Projet Transversal SEP → *MUSIC* !

➔ improve the understanding and the follow-up of MS pathologies

Françoise DURAND-DUBIEF, Thomas GRENIER

Team MYRIAD: Michael SDIKA (30%), Hugues BENOIT-CATTIN (10%), Thomas GRENIER (30%)

Team MAGICS: Hélène RATINEY (30%), François COTTON (30%), Dominique SAPPEY-MARINIER (20%), Eric VAN REETH (10%), Olivier BEUF (10%), Françoise DURAND-DUBIEF (30%)

Plateforme Pilot: Denis GRENIER (10%), Sophie GAILLARD (10%)

Plateforme VIP: Sorina POP (10%)

Informatic and Development Department: Frederic CERVENANSKY

Main Results

- ~29 Proceeding and publications
- Collaborations (publications/projects) with
  - **International** : Harvard Medical School (C. Guttmann), American University of Beirut Medical Center (Lebanon, Salem Hanoun), DEMACS (Italy, Claudio Stamile), DICEAM (Italy), Institute of Clinical Research Odenese (Denmark)
  - **National** : Grenoble Institute of Neurosciences, Institut de Bio-Imagerie de Bordeaux, Toulouse NeuroImaging Center, Icube (A. Attye),
  - **Clinical centers** : CERMEP, HCL, CHU Nimes,
  - **National MS groups** : EDMUS, OFSEP

Examples :
- Seasonality in MS (Charles Guttmann)
- Correlation between biomarkers of inflammation and biomarkers in MRI (Eric Thouvenot, Charles Guttmann, Zsolt Iles)

Main Results

- Structural imaging and tissue characterization for a better prediction of the disease course in MS patients (Dominique Sappey-Marinier)
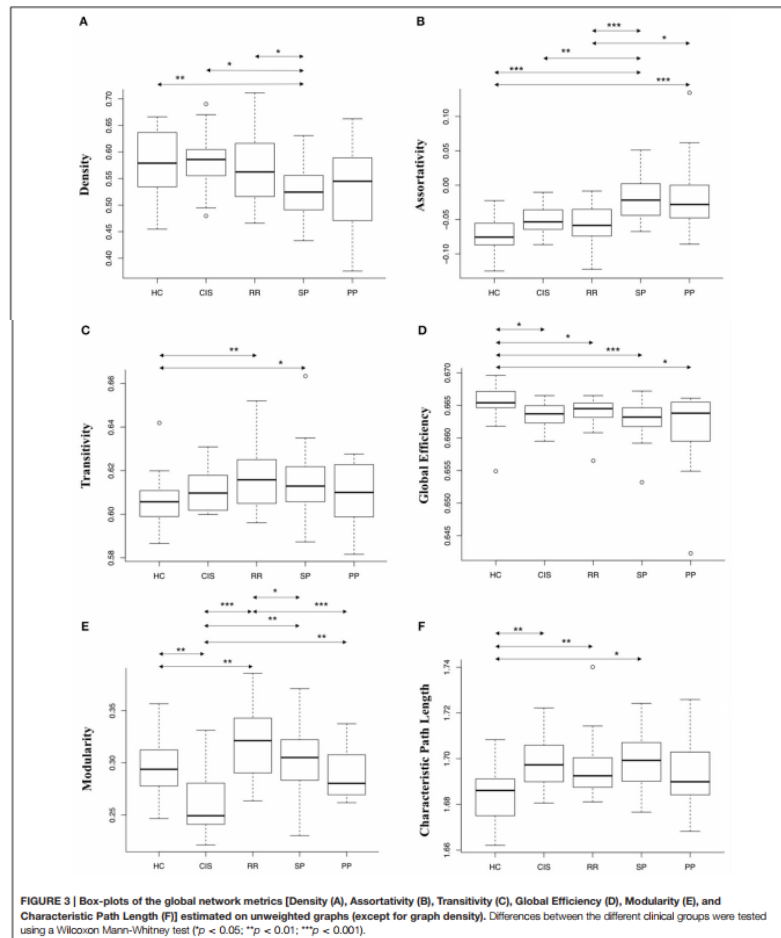

FIGURE 3 | Box-plots of the global network metrics [Density (A), Assortativity (B), Transitivity (C), Global Efficiency (D), Modularity (E), and Characteristic Path Length (F)] estimated on unweighted graphs (except for graph density). Differences between the different clinical groups were tested using a Wilcoxon Mann-Whitney test ($^*p < 0.05$; $^{**}p < 0.01$; $^{***}p < 0.001$).

