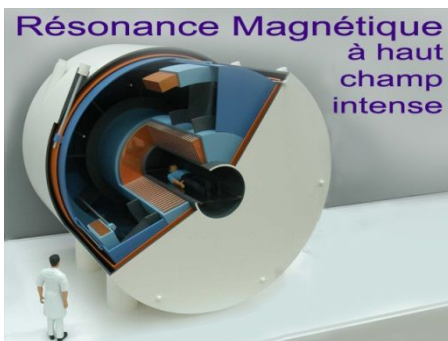
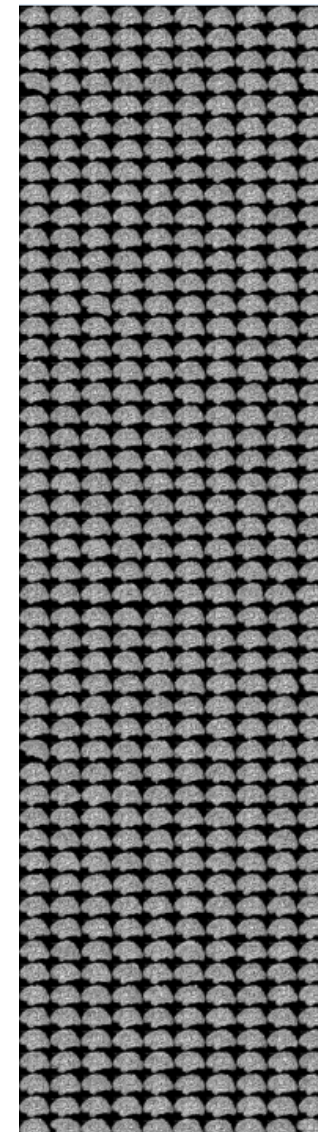
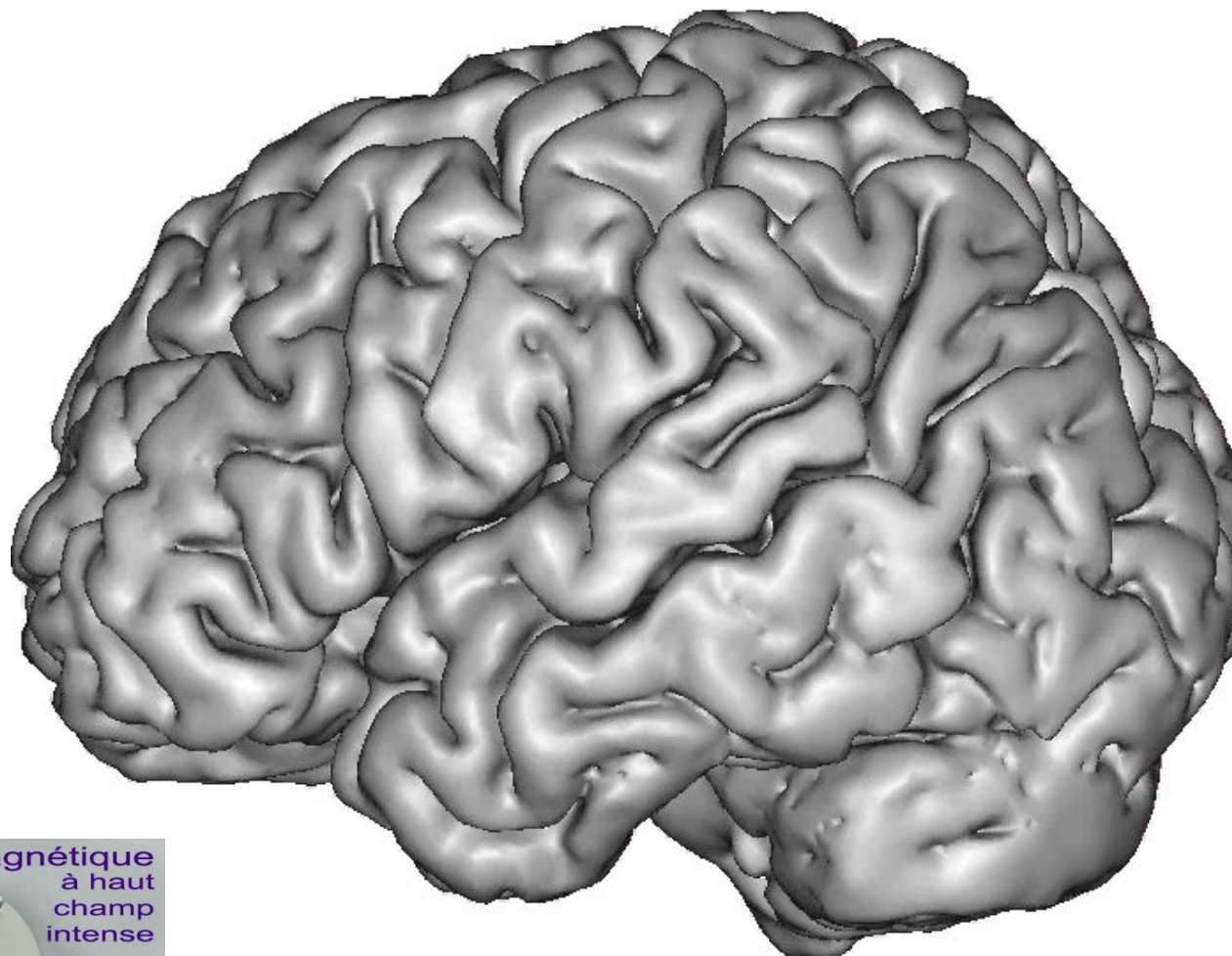


