre, UCL Queen Square Institute of Neurology, Faculty of Brain Sciences, University College London, London, United Kingdom; <sup>5</sup>Department of Brain and Behavioral Sciences, University of Pavia, Pavia, Italy; <sup>6</sup>Medical Physics and MR Lab, Fondazione IRCCS Stella Maris, Pisa, Italy; <sup>7</sup>Laboratory of Neuroinformatics, IRCCS Istituto Centro San Giovanni di Dio Fatebenefratelli, Brescia, Italy; <sup>8</sup>Laboratory of Biology of Neurodegenerative Disorders, Istituto di Ricerche Farmacologiche Mario Negri IRCCS, Milan, Italy; <sup>9</sup>Neuroradiology Unit, IRCCS Istituto Clinici Scientifici Maugeri, Pavia, Italy; <sup>10</sup>IRCCS Fondazione Don Carlo Gnocchi Onlus, Milan, Italy; <sup>11</sup>Medical Physics, IRCCS Istituto Ospedale Pediatrico Bambino Gesù, Rome, Italy; <sup>12</sup>Neuroradiology Unit, IRCCS Humanitas Research Hospital, Milan, Italy; <sup>13</sup>Unit of Neuroradiology, Oasi Research Institute-IRCCS, Troina, Italy; <sup>14</sup>Neuroimaging Unit, Scientific Institute, IRCCS E. Medea, Bosisio Parini, Italy; <sup>15</sup>Neuroimaging Laboratory, Santa Lucia Foundation, IRCCS, Rome, Italy; <sup>16</sup>Neuroradiologia, IRCCS Ospedale San Raffaele, Milan, Italy; <sup>17</sup>IRCCS Strylab SDN, Naples, Italy; <sup>18</sup>Unità di Neuroradiologia, Fondazione IRCCS Ca' Granda Ospedale Maggiore Policlinico, Milan, Italy; <sup>19</sup>IRCCS San Camillo Hospital, Venice, Italy; <sup>20</sup>Istituto di Radiologia, UOC Radiologia e Neuroradiologia, IRCCS Fondazione Policlinico Universitario Agostino Gemelli, Rome, Italy; <sup>21</sup>IRCCS Centro Neurolesi "Bonino-Pulejo", Messina, Italy; <sup>22</sup>Department of Radiology, Istituto Auxologico Italiano, IRCCS, Milan, Italy; <sup>23</sup>IRCCS NeuroMed, Pizzoli, Italy; <sup>24</sup>Department of Biomedical Sciences, Humanitas University, Milan, Italy; <sup>25</sup>Neuroradiologia IRCCS Ospedale Policlinico San Martino, Genoa, Italy; <sup>26</sup>Dipartimento di Scienze della Salute Università di Genova, Genoa, Italy; <sup>27</sup>UO Neuroradiologia, IRCCS Istituto Giannina Gaslini, Genoa, Italy; <sup>28</sup>Functional and Molecular Neuroimaging Unit, IRCCS Istituto delle Scienze Neurologiche di Bologna, Bologna, Italy; <sup>29</sup>Scientific Direction, Fondazione IRCCS Istituto Neurologico Carlo Besta, Milan, Italy

# Optimization and harmonization of “advanced” MRI protocols in neuroimaging multi-site studies

## Deep learning models based on neuroimaging in epilepsy

K.B. García-Ramó et al.

Clinical Neurology and Neurosurgery 232 (2023) 107879



Compared with traditional diagnostic methods, Radiomics has advantages such as shorter diagnostic time, labor saving, and the ability to improve disease screening making a definite impact at a single patient level