Graph Theory-Based Brain Connectivity for Automatic Classification of Multiple Sclerosis Clinical Courses

Gabriel Kocevar[1][†], Claudio Stamile[1][†], Salem Hannoun[1,2], François Cotton[1,3], Sandra Vukusic[4], Françoise Durand-Dubief[1,4] and Dominique Sappey-Marinier[1,5*]

Main Results

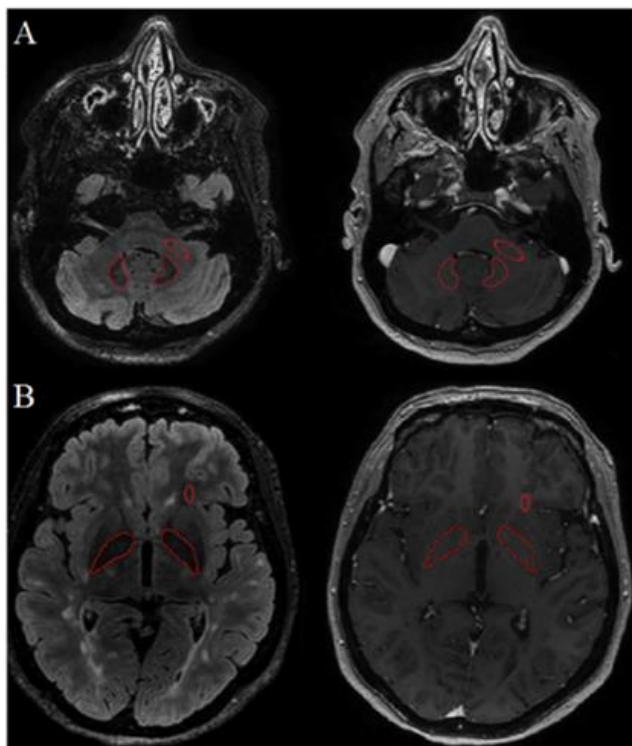- Gadolinium deposition in MS (François Cotton, Dominique Sappey-Marinier, Françoise Durand-Dubief)

Fig. 1. Delineation of the dentate nucleus with the middle cerebellar peduncle (A), and the globus pallidus with the semioval white matter (B) regions of interest on 3D FLAIR images (registered on the enhanced T1-weighted images).

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Research article

Weekly enhanced T1-weighted MRI with Gadobutrol injections in MS patients: Is there a signal intensity increase in the dentate nucleus and the globus pallidus?

Paul Jaulent[a], Salem Hannoun[b,c], Gabriel Kocevar[b], Fabien Rollot[d,e], Francoise Durand-Dubief[a,b,d], Sandra Vukusic[a,b,d], Jean-Christophe Brisset[e], Dominique Sappey-Marinier[a,b,f], Francois Cotton[a,b,g,*]