Mesurer le cerveau numérique

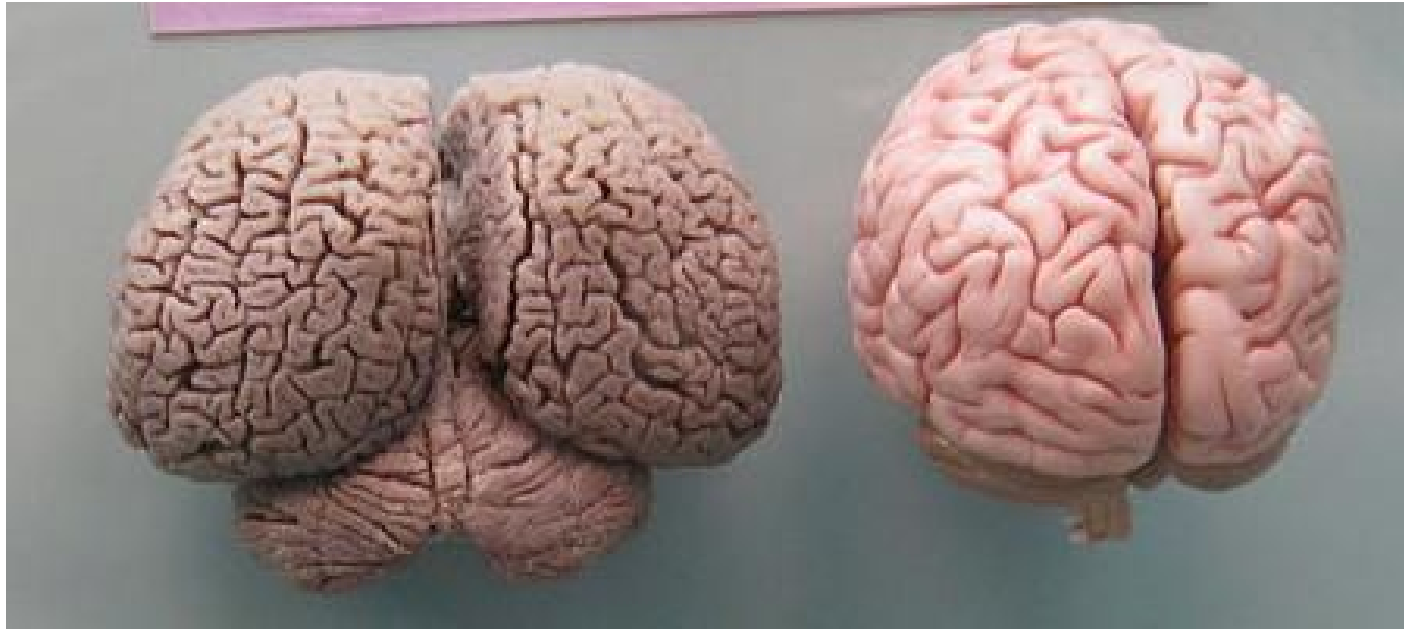


J.-F. Mangin

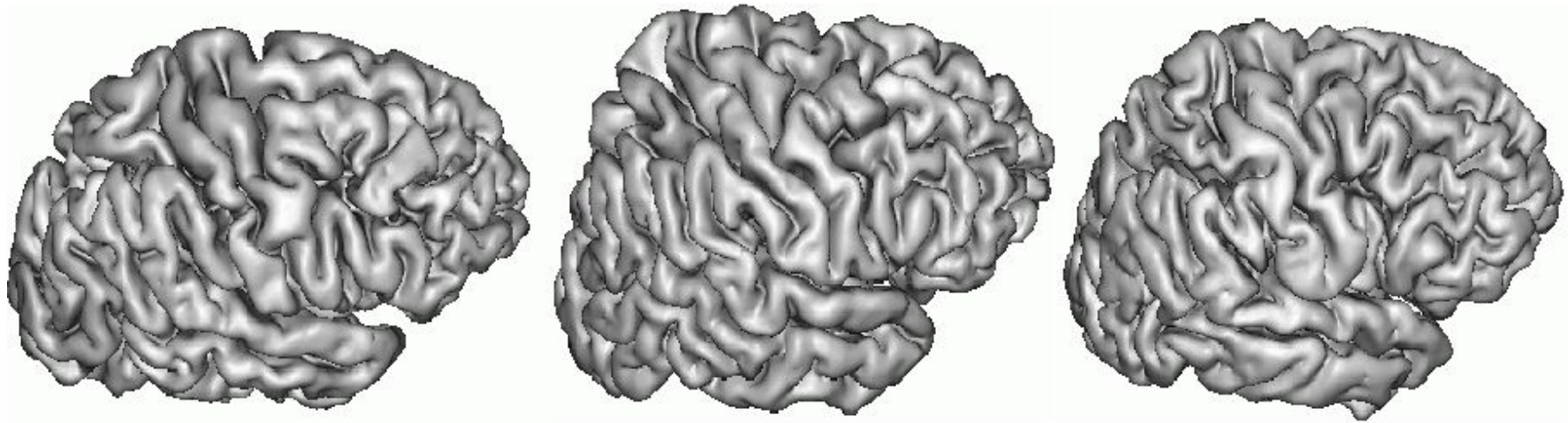
Nous n'avons pas le cortex le plus plissé !

Le dauphin