Table 1 Important Aspects of Radiomics

Aspect

Uses standard-of-care images

Interrogates the entire tumor

Can be used to interrogate stroma

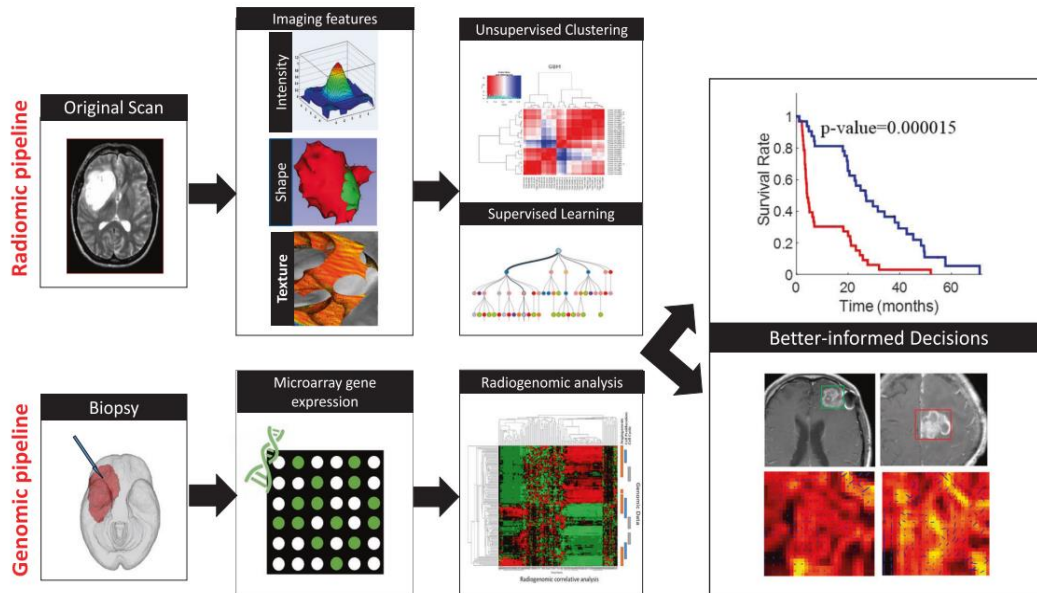
Enables longitudinal monitoring

Gillies, R.J et al., Radiology 2016

# Optimization and harmonization of “advanced” MRI protocols in neuroimaging multi-site studies

## Radiomics

## Radiogenomics



G Singh et al., British Journal of Cancer 2021

## DEMOCRATIZING MRI

# Helping everyone, everywhere in the world benefit from advances in MRI technology

INTERVIEW BY LAURA BORTOLOTTI, MARIA EUGENIA CALIGIURI

**P**rof. Derek Jones, Director of CUBRIC (Cardiff University Brain Research Imaging Centre, in Cardiff, Wales UK) and MRI legend, is currently Vice-President of ISMRM, which means he will become President at the Business Meeting in Toronto. In this interview, he tells us about the newest, most exciting initiative from our Society's leadership: an unprecedented effort to improve the accessibility

of MR hardware, education and knowledge on a global basis, starting with Africa.

Dr. Udunna Anazodo, Assistant Professor in the Department of Neurology and Neurosurgery, and also a member of the Neuroimaging and Neuroinformatics research group at The Neuro, in Montreal, also gives an overview of the events that eventually led to the birth of the ISMRM African Chapter.

**MRMH: Had you ever been to Africa before undertaking this new adventure?**

**Derek:** Yes, I was lucky enough to first go to Kenya when I won a TV competition as a teenager. I'd been to Egypt as a student, and South Africa on honeymoon, but I never would have imagined that I'd come back one day in any official capacity, helping our Society to democratise MRI.





## Neuroimaging Lab Areas and People

Caterina Tonon

### Technical development & data analysis

David Neil Manners  
Giovanni Sighinolfi  
Elena Cantoni  
Greta Venturi

### Neuroradiology

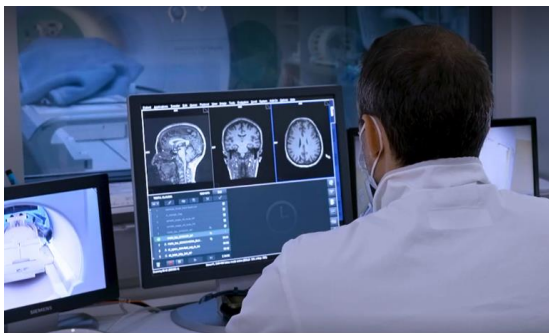
Gianfranco Vornetti  
Fiorina Bartiromo  
Lorenzo Motta

### Neuropsychology

Magali Jane Rochat  
Lucia Guidi

### Molecular Biology

Luca Morandi



Programma Neuroradiologia con Tecniche ad elevata complessità - Francesco Toni

Neuroradiology Area Radiographers and Nurses Staff - Bellaria Hospital

Administrative office - Bellaria Hospital

Samantha Deserri





