SSMG.
Bruxelles, février 2014.

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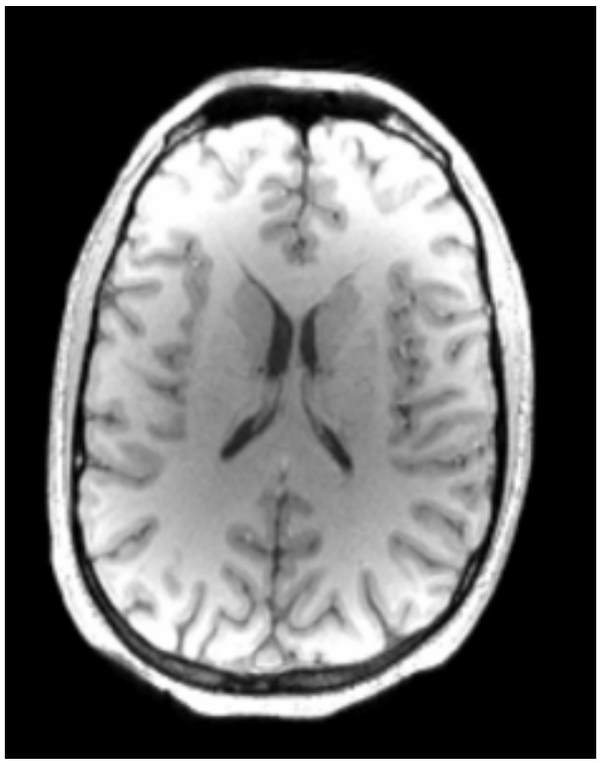
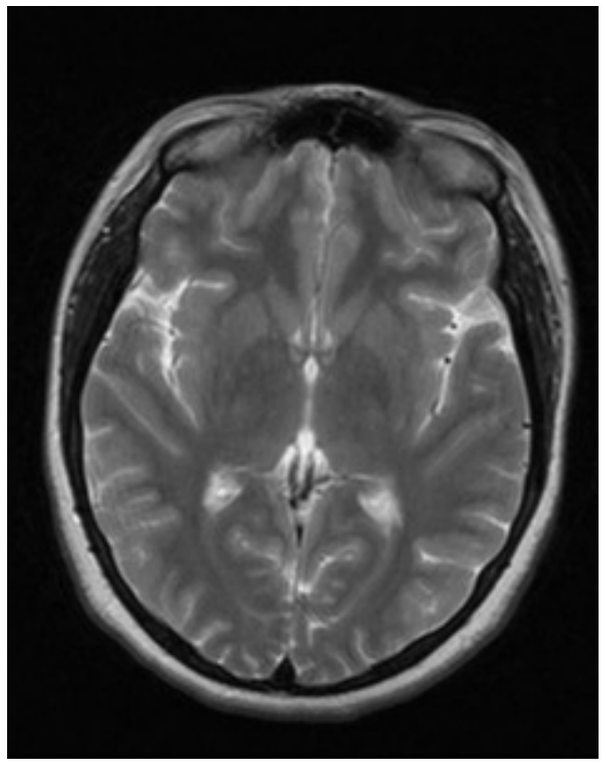
Sommaire

- Introduction
- SEP
- Traumatismes cérébraux
- Conclusion

I. Introduction



T1



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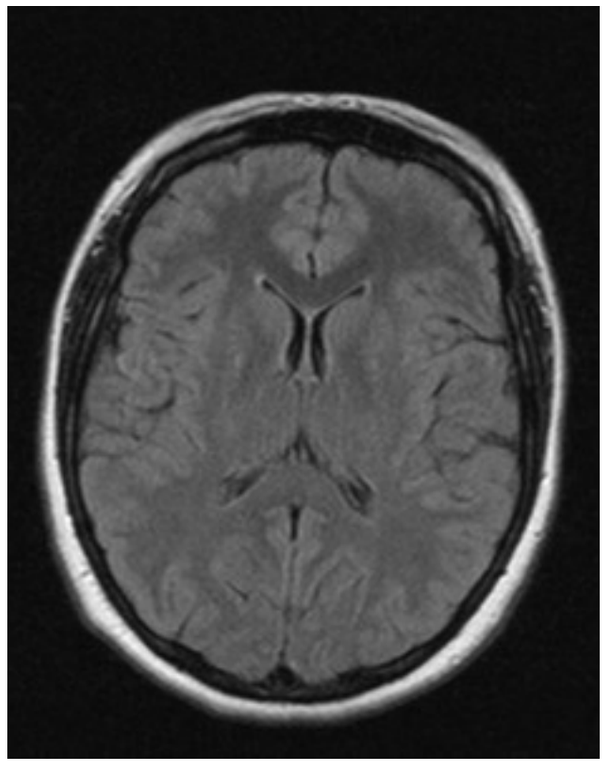
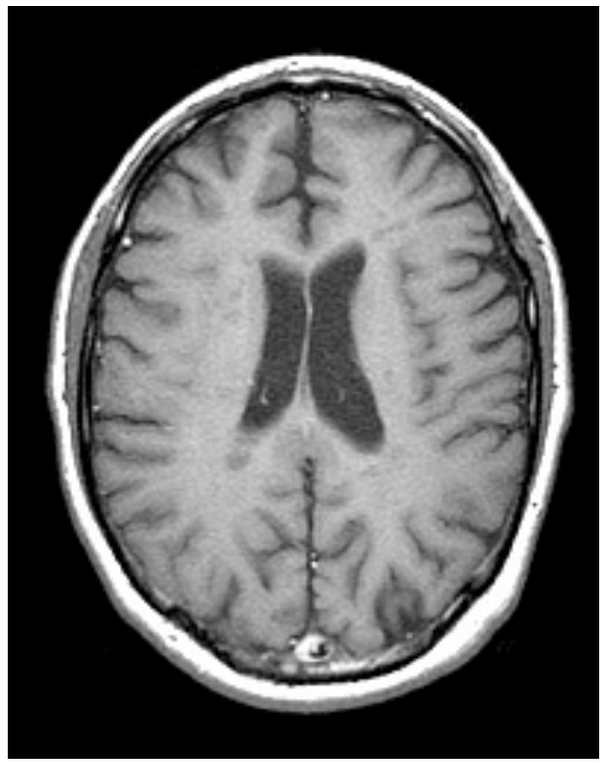
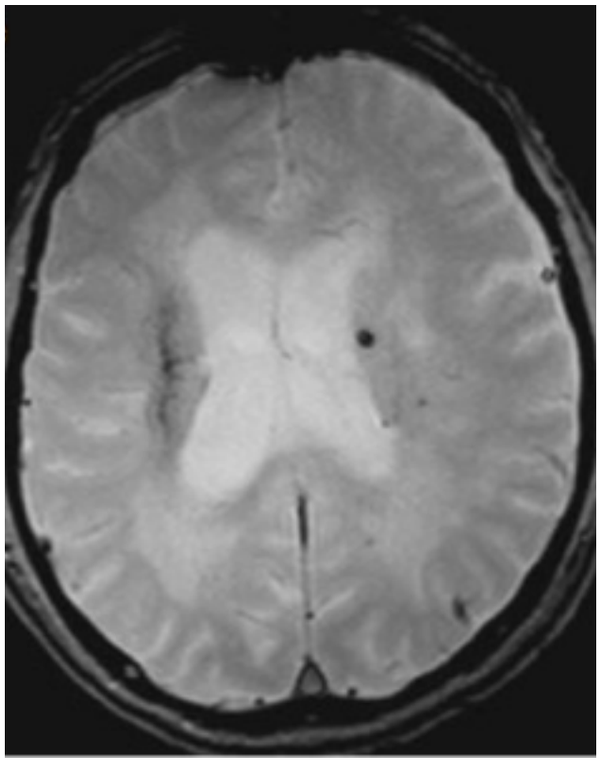