L'homme



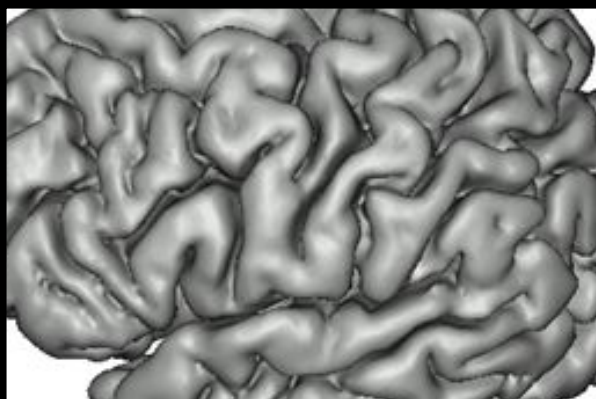
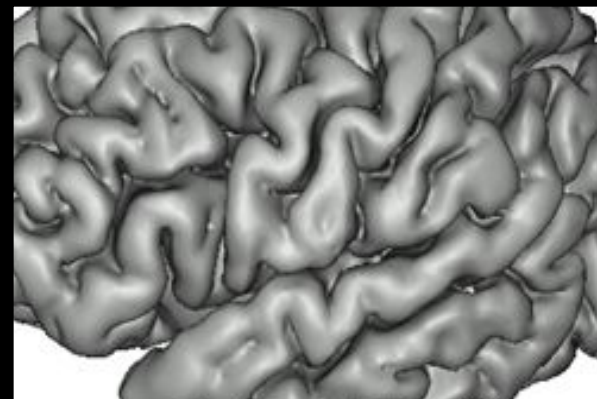
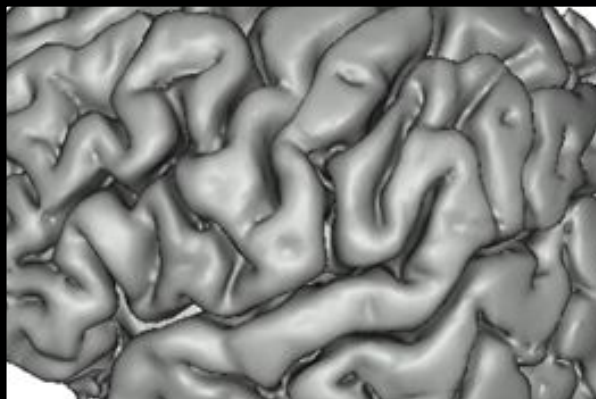
Pourquoi nos cerveaux sont-ils si différents?