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[d] Service de Neurologie A and Eugène Devic EDMUS Foundation against Multiple Sclerosis, Hôpital Neurologique Pierre Wertheimer, Hospices Civils de Lyon, 69677, Bron, France
[e] Observatoire Français de la Sclérose en Plaques, Université de Lyon, 69677, Bron, France
[f] CERMEP-Imagerie du Vivant, Université de Lyon, 69677, Bron, France
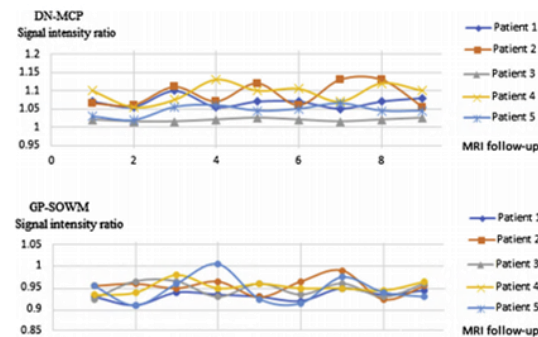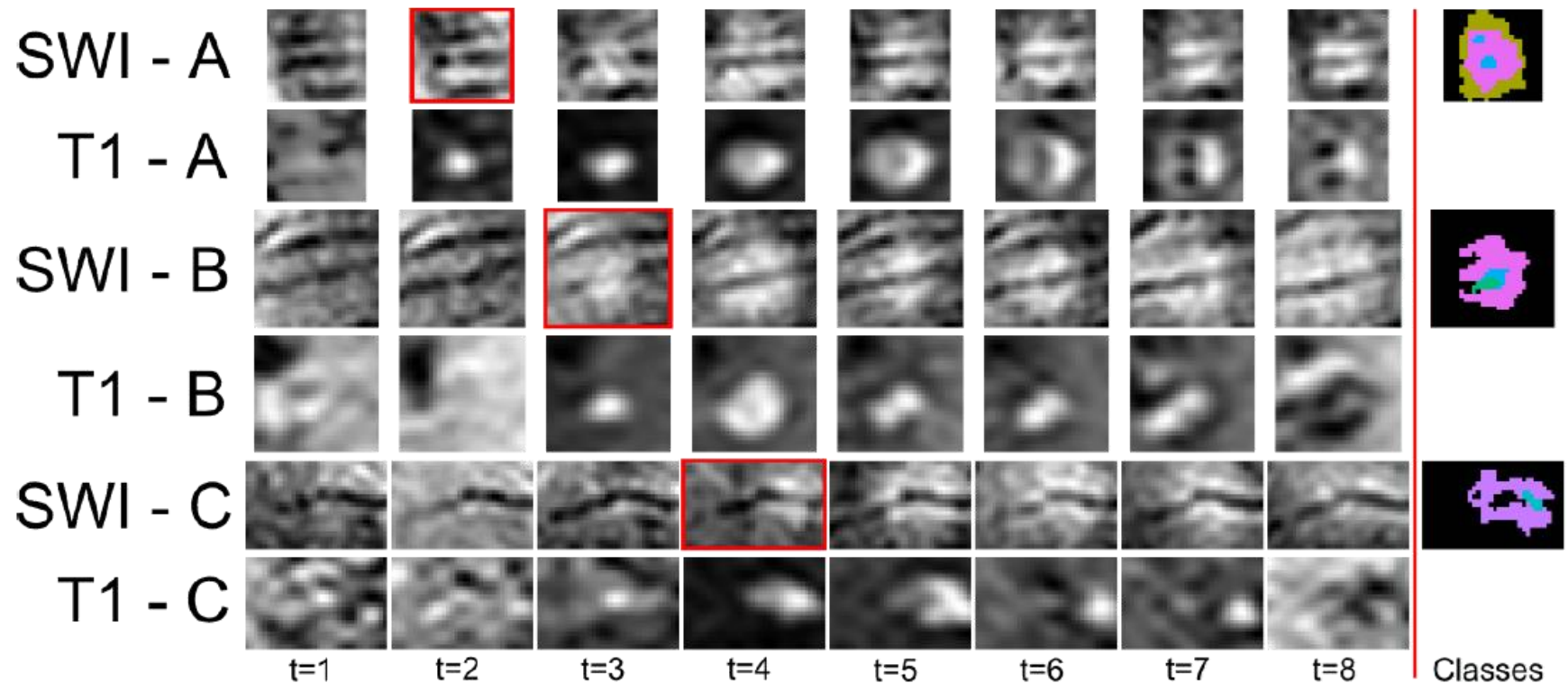[g] Service de Radiologie, Centre Hospitalier Lyon Sud, Hospices Civils de Lyon, 69310, Pierre Bénite, France