FLAIR

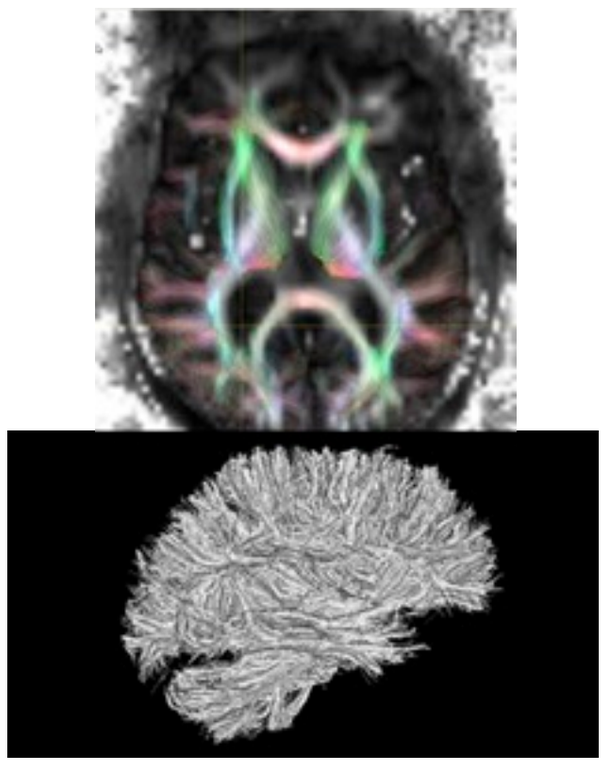


T1+G

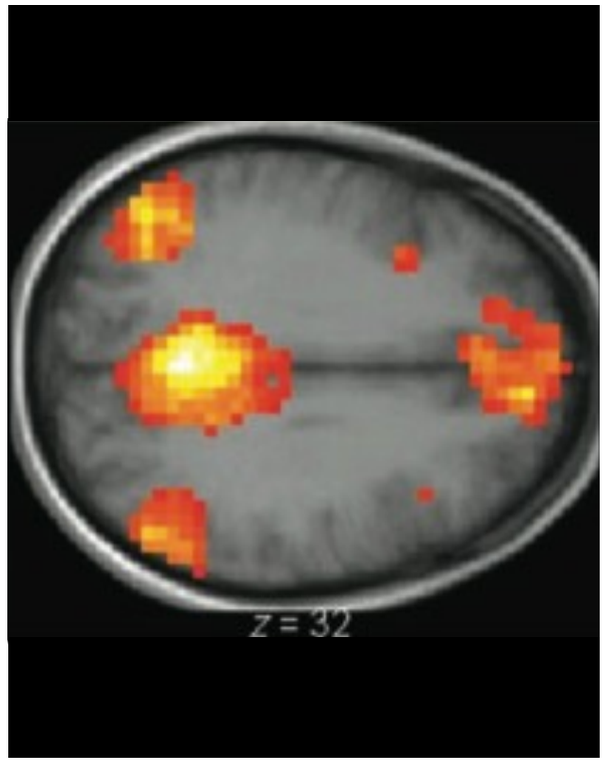
I. Introduction



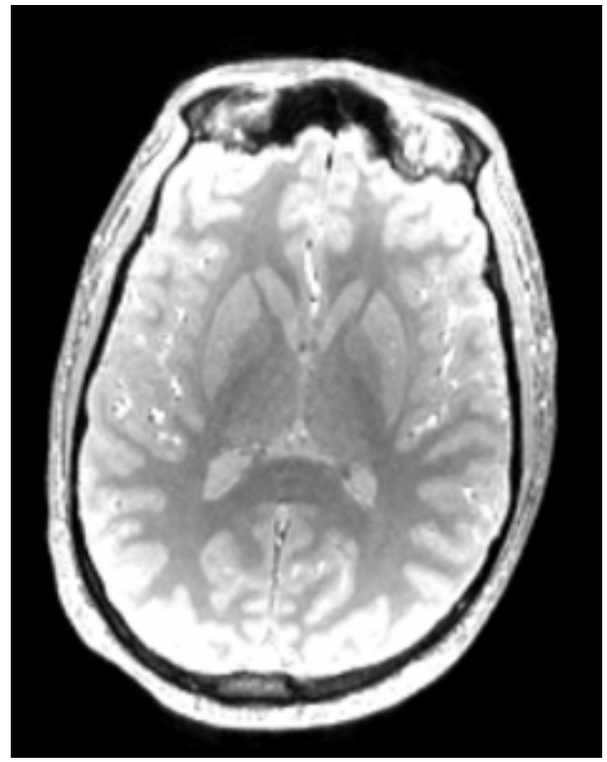
T2*



Diff



fMRI



MTR

III. SEP

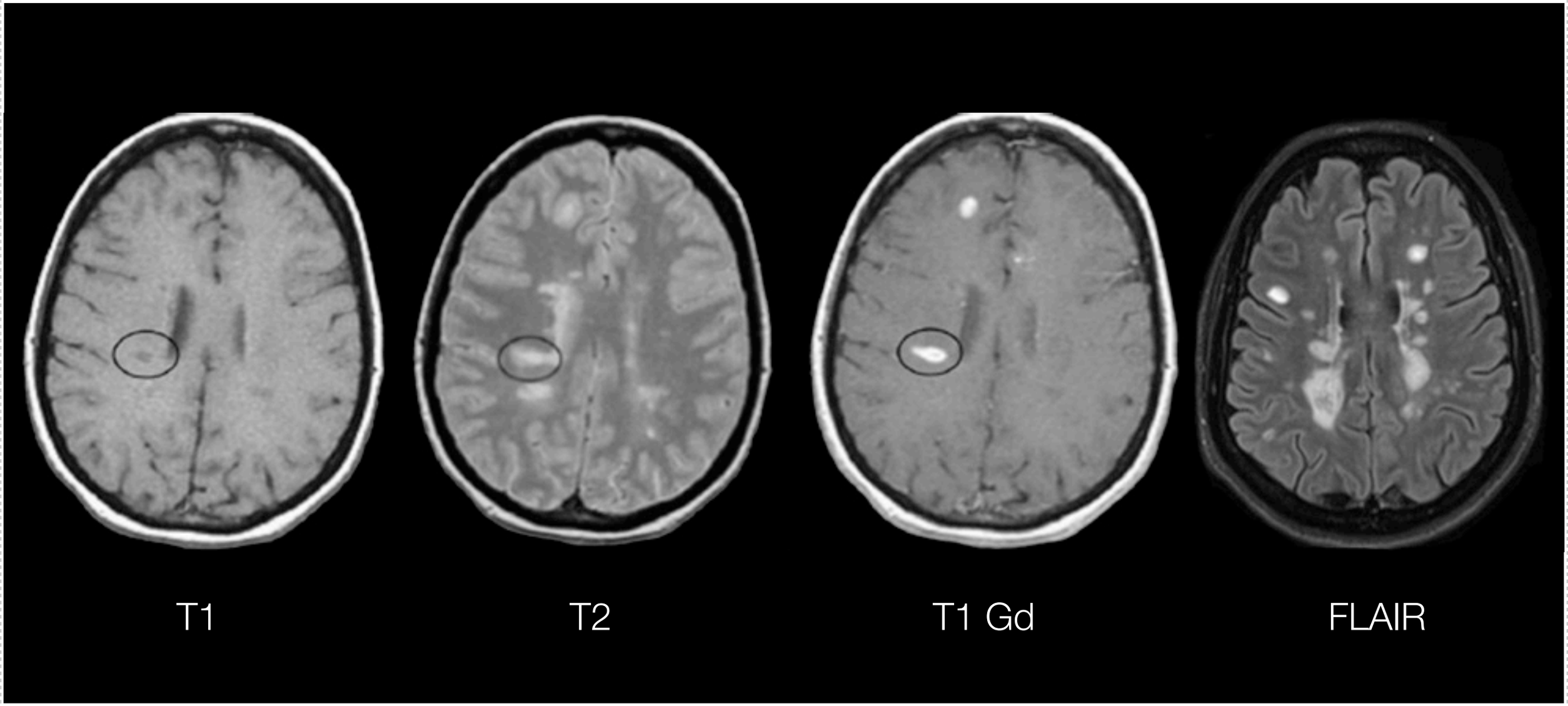
- L'IRM cérébrale avec des séquences classique permet de faire le diagnostic sur base d'un seul examen (+ clinique et anamnèse bien sûr).

- NB: CT-Scan = inutile, ne permet pas de visualiser les lésions.

TABLE 4: The 2010 McDonald Criteria for Diagnosis of MS

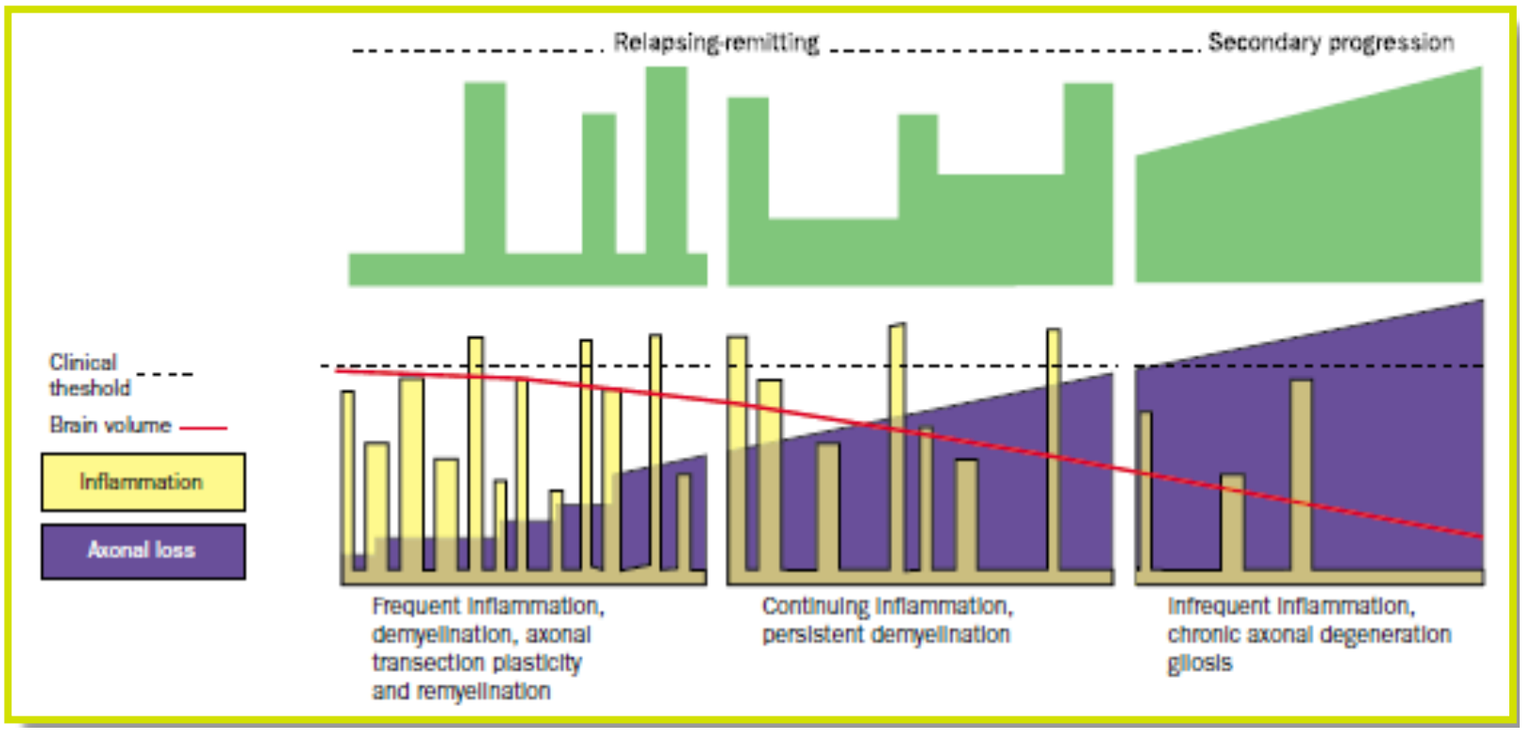
Clinical Presentation	Additional Data Needed for MS Diagnosis
≥2 attacks[a]; objective clinical evidence of ≥2 lesions or objective clinical evidence of 1 lesion with reasonable historical evidence of a prior attack[b]	None[c]
≥2 attacks[a]; objective clinical evidence of 1 lesion	Dissemination in space, demonstrated by: ≥1 T2 lesion in at least 2 of 4 MS-typical regions of the CNS (periventricular, juxtacortical, infratentorial, or spinal cord)[d]; or Await a further clinical attack[a] implicating a different CNS site
1 attack[a]; objective clinical evidence of ≥2 lesions	Dissemination in time, demonstrated by: Simultaneous presence of asymptomatic gadolinium-enhancing and nonenhancing lesions at any time; or A new T2 and/or gadolinium-enhancing lesion(s) on follow-up MRI, irrespective of its timing with reference to a baseline scan; or Await a second clinical attack[a]
1 attack[a]; objective clinical evidence of 1 lesion (clinically isolated syndrome)	Dissemination in space and time, demonstrated by: For DIS: ≥1 T2 lesion in at least 2 of 4 MS-typical regions of the CNS (periventricular, juxtacortical, infratentorial, or spinal cord)[d]; or Await a second clinical attack[a] implicating a different CNS site; and For DIT: Simultaneous presence of asymptomatic gadolinium-enhancing and nonenhancing lesions at any time; or A new T2 and/or gadolinium-enhancing lesion(s) on follow-up MRI, irrespective of its timing with reference to a baseline scan; or Await a second clinical attack[a]
Insidious neurological progression suggestive of MS (PPMS)	1 year of disease progression (retrospectively or prospectively determined) plus 2 of 3 of the following criteria[d]: 1. Evidence for DIS in the brain based on ≥1 T2 lesions in the MS-characteristic (periventricular, juxtacortical, or infratentorial) regions 2. Evidence for DIS in the spinal cord based on ≥2 T2 lesions in the cord 3. Positive CSF (isoelectric focusing evidence of oligoclonal bands and/or elevated IgG index)

Polman et al, *Ann Neurol*, 2011



III. SEP

III. SEP



Compston & Coles, *Lancet,* 2002

- Actuellement: paradoxe clinico-radiologique

The clinico-radiological paradox in multiple sclerosis revisited

Frederik Barkhof

The use of magnetic resonance imaging as a surrogate outcome measure in clinical trials, or even as a prognosticator in the assessment of the natural evolution, assumes a close relationship between extent and rate of development of magnetic resonance imaging abnormalities with the clinical status and rate of development of disability. While it may seem obvious that patients who develop new lesions are worse off than those without new lesions, the association between clinical findings and radiological extent of involvement is generally poor. In this review, various confounders are discussed, including inappropriate clinical rating, lack of histopathological specificity (especially for axonal loss), neglect of spinal cord involvement, underestimation of damage to the normal appearing brain tissue (both white and gray matter), and masking effects of cortical adaptation. It is concluded that much progression has been made in magnetic resonance techniques so that the clinico-radiological dissociation has indeed proved to be a paradox. Thus, the relevance of normal appearing brain tissue damage, residual brain volume, spinal cord damage and cerebral plasticity had to be reiterated. The increased awareness of the subtle interplay between these dimensions should be kept in mind when magnetic resonance is used as a surrogate outcome measure. This corroborates with conventional wisdom that one should not rely on a single magnetic resonance measure, but take full advantage of the fact that magnetic resonance is able to provide multidimensional information. Curr Opin Neurol 15:239–245.

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Current Opinion in Neurology 2002, 15:239–245

Abbreviations

EDSS	Expanded Disability Status Scale
MRI	magnetic resonance imaging
MSFC	Multiple Sclerosis Functional Composite

1350-7540

Introduction

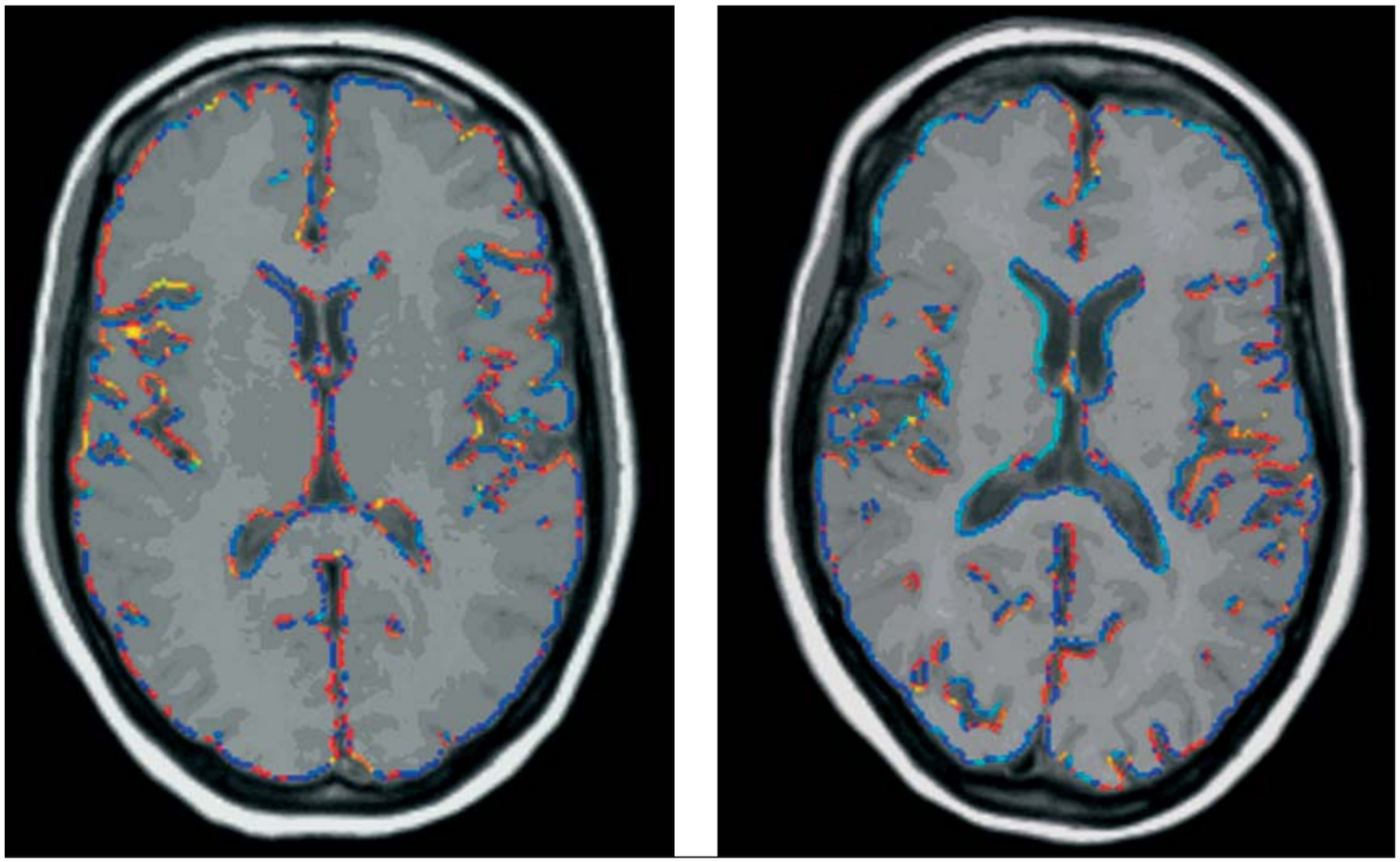
In the field of multiple sclerosis, magnetic resonance imaging (MRI) is widely applied to ascertain the diagnosis. In the recently published diagnostic criteria [1••], MRI is given a much more prominent role, allowing one to demonstrate not only dissemination in space, but also dissemination in time [2•]. Its diagnostic sensitivity reflects the ability to identify clinically silent lesions, which, when studied sequentially, display a dynamic pattern of waxing and waning that is governed by a variety of immunological and other factors [3–10,11•,12,13]. Unlike the clinical picture, there are frequent new silent lesions, which can be used to study the natural course or attempts to modify the natural course. In fact, gadolinium-enhanced and T2-weighted MRI is widely used to monitor treatment efficacy, serving as an important secondary outcome measure in most phase III clinical trials [14•,15,16], and often being used as the primary outcome in exploratory ('proof-of-concept') phase II studies [17–20].