7 milliards de cerveaux
7 milliards de motifs de plissement ?



Deux paires de jumeaux



La dynamique du plissement cortical



Plissement...

3 mois

Vieillesse

Maladie
d'Alzheimer

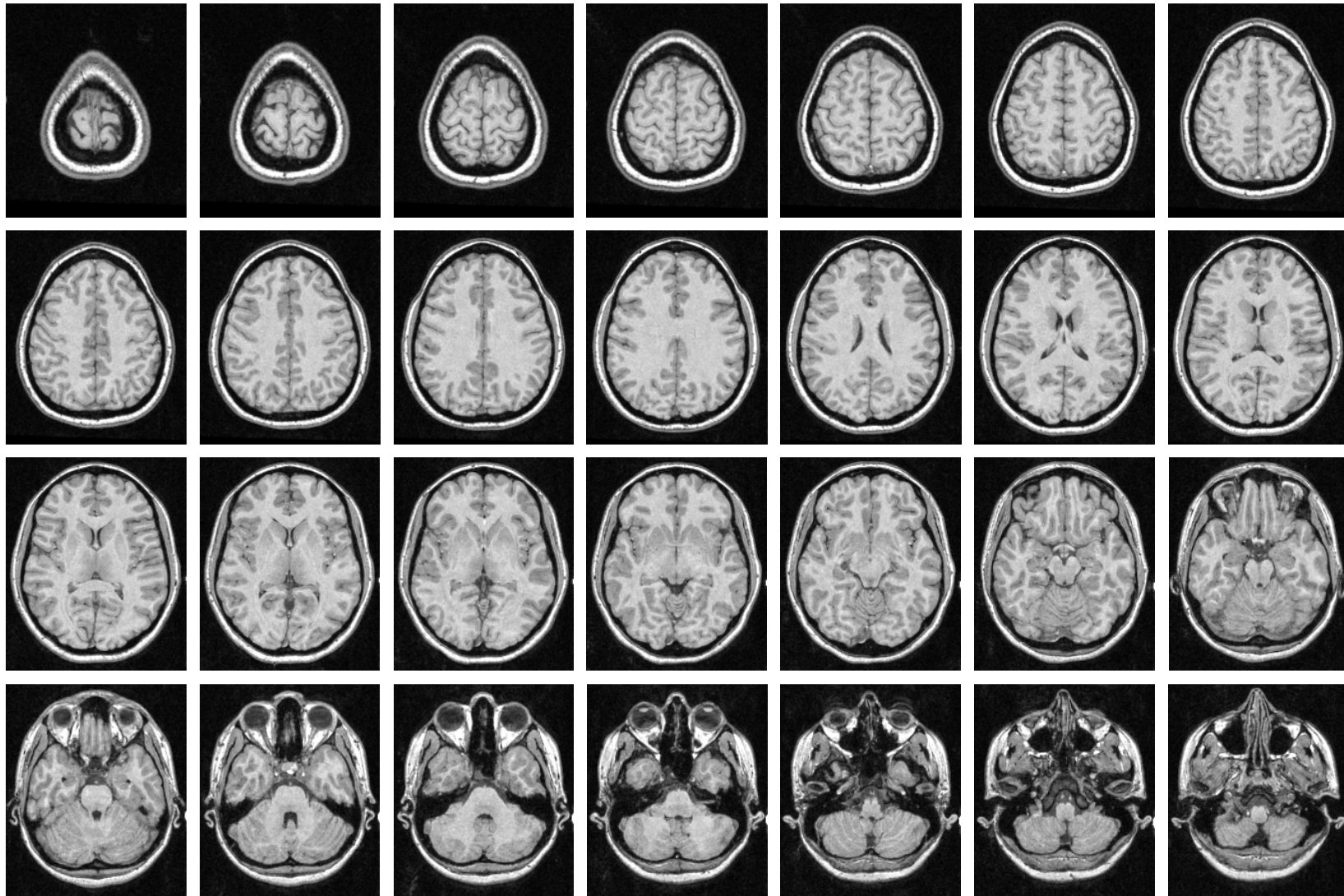
Adolescence

In utero

Déplissement
accéléré

Déplissement

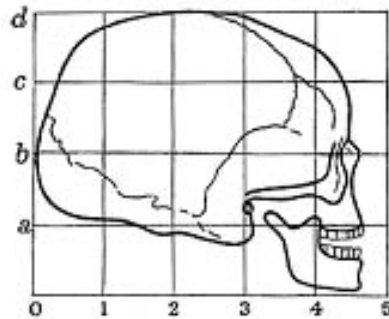
Décrypter les motifs du plissement cortical est un casse-tête pour le radiologue



Comment comparer les cerveaux?