Fig. 2. Evolution of DN-MCP and GP-SOWM signal intensity ratio over the eight weeks period and six months after the beginning. (DN = Dentate Nucleus; MCP = Middle Cerebellar Peduncle; GP = Globus Pallidus; SOWM = Semi-Oval White Matter).
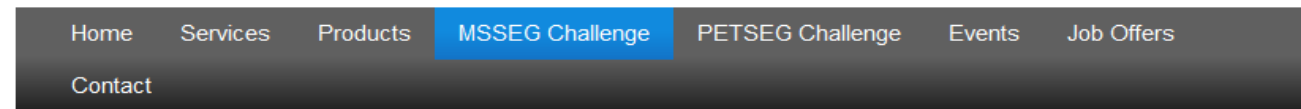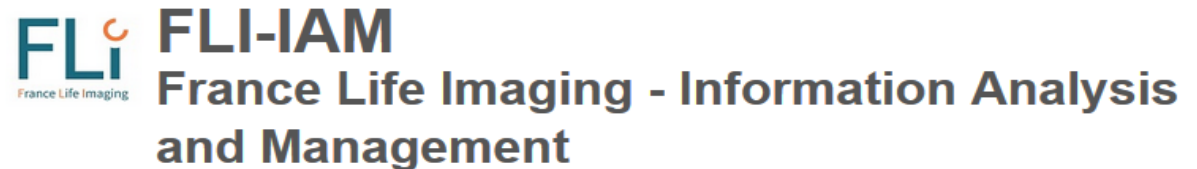
Main Results

- Venular development of MS active lesions (PhD Simon Mure, Thomas Grenier, François Cotton, Hugues Benoit-Cattin)

→ SWI and T1-gadolinium ROIs

Main results

- ## MS SEG Challenge MICCAI 2016