The use of MRI as a surrogate outcome measure in clinical trials, or even as a prognosticator in the assessment of the natural evolution, assumes a close relationship between extent and rate of development of MRI abnormalities with the clinical status and rate of development of disability. While it may seem obvious that patients who develop new lesions are worse off than those without new lesions, the association between clinical findings and radiological extent of involvement generally is poor. In this review, various confounders will be discussed to what has optimistically been labeled 'the clinico-radiological paradox', assuming that the relation is indeed tighter when controlled for these confounders. This review discusses progress that has been made in overcoming some of these limitations, including inappropriate clinical rating, lack of histopathological specificity (especially for axonal loss), neglect of spinal cord involvement, underestimation of damage to the normal appearing brain tissue (both white and gray matter), and compensation by cortical adaptation.

New rating scales: including cognitive assessment

The limitations of the Expanded Disability Status Scale (EDSS) are well known. They include incomplete coverage of central nervous system domains, non-linearity, and observer bias. In an attempt to develop a more comprehensive scale, the Multiple Sclerosis Functional Composite (MSFC) has been developed. The MSFC combines information from three independent

III. SEP

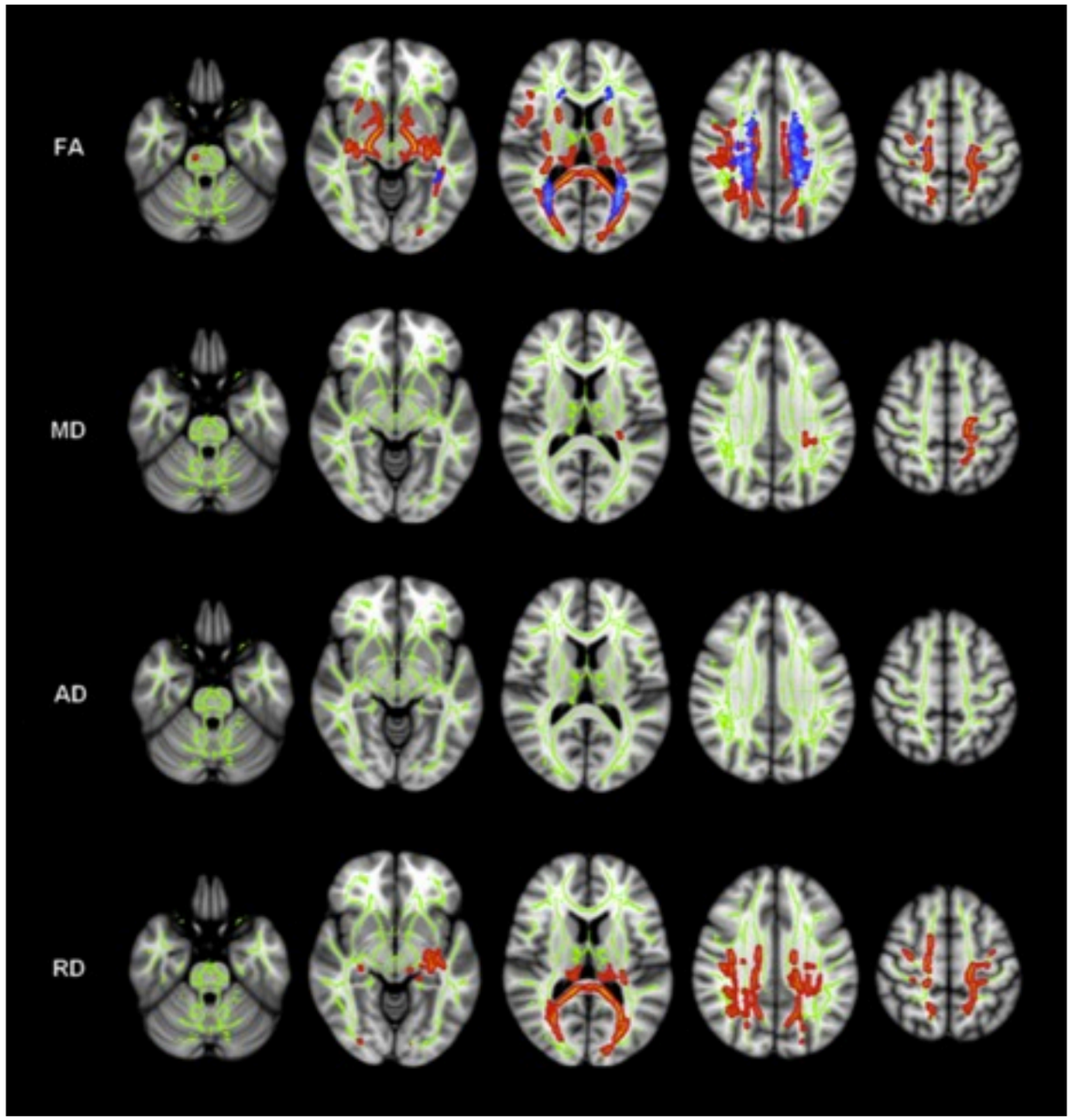


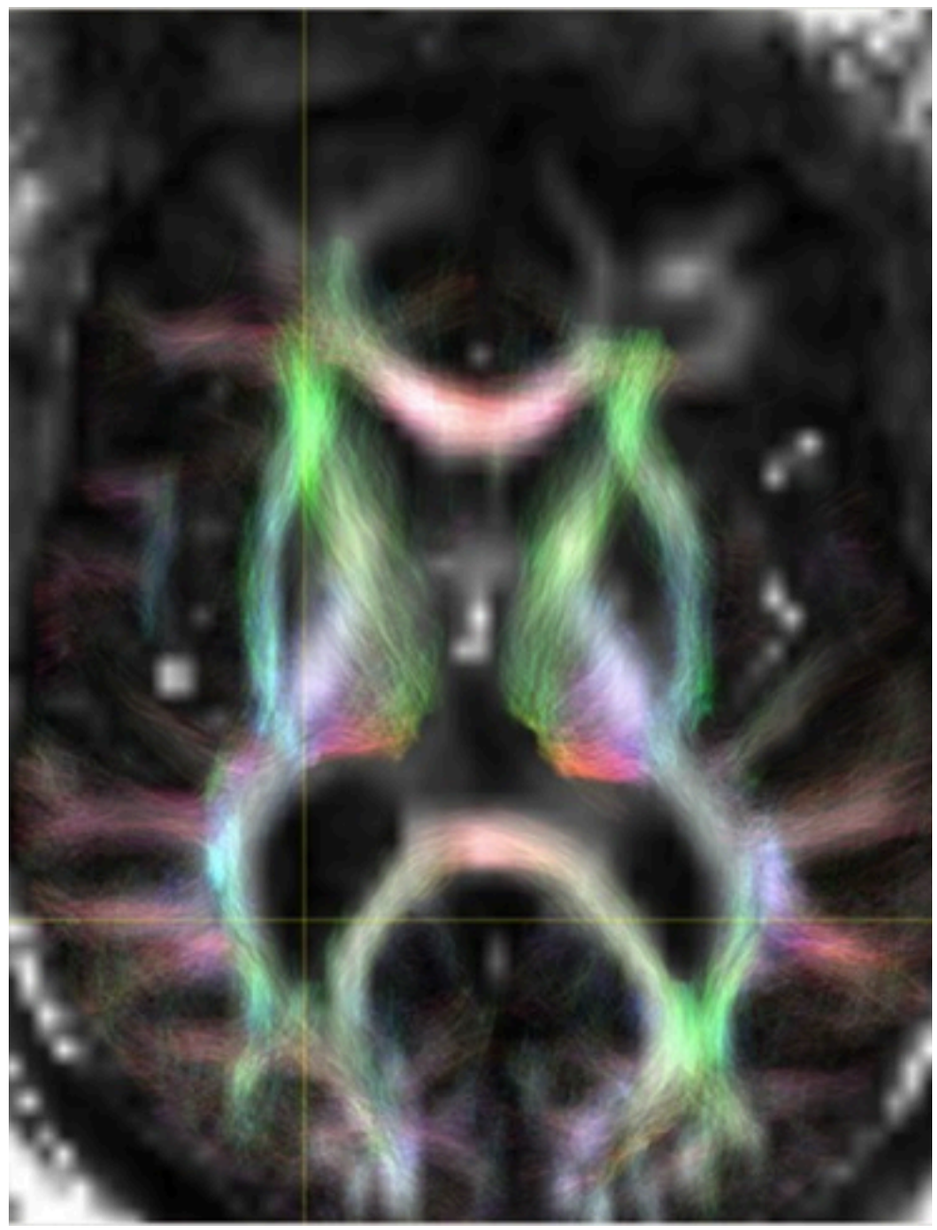
Bakshi et al, *Lancet Neurol,* 2008

- Développement: mesure atrophie/VBM

III. SEP

- Dével.: Diffusion (MD/FA/ DTI)