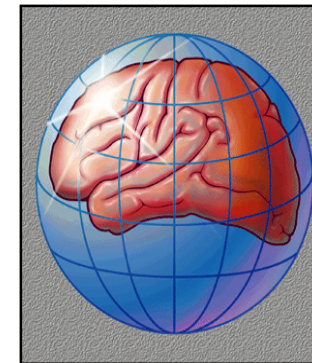
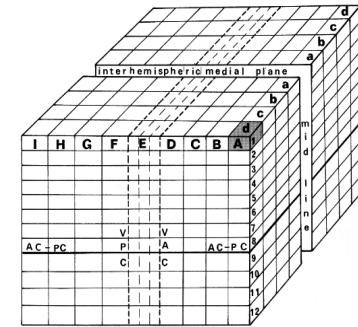
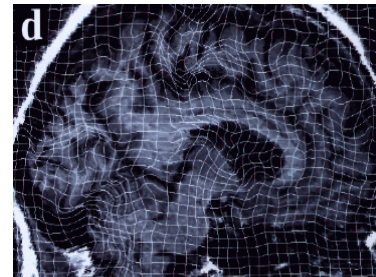
Paleoanthropologie

Un crane modèle
associé à une grille
(D'Arcy Thompson 1917)



Neurochirurgie / Neuroimagerie

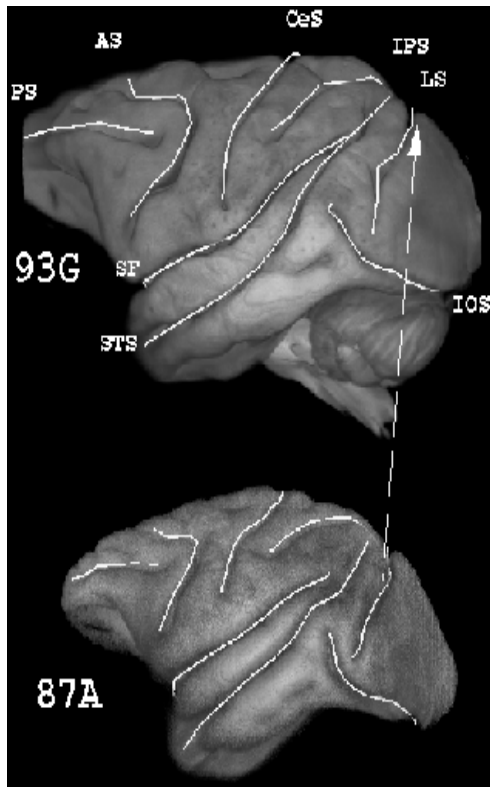
C'est la stratégie moderne



Difficile à appliquer à l'étude des plissements !

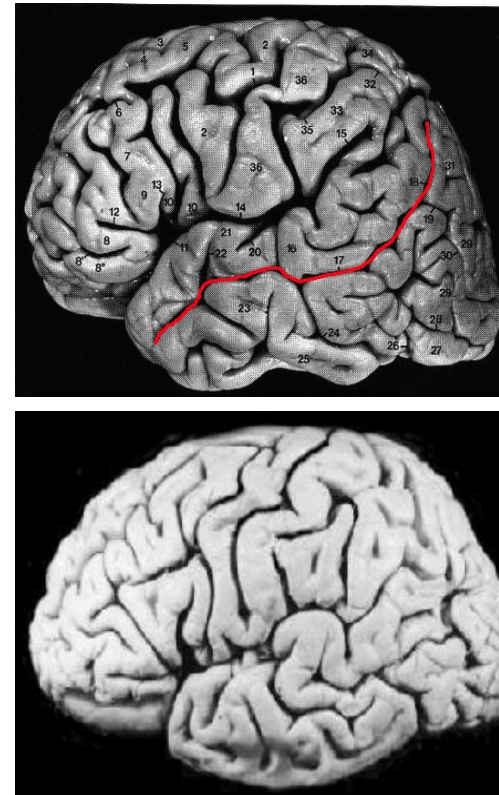
Quels plis peut on apparier à travers les sujets?