13 teams
→ Nature scientific reports

Goal for the next period

➔ improve the understanding and the follow-up of **neuro inflammation** pathologies
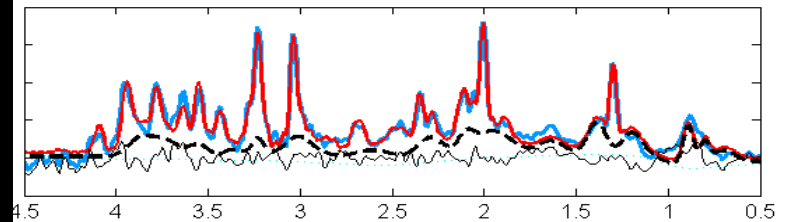
- **High field MRI + Preclinical approach**
  - Different animal models of MS, AQP4 NMOSD and MOG NMOSD explored with the new 11.7 T MRI system
  - Needs of dedicated data analysis methods (segmentation, detection, follow up, prediction, …)
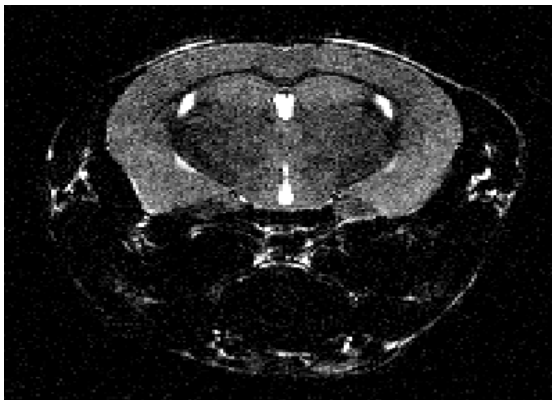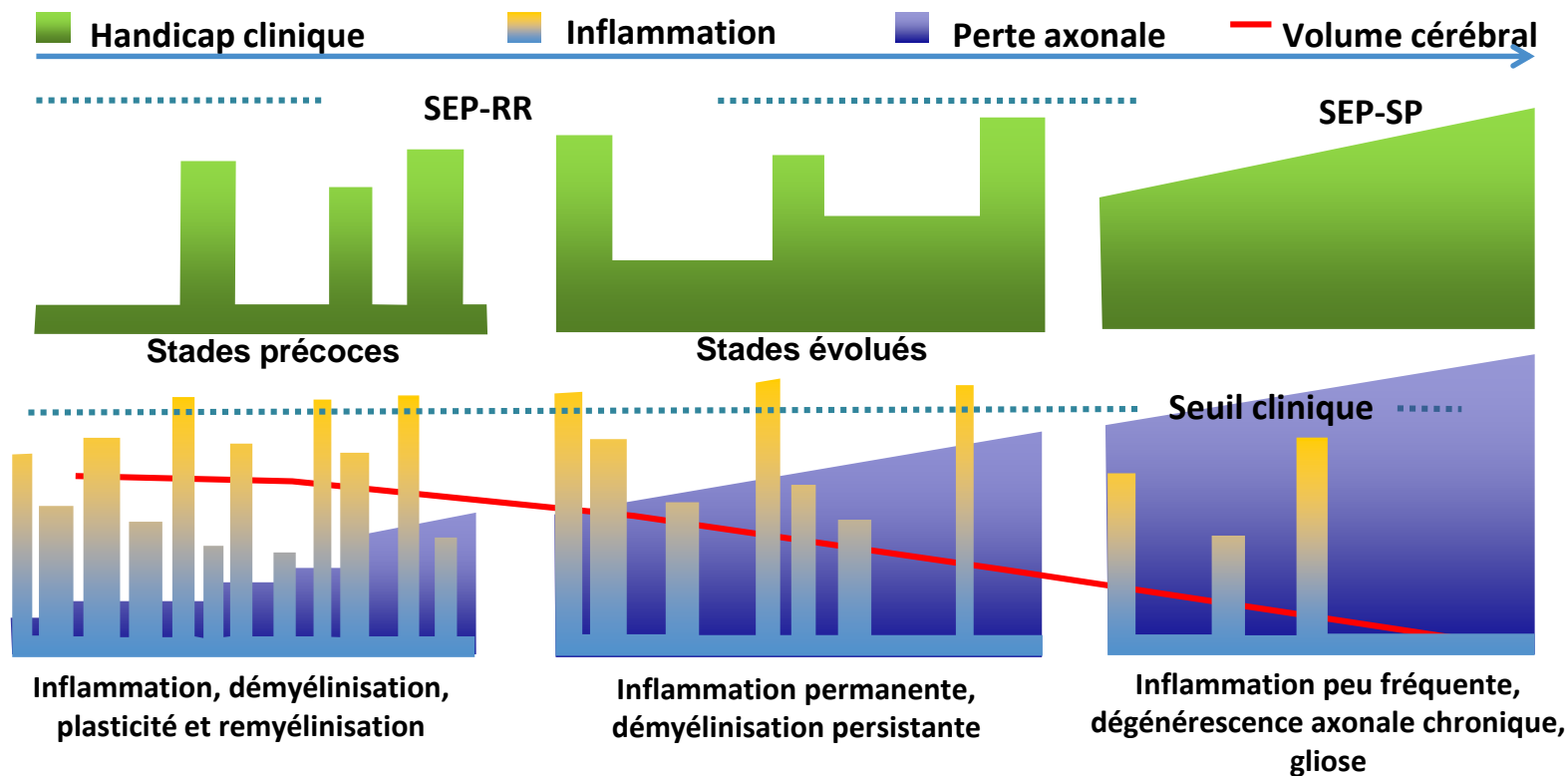