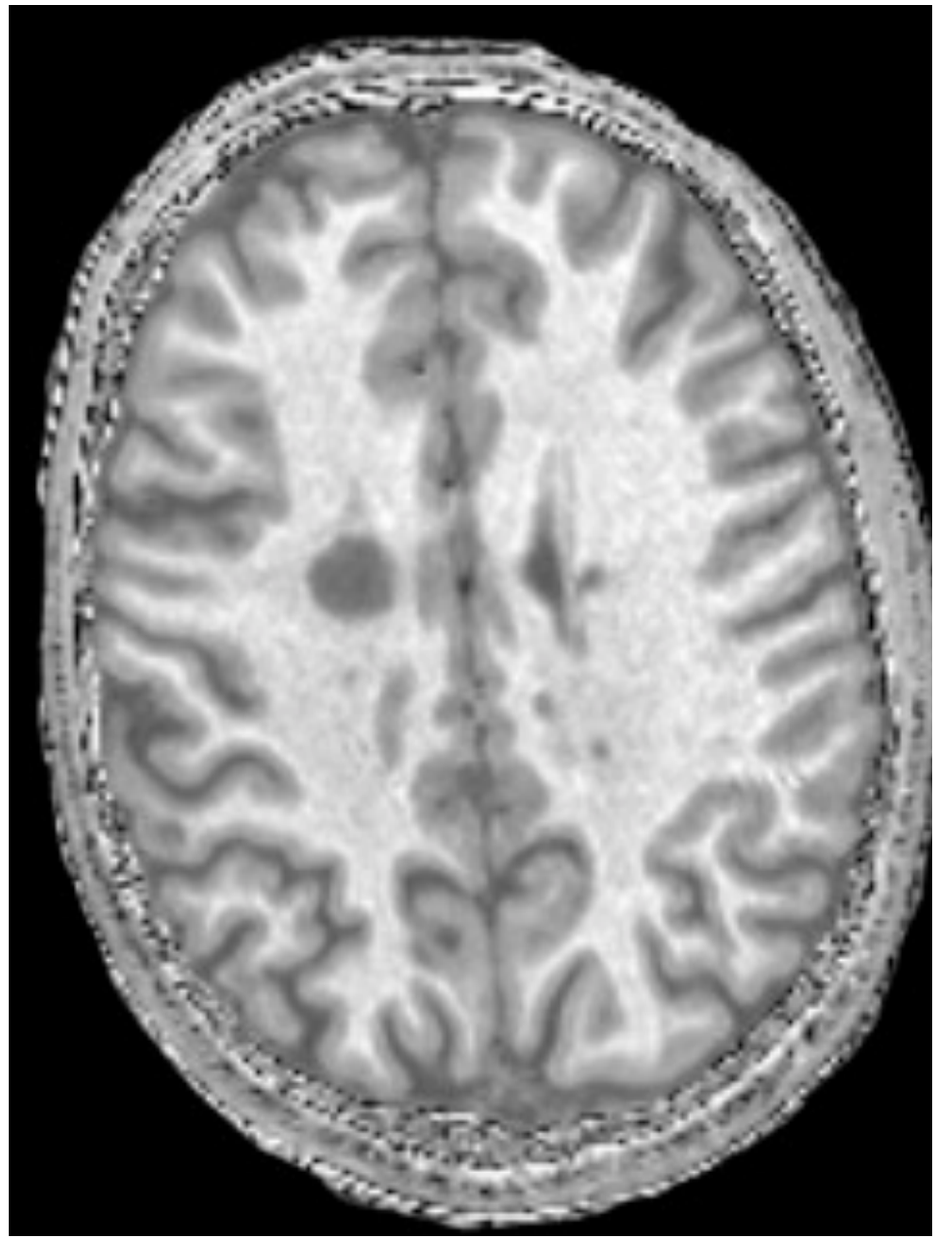




Liu, *Eur J Neurol*, 2011

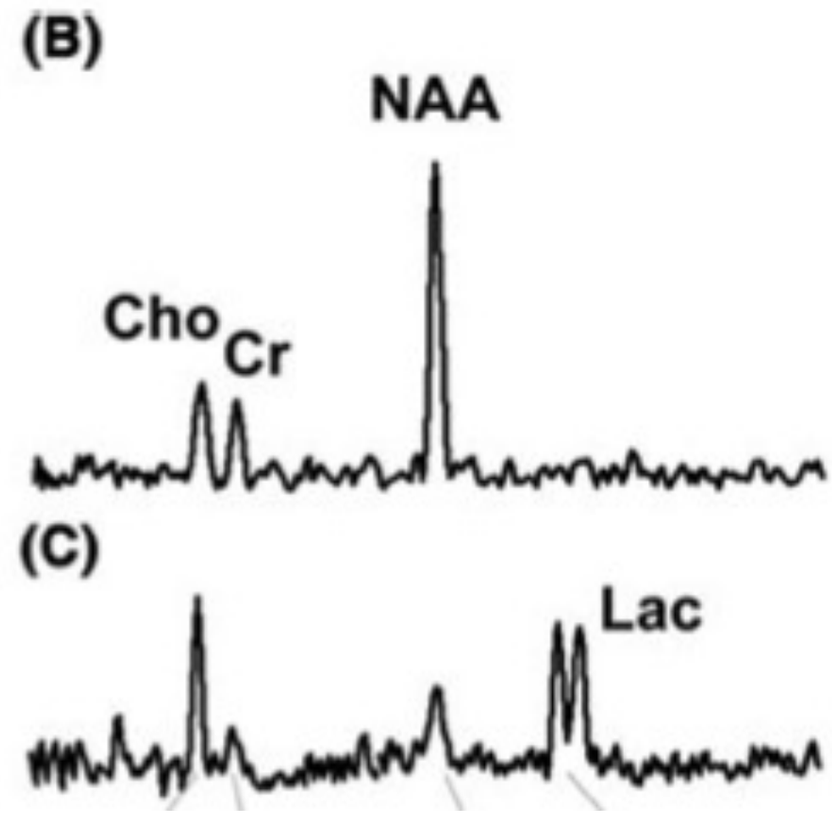
III. SEP

- Développement: Transfert de Magnétisation



III. SEP

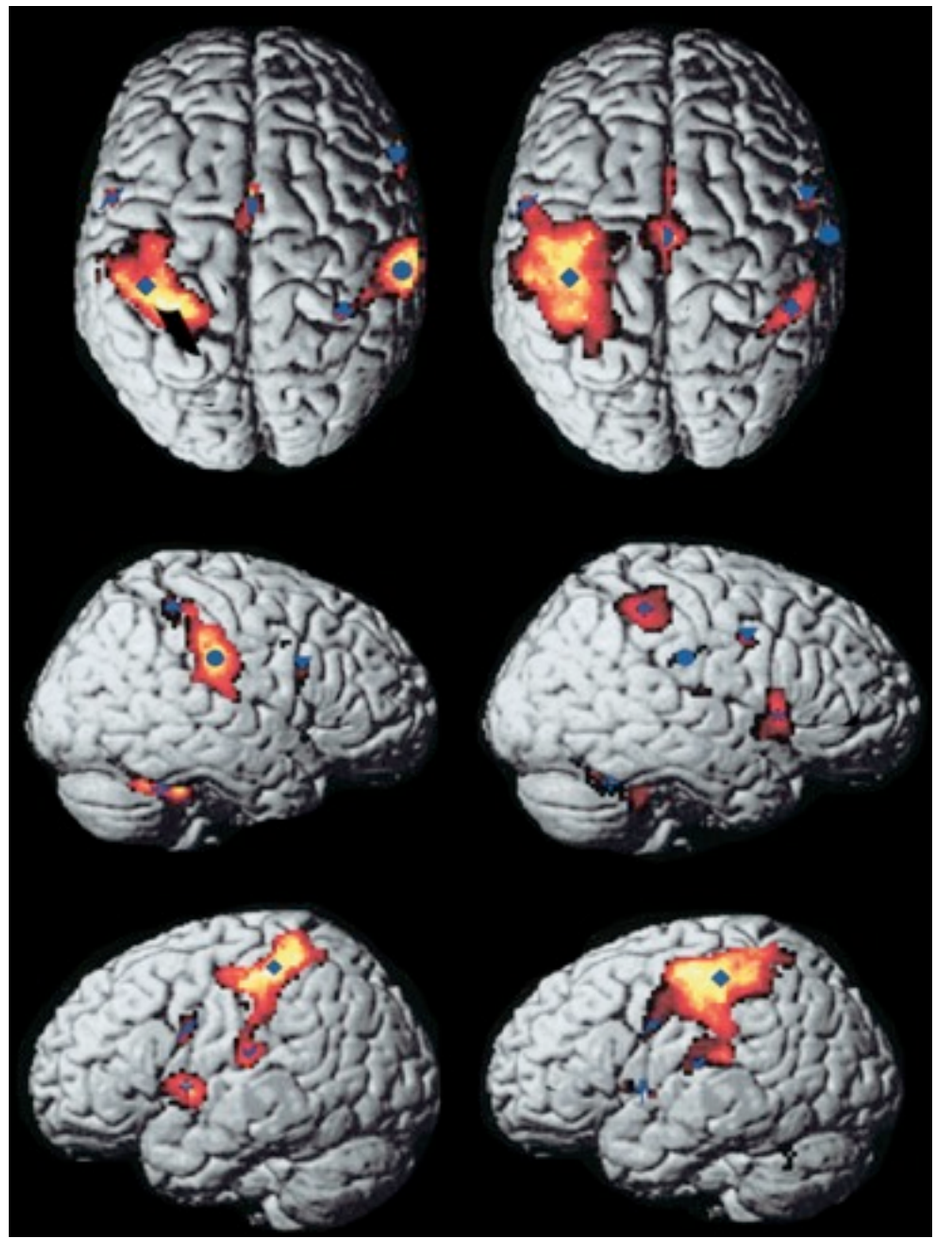
- H-MRS: mesure de certains métabolites reflétant l'intégrité structurelle et fonctionnelle du tissu cérébral.



Filippi et al, in: Handbook of multiple sclerosis, Cook (ed) 2006

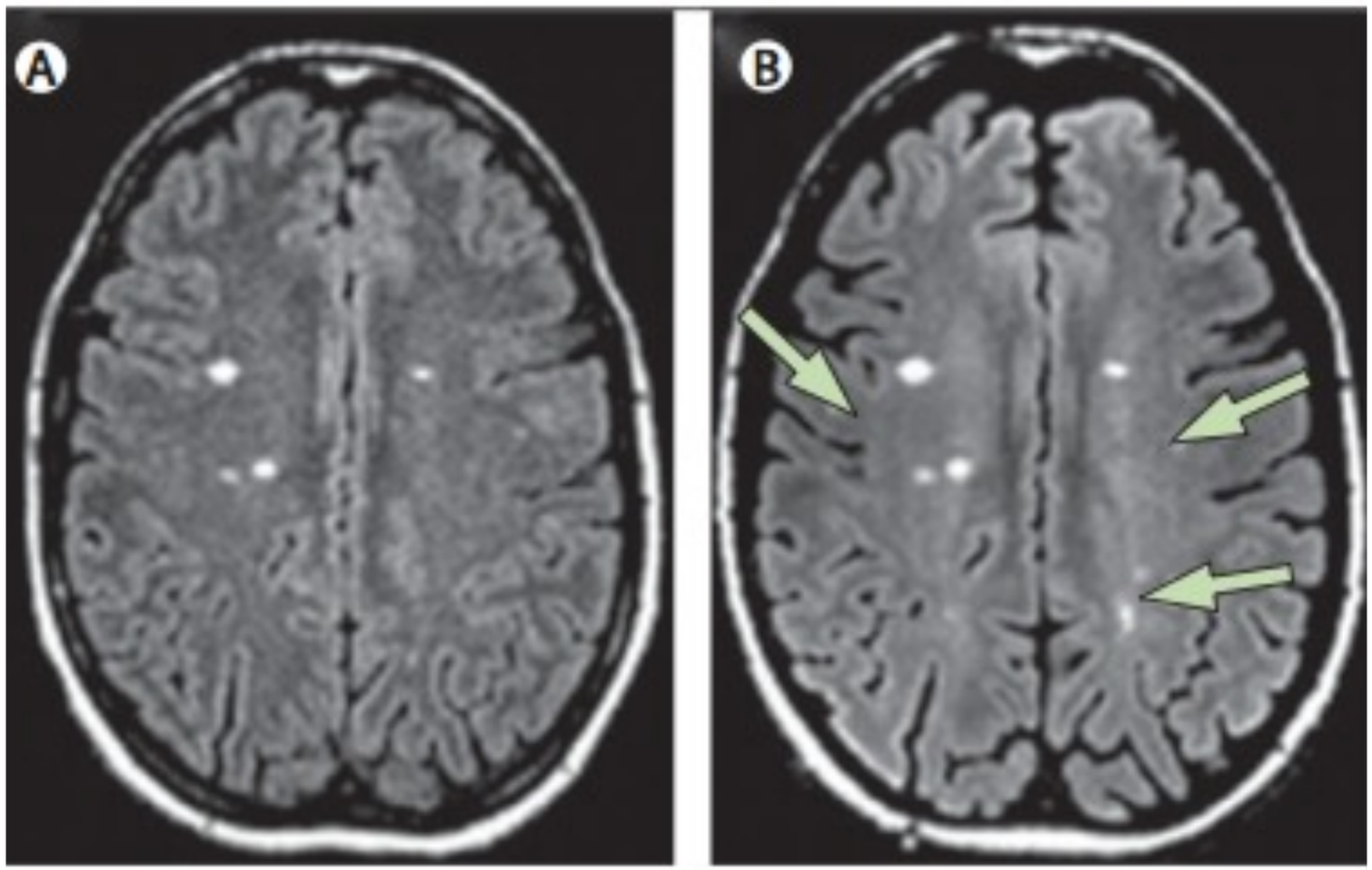
III. SEP

- Développement: fMRI
  - modification des RSNs y comprit DMN chez patients SEP
  - Modifications corrélées aux épreuves cognitives et au phénotype SEP
  - Pourrait représenter l'effet de la neuroplasticité initialement



Rocca et al, *Ann Neurol,* 2002

III. SEP

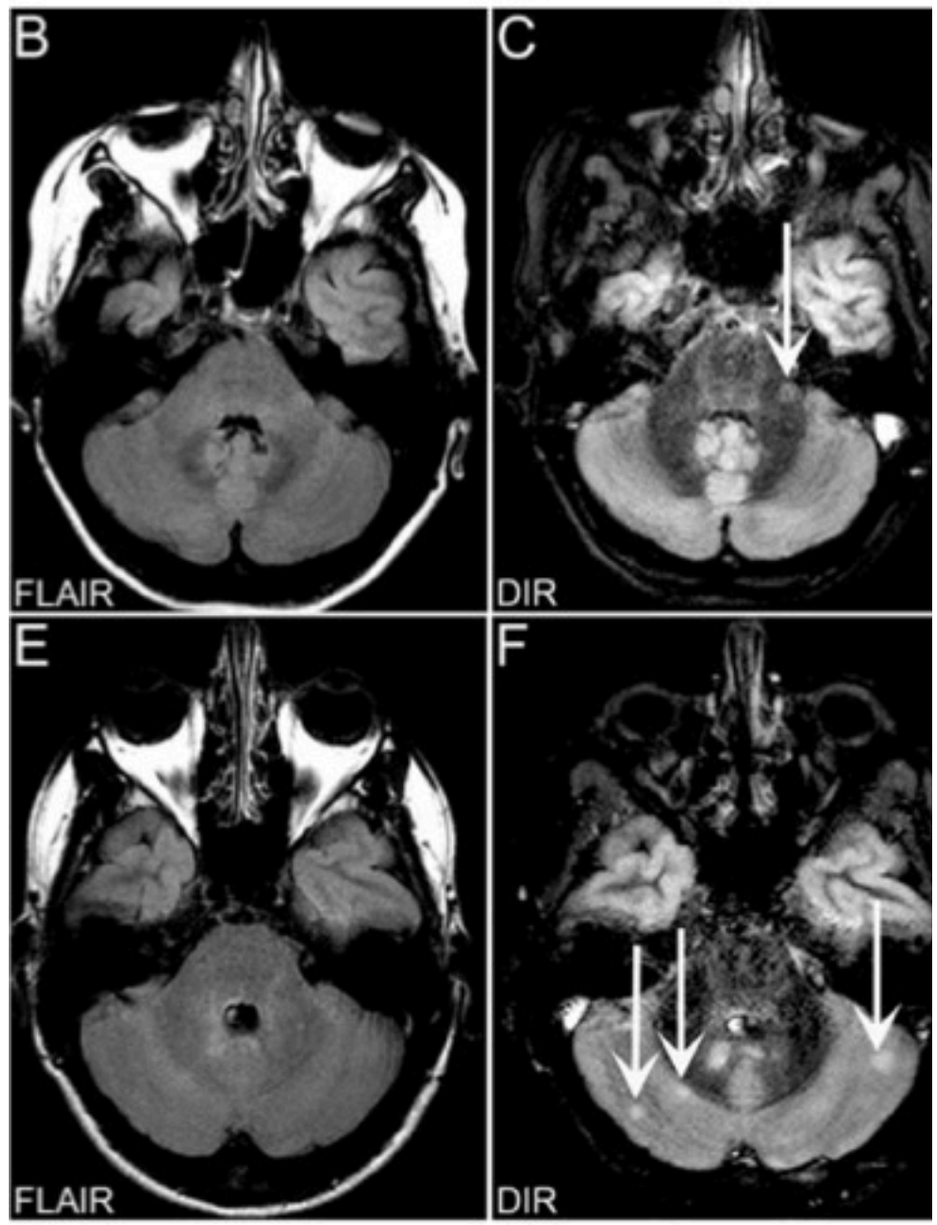


Bakshi et al, *Lancet Neurol* 2008

- Développement:UHF MRI
  - Permet de démontrer lésions plus fines, expliquant certaines anomalies des séquences non-conventionnelles dans NAWM
  - Permet de réaliser IRM au sodium (étude gradient Na + intra/extra => reflet intégrité membranaire)