Les macaques



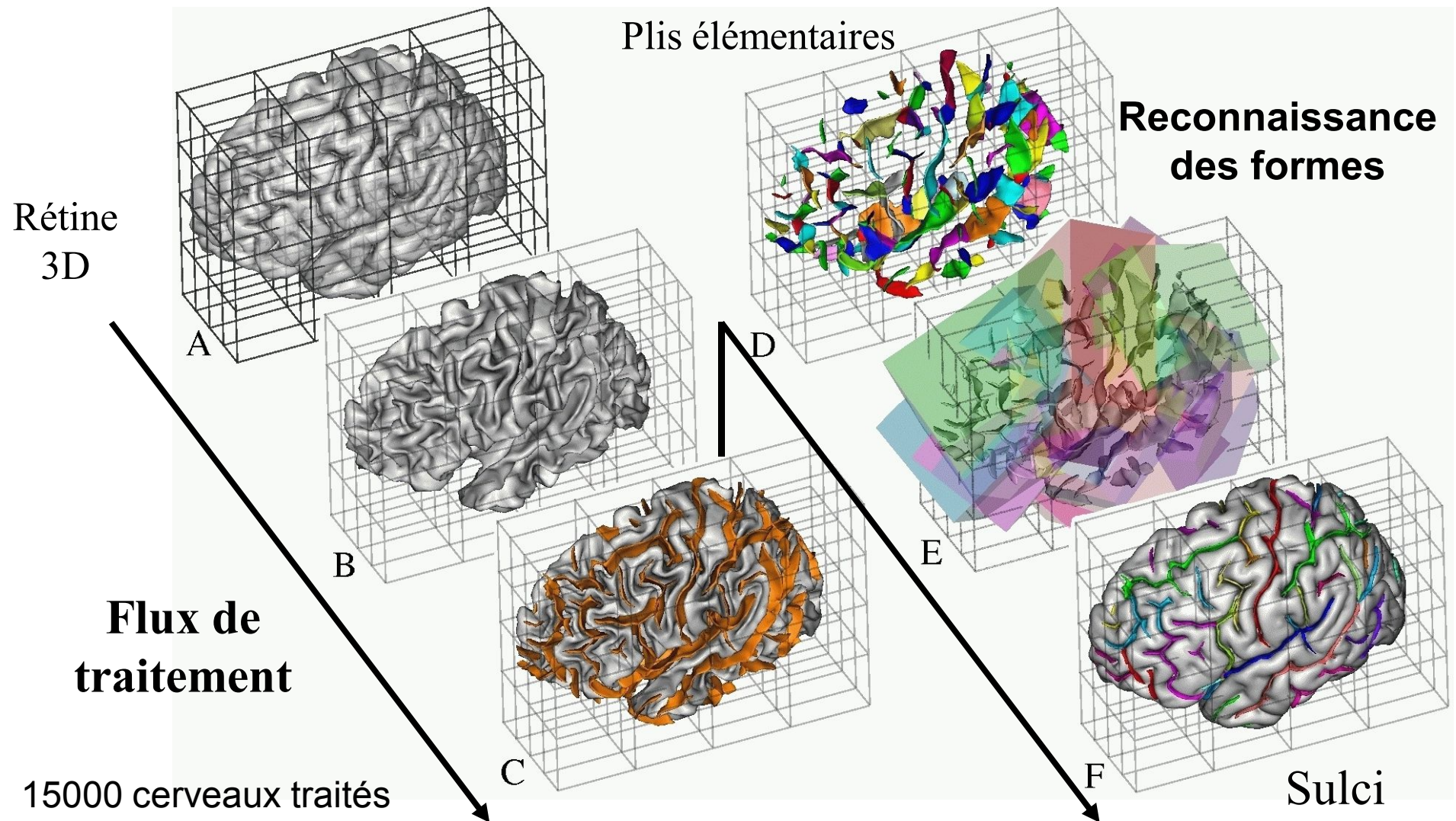
Miller et al.

Les hommes