T2w TE/TR= 64/5500
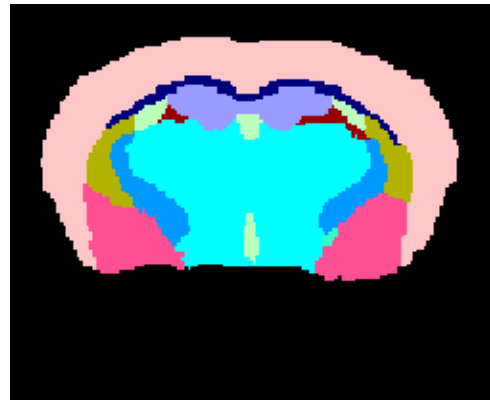
Brain segmentation

MR spectrum at 11.7T short TE=6.5ms

- New name ***MUSIC*** : **MU**ltiple **S**clerosis and neuro**I**nflammation: from preclinical to **C**linical investigation

Pathophysiological phenomenon in MS

Spectrum of inflammatory diseases
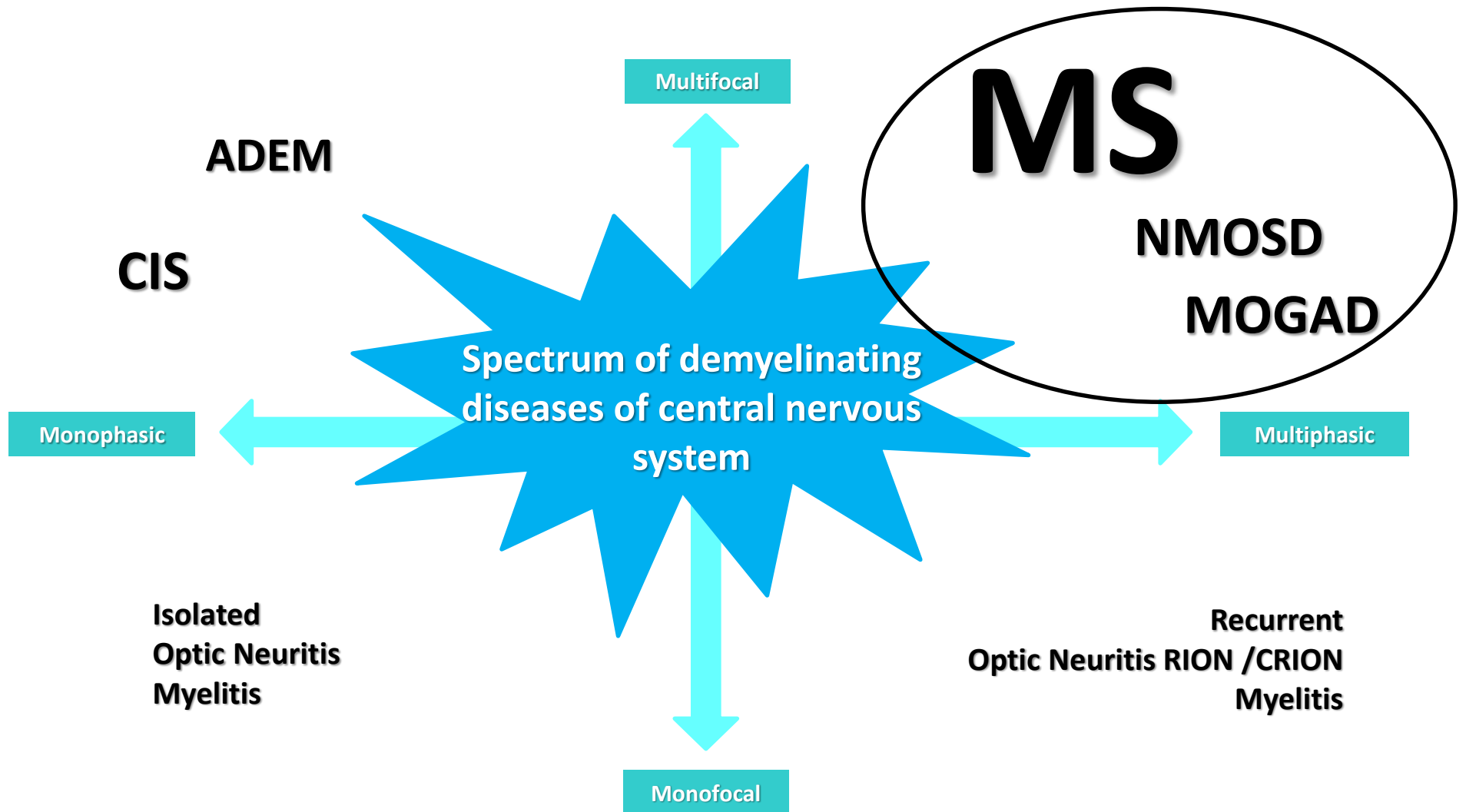
To Conclude
Work force and funding for next period

Work force

→ EDISS PhD Thesis (V. Wargnier-Dauchelle, start 2019) F. Cotton, M. Sdika, T. Grenier

→ EDISS PhD Thesis (Berardino BARILE, start 2019) D. Sappey-Marinier,

Dedicated Data Bases

→ OFSEP collaboration (French MS database) – Pr Vukusic

Funds

→ ANR Gladism v2 : MRI and Deep Learning to identify Gd+ lesions without Gadolinium (CREATIS (PI) – CMRBM- Visages-INRIA) ✗

→ ARSEP Annual call (optimal MRI, preclinic follow-up), F. Durand-Dubief

→ European Network NOMADMUS, dedicated to NMOSD - Dr Marignier

→ Neurodis (optimal MRI, preclinic follow-up) F. Durand-Dubief, H. Rattiney

→ EDMUS (collaboration with Berlin), D. Sappey-Marinier ✓

→ *Fondation* EDMUS (detect and segmentation of MS lesions), M. Sdika

→ Labex PRIMES (acquisitions and internship, demyelinating study) ✓

Linked with ANR obtained by Fabien Chauveau