III. SEP

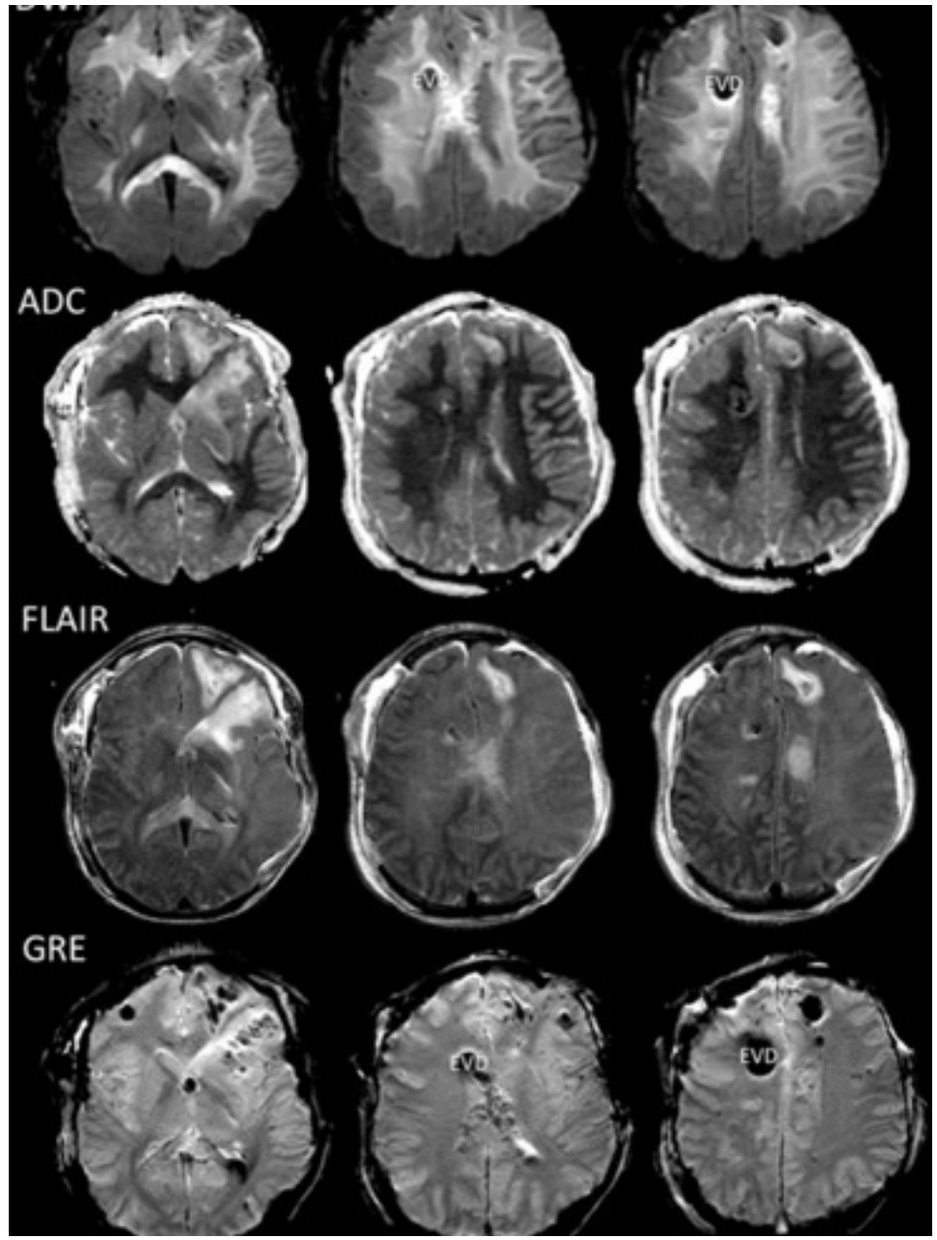
- Futur/autres:
  - MWF
  - Perfusion MRI
  - SWI
  - DIR
  - Iron deposit quantification
  - Connectome



Wattjes et al, *AJNR* 2007

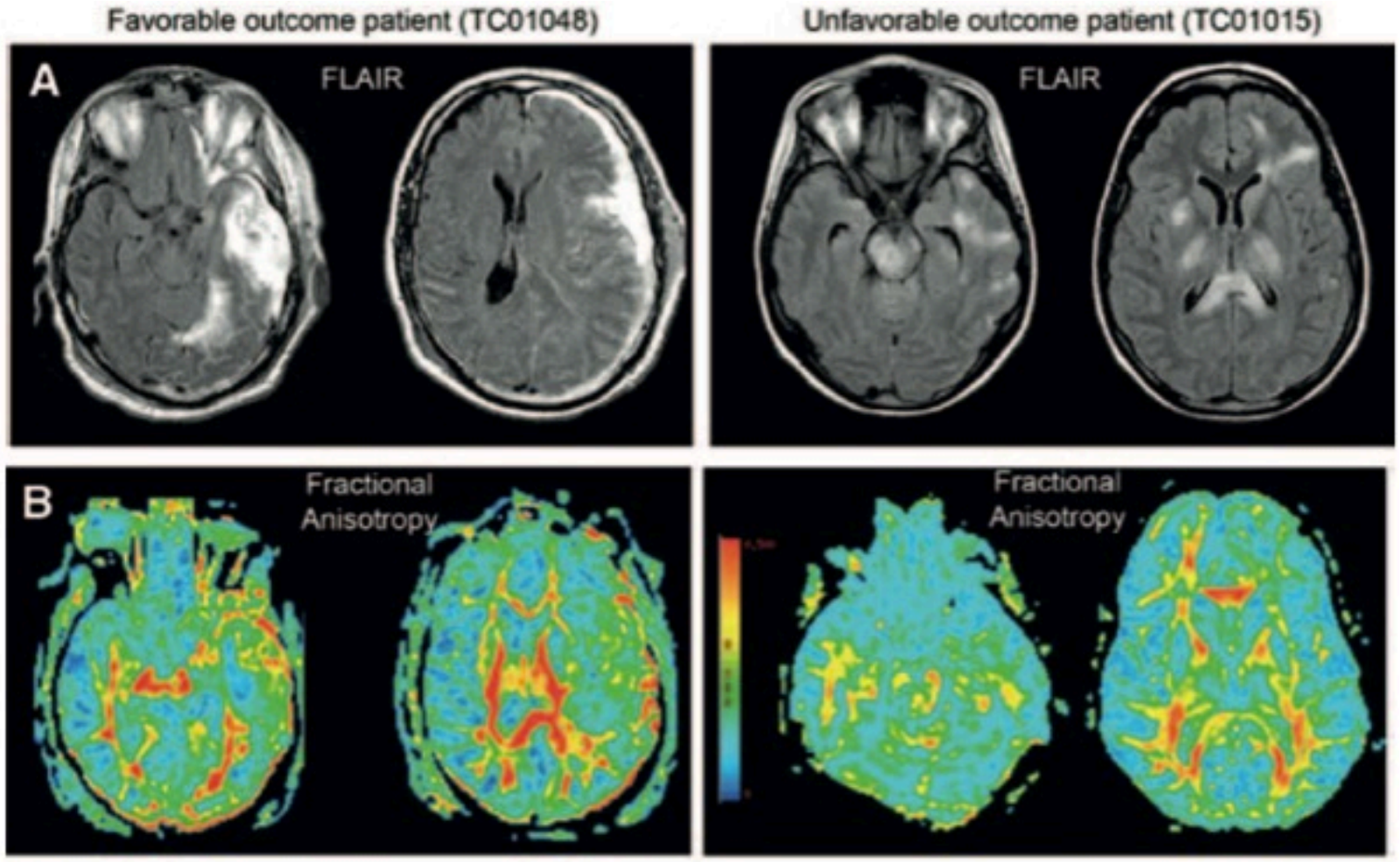
V. Trauma

- Traumatisme crânien sévère: CT-Scan Cérébral !
- Trauma léger/modéré: Canadian head-CT rule détermine nécessité de scanner.
- Place de la MRI: montre DAI, meilleure résolution pour tronc et fosse post. Peu/pas d'intérêt pour prise en charge aiguë.



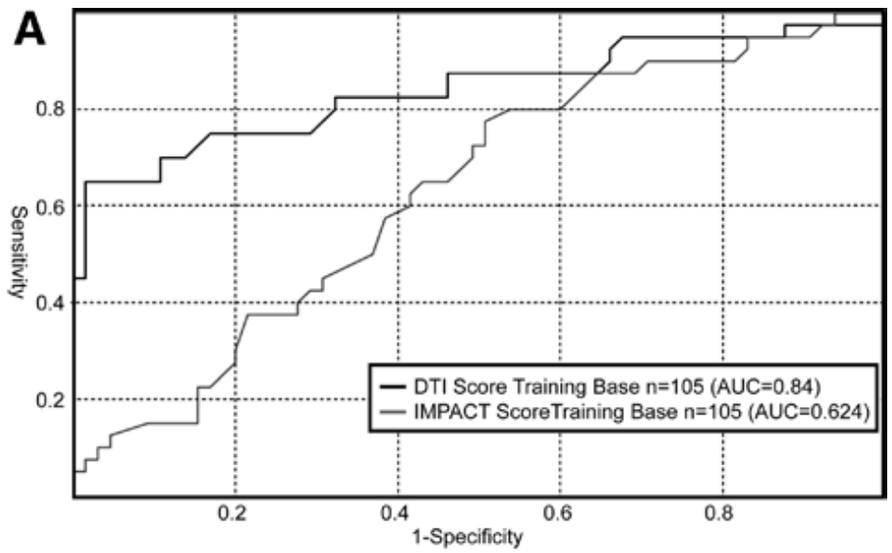
Edlow et al, *Neurocrit Care*, 2013

V. Trauma

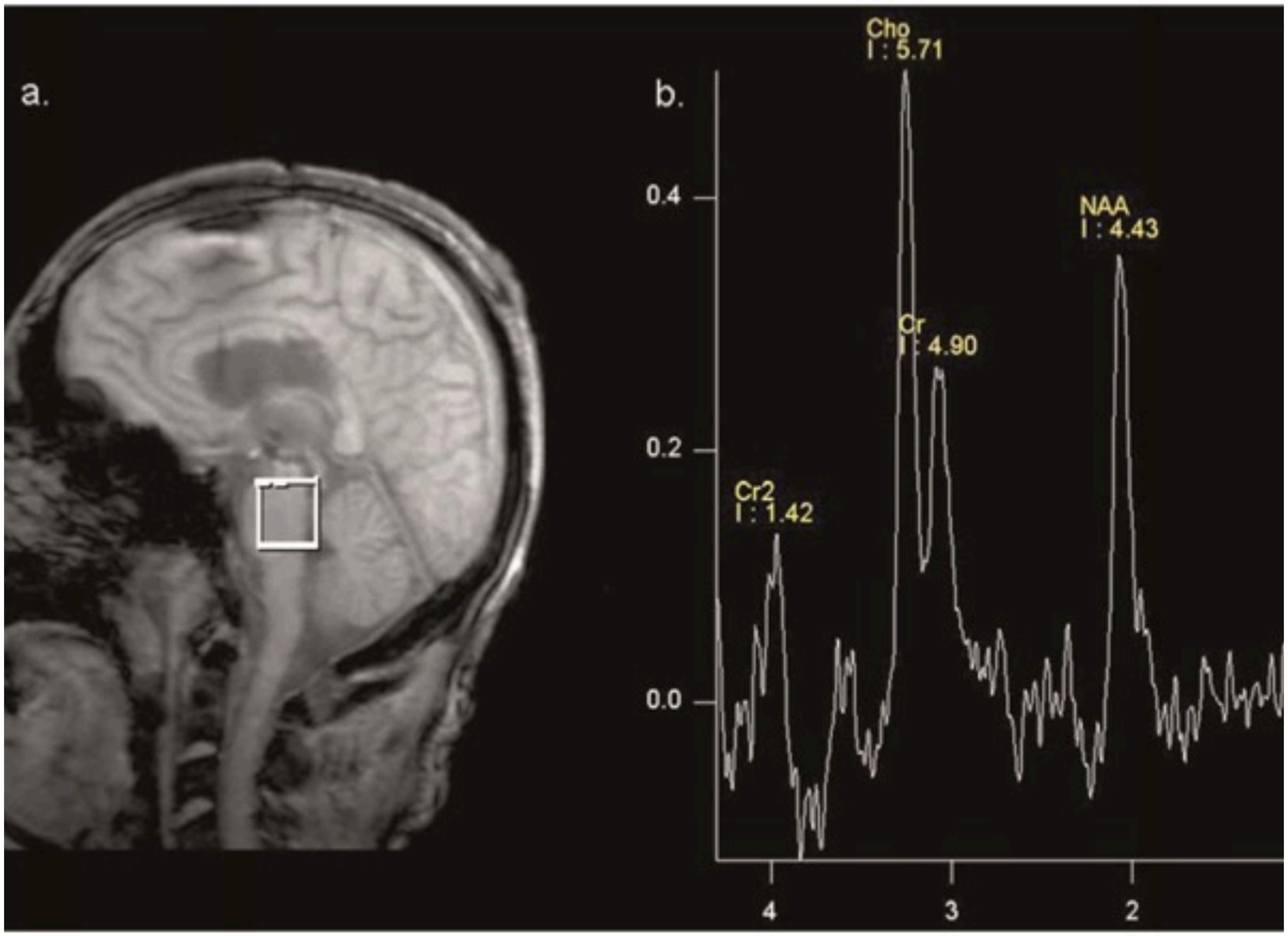


Galanaud *et al, Anesthesiology,* 2012

- En développement: utilisation IRM (DTI) en aigu comme outil pronostic



V. Trauma

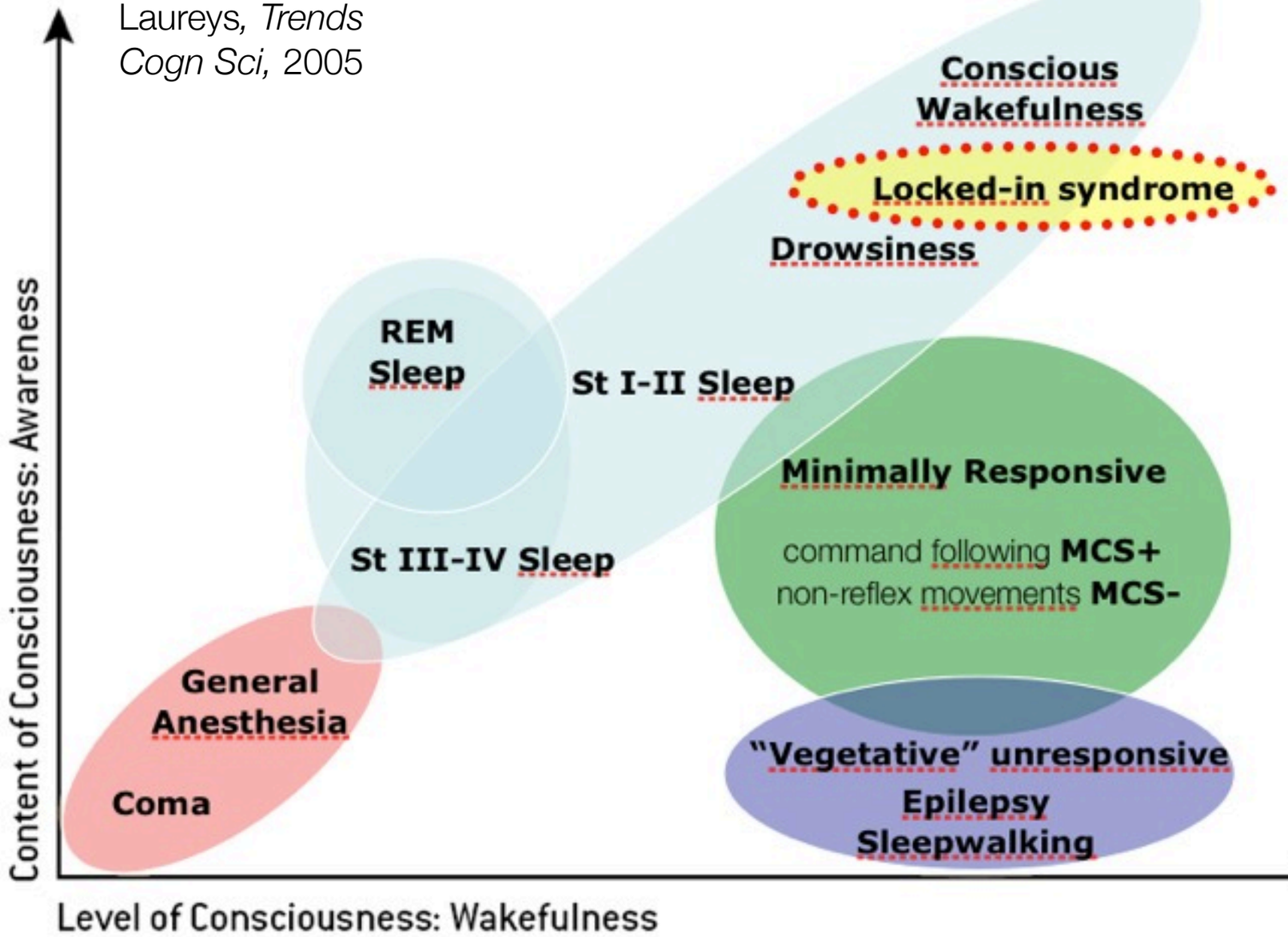


Tshibanda et al, *Prog Brain Res,* 2009

- Développement: H-MRS
  - NAA/Cr plus faible chez patients avec mauvais outcome (GOS 1-3)
  - GOS anti-corrélé avec NAA et corrélé avec La

V. Trauma

Laureys, *Trends Cogn Sci*, 2005

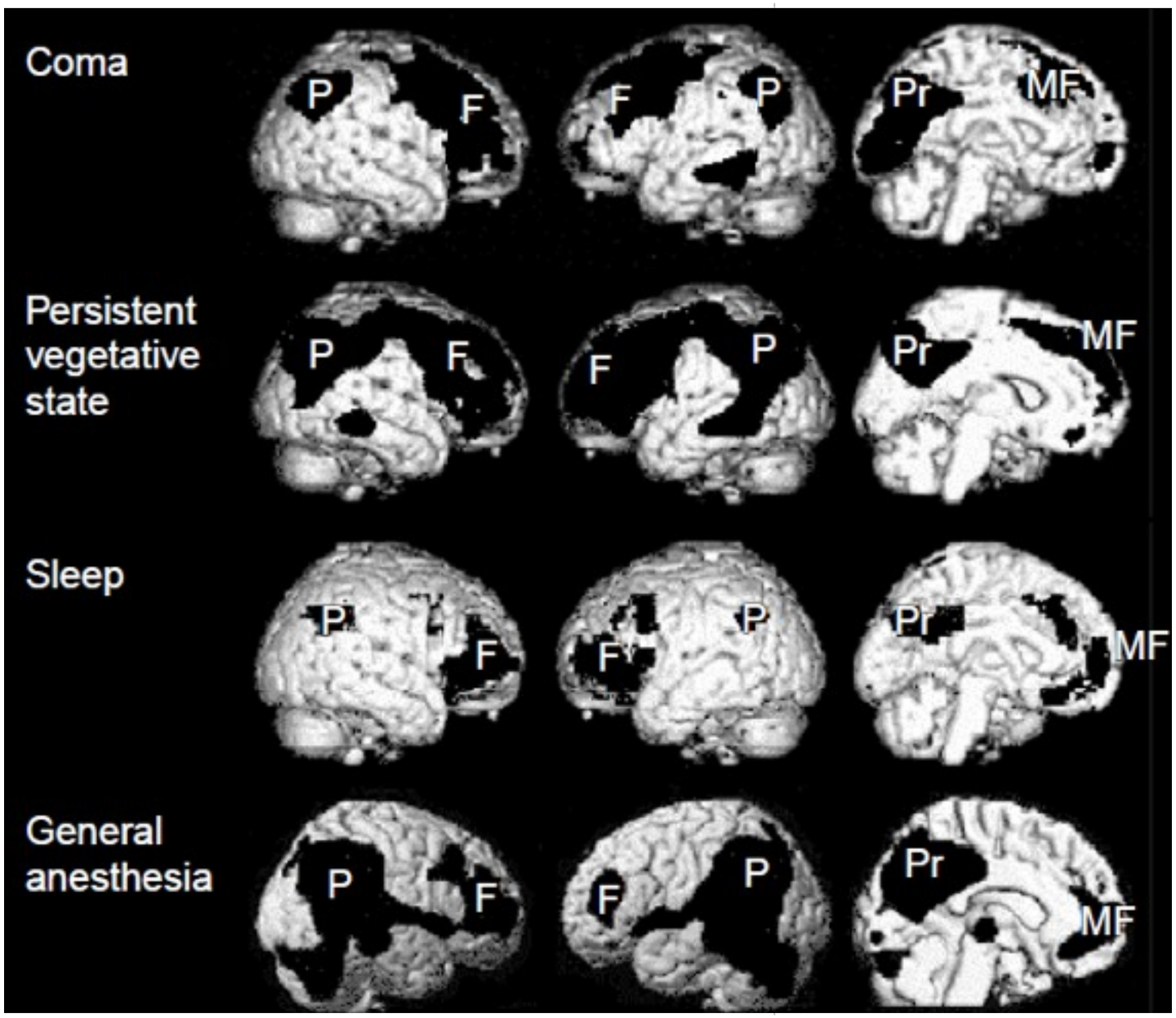


JFK COMA RECOVERY SCALE - REVISED ©2004
Record Form

Patient: Date:								
AUDITORY FUNCTION SCALE								
4 - Consistent Movement to Command *								
3 - Reproducible Movement to Command *								
2 - Localization to Sound								
1 - Auditory Startle								
0 - None								
VISUAL FUNCTION SCALE								
5 - Object Recognition *								
4 - Object Localization: Reaching *								
3 - Visual Pursuit *								
2 - Fixation *								
1 - Visual Startle								
0 - None								
MOTOR FUNCTION SCALE								
6 - Functional Object Use †								
5 - Automatic Motor Response *								
4 - Object Manipulation *								
3 - Localization to Noxious Stimulation *								
2 - Flexion Withdrawal								
1 - Abnormal Posturing								
0 - None/Flaccid								
OROMOTOR/VERBAL FUNCTION SCALE								
3 - Intelligible Verbalization *								
2 - Vocalization/Oral Movement								
1 - Oral Reflexive Movement								
0 - None								
COMMUNICATION SCALE								
2 - Functional: Accurate †								
1 - Non-Functional: Intentional *								
0 - None								
AROUSAL SCALE								
3 - Attention								
2 - Eye Opening w/o Stimulation								
1 - Eye Opening with Stimulation								
0 - Unarousable								
TOTAL SCORE								

Giacino, *Arch Phys Med Rehab* , 2004

V. Trauma



PET-CT

Vigilance conservée
Pas de «conscience»

Pas de vigilance
Pas de «conscience»

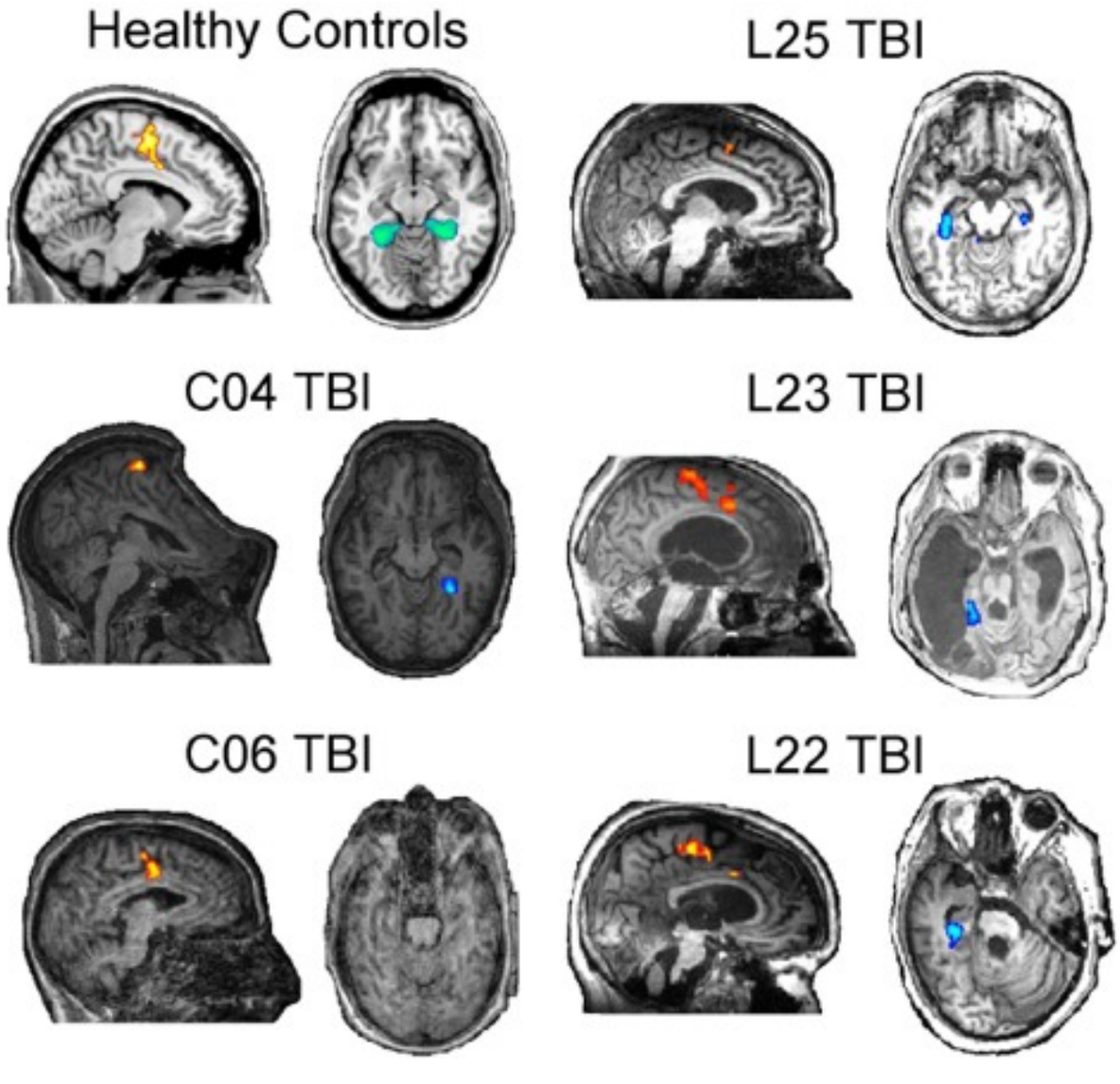
TRENDS in Cognitive Sciences

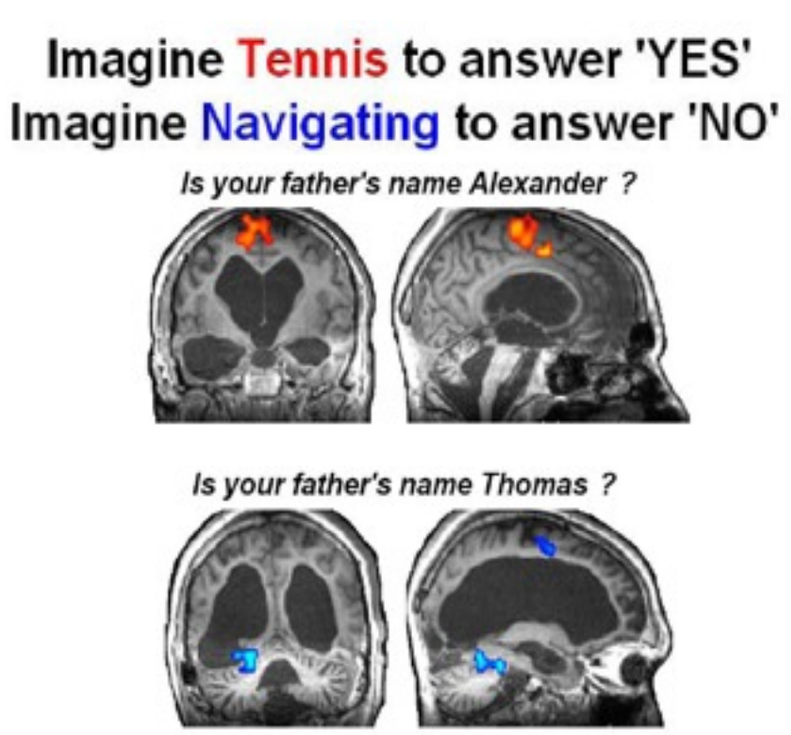
Baars, Ramsoy, Laureys,
Trends in Neurosciences
2003

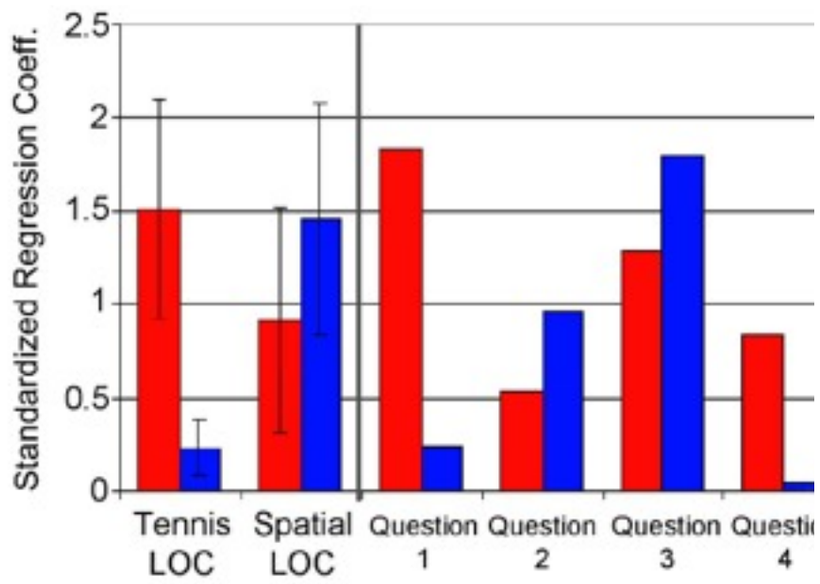
V. Trauma

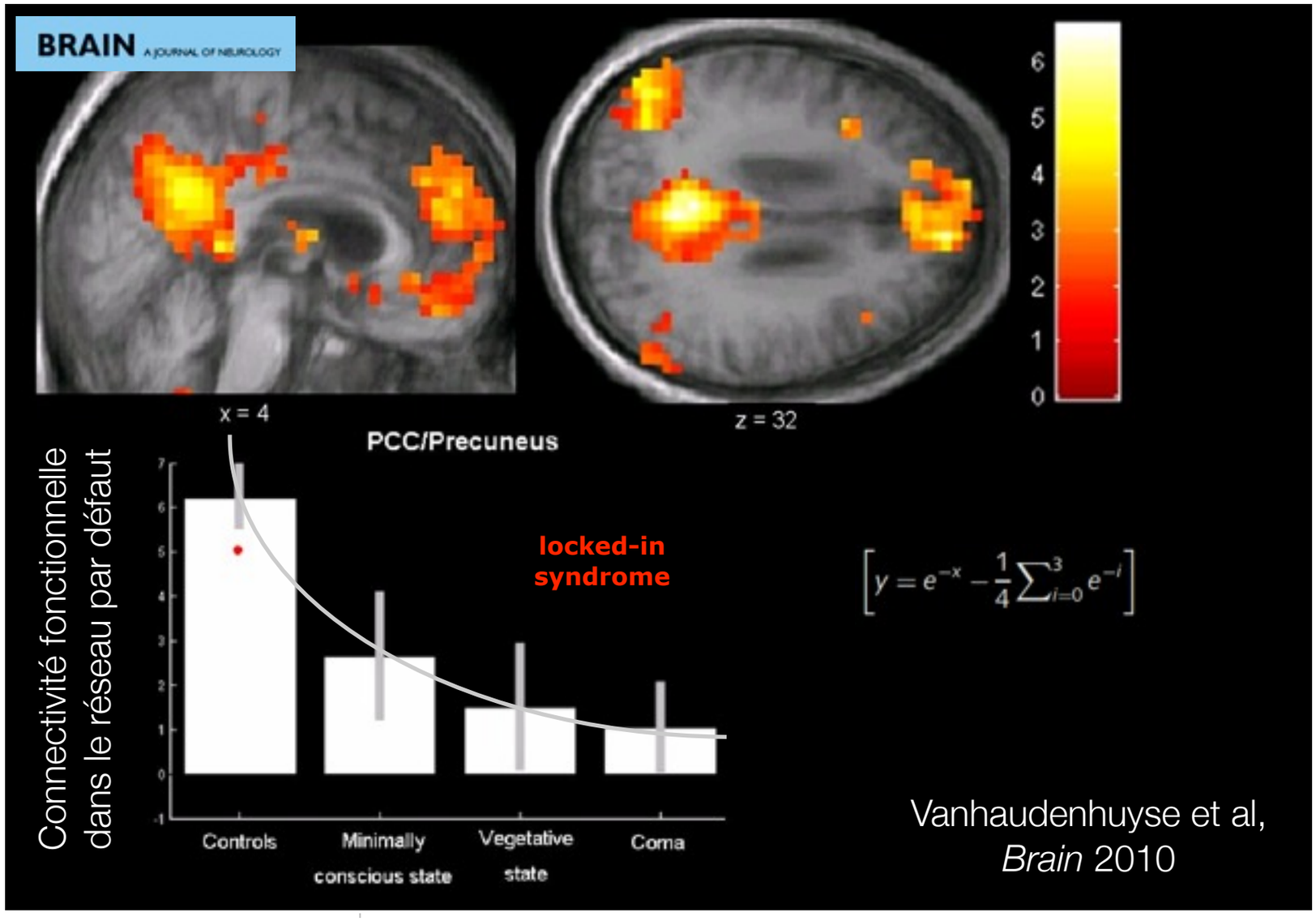
- fMRI: paradigme actif

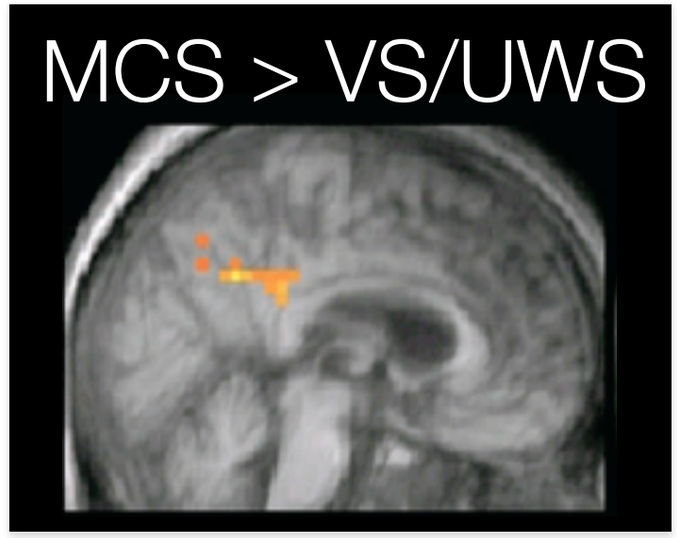
Monti & Vanhaudenhuyse, et al
New England J Med 2010









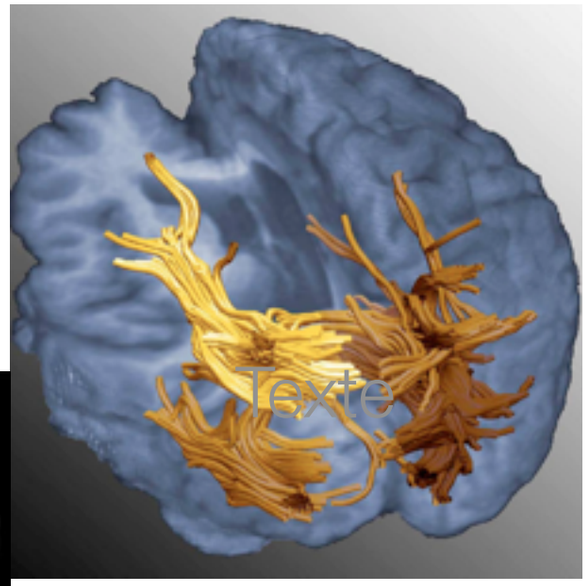


V. Trauma

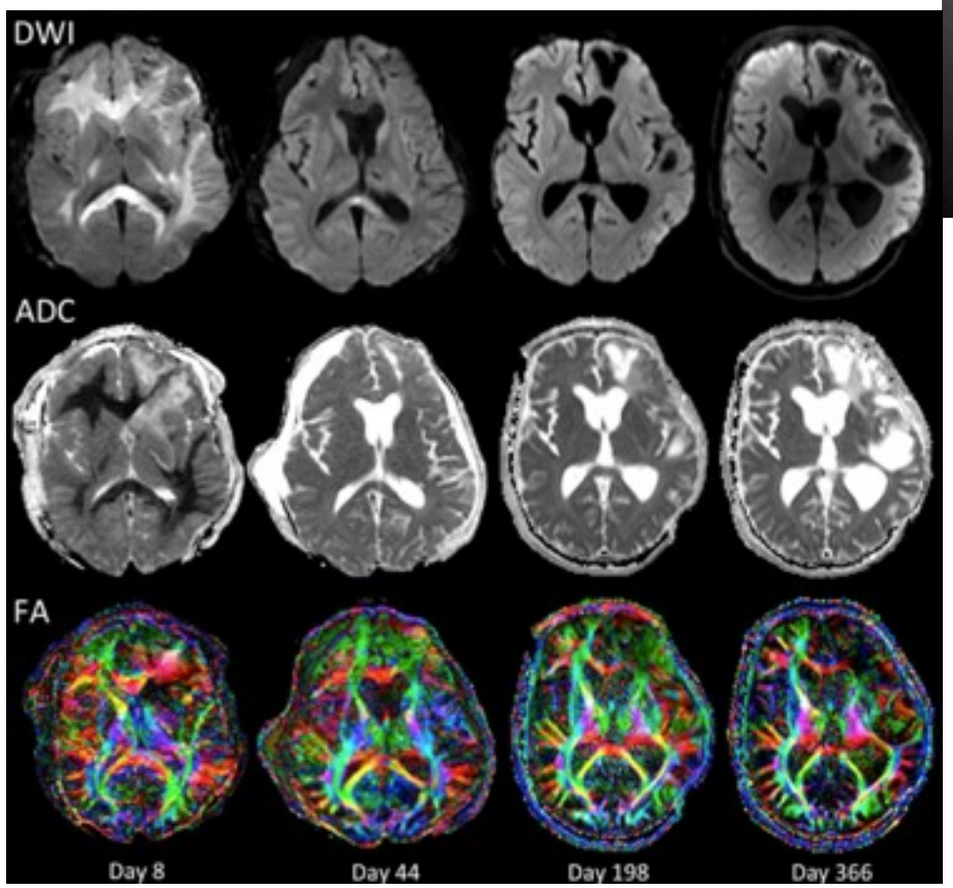
- fMRI: resting state

V. Trauma

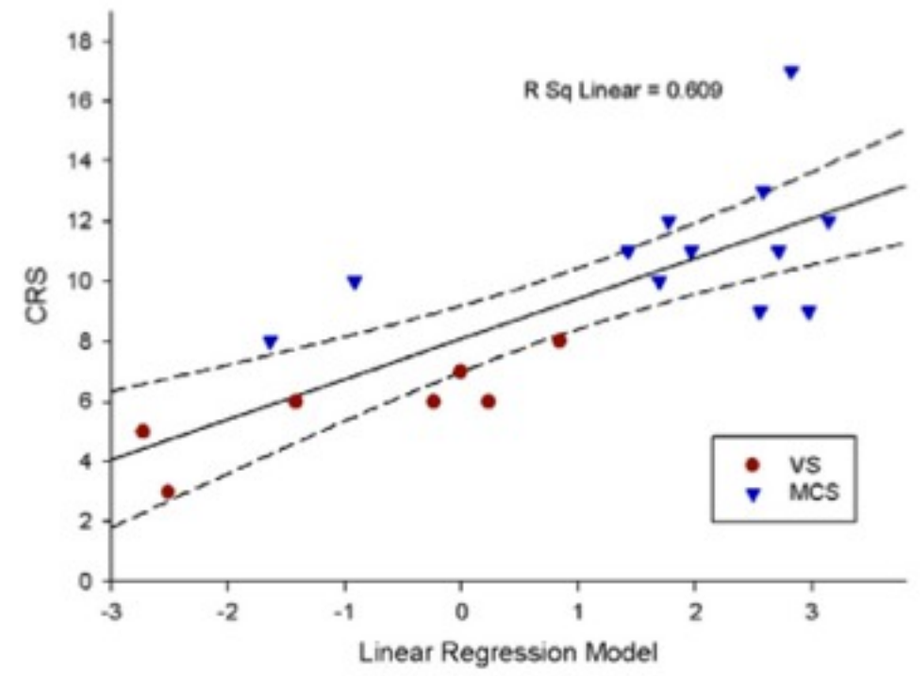
- Diffusion et DTI



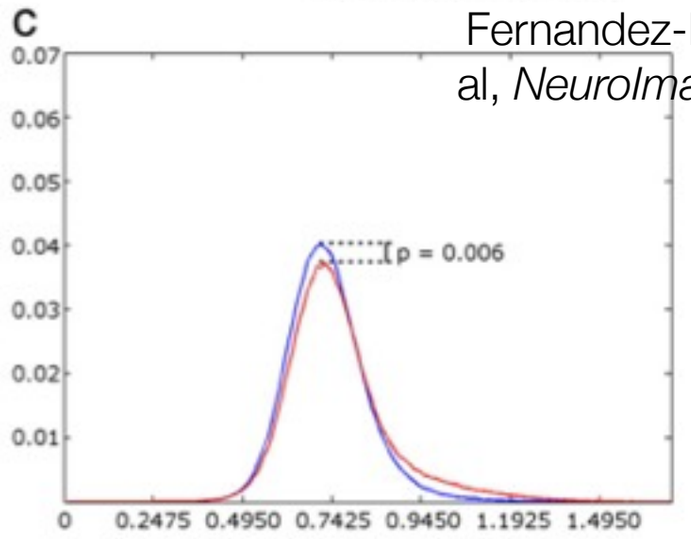
Voss et al, *J Clin Invest*, 2006



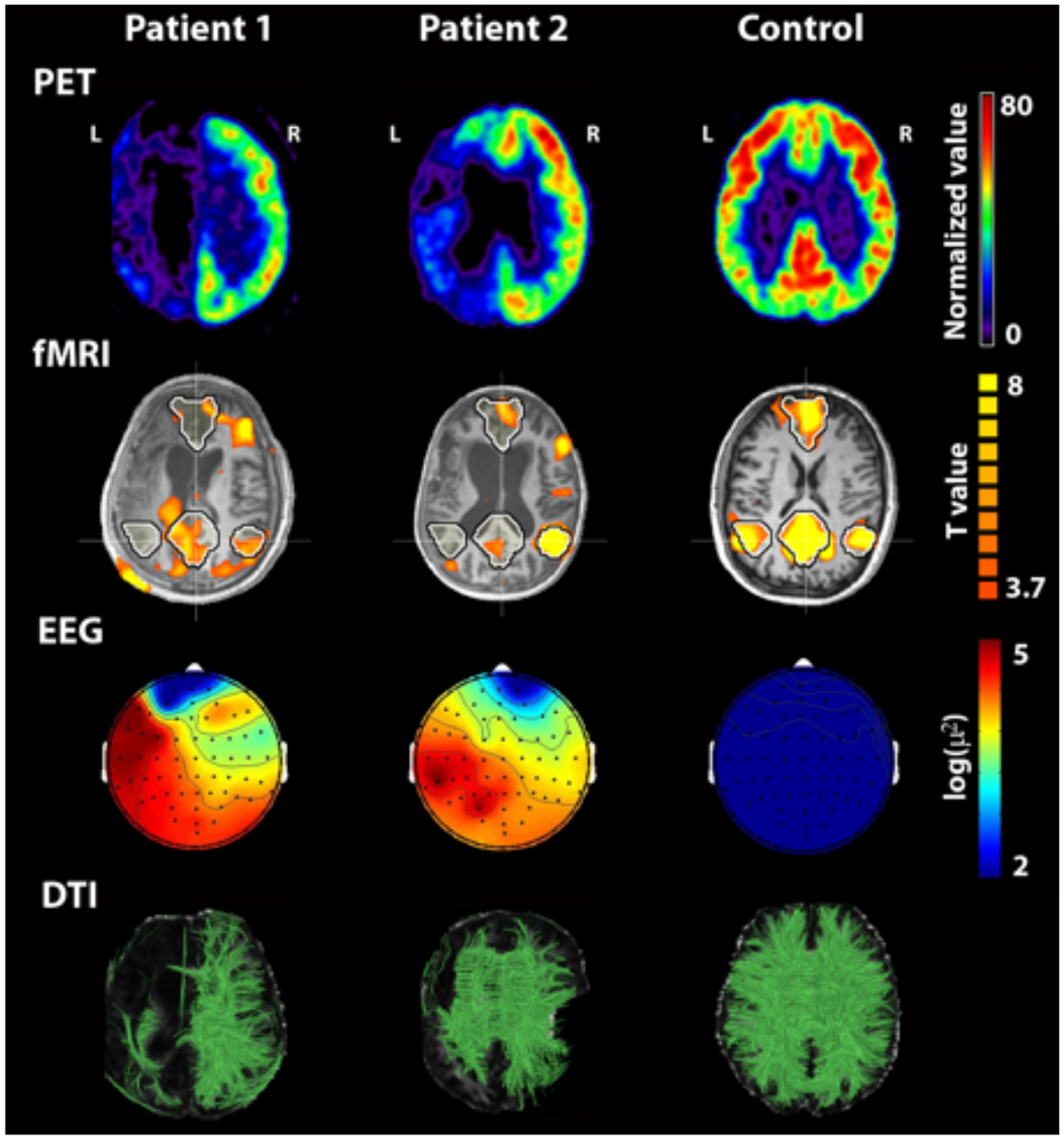
Edlow et al, *Neurocrit Care*, 2013



Fernandez-Espejo et al, *NeuroImage*, 2011

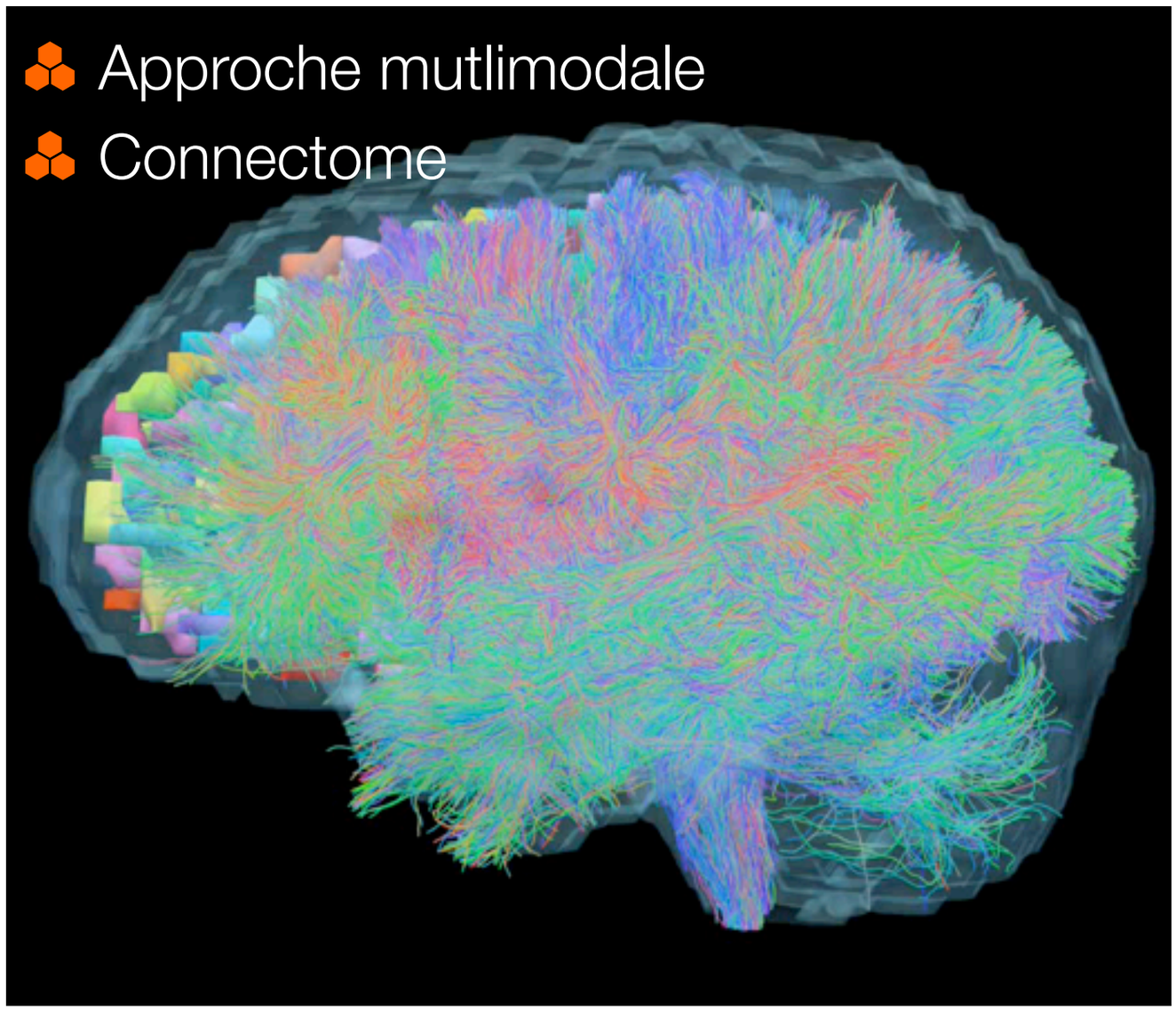


V. Trauma



Bruno et al, *Prog Brain Res,* 2011

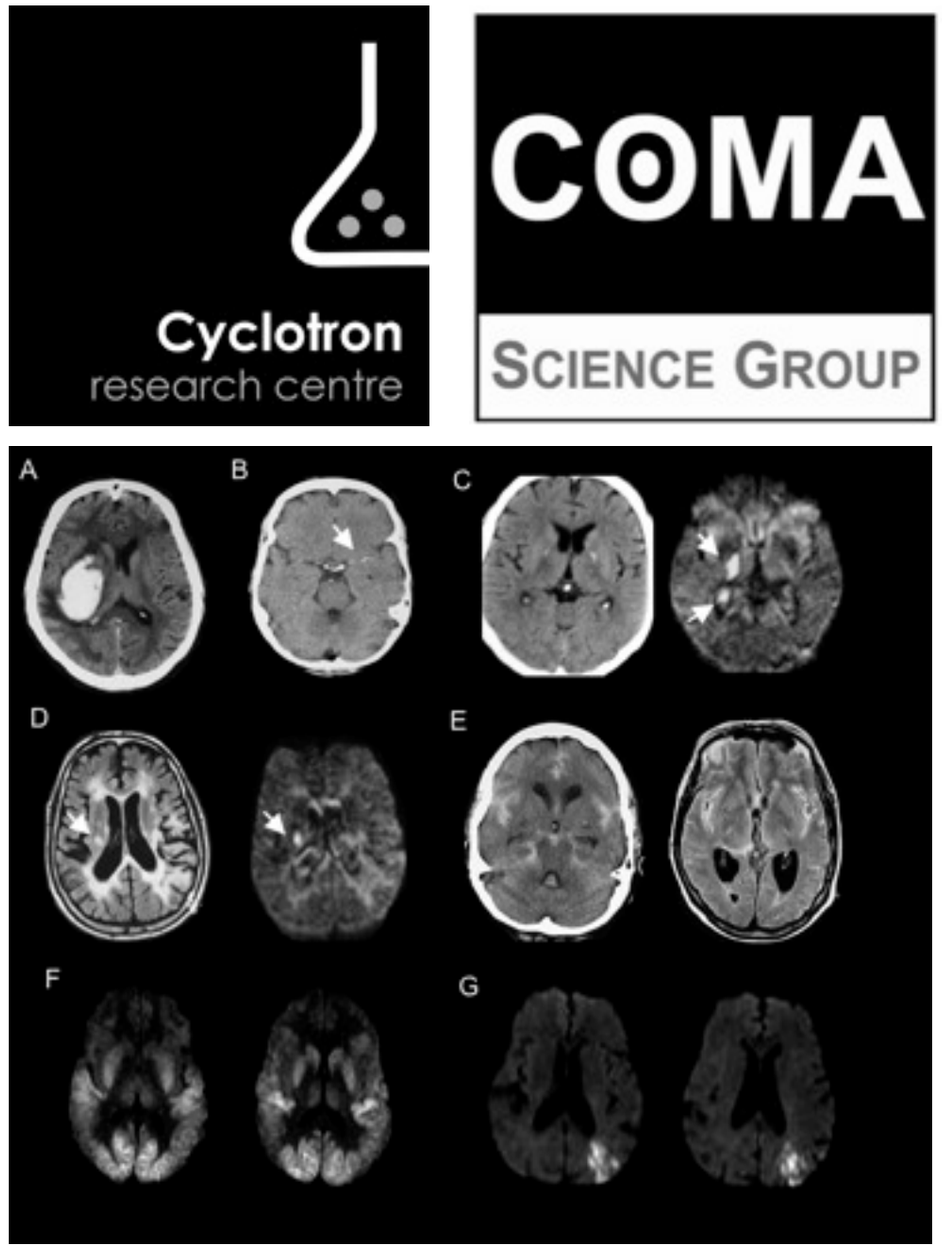
- Approche mutlimodale
- Connectome



Erik Ziegler, *Cyclotron Art Committee*

VI. Conclusion

- Merci.
- L’ensemble des illustrations non référencées dans la partie SEP m’ont été gentiment fournies par le Dr E. Lommers, que je remercie chaleureusement.



Bodart & Laureys, *OUP (ed Filippi),* 2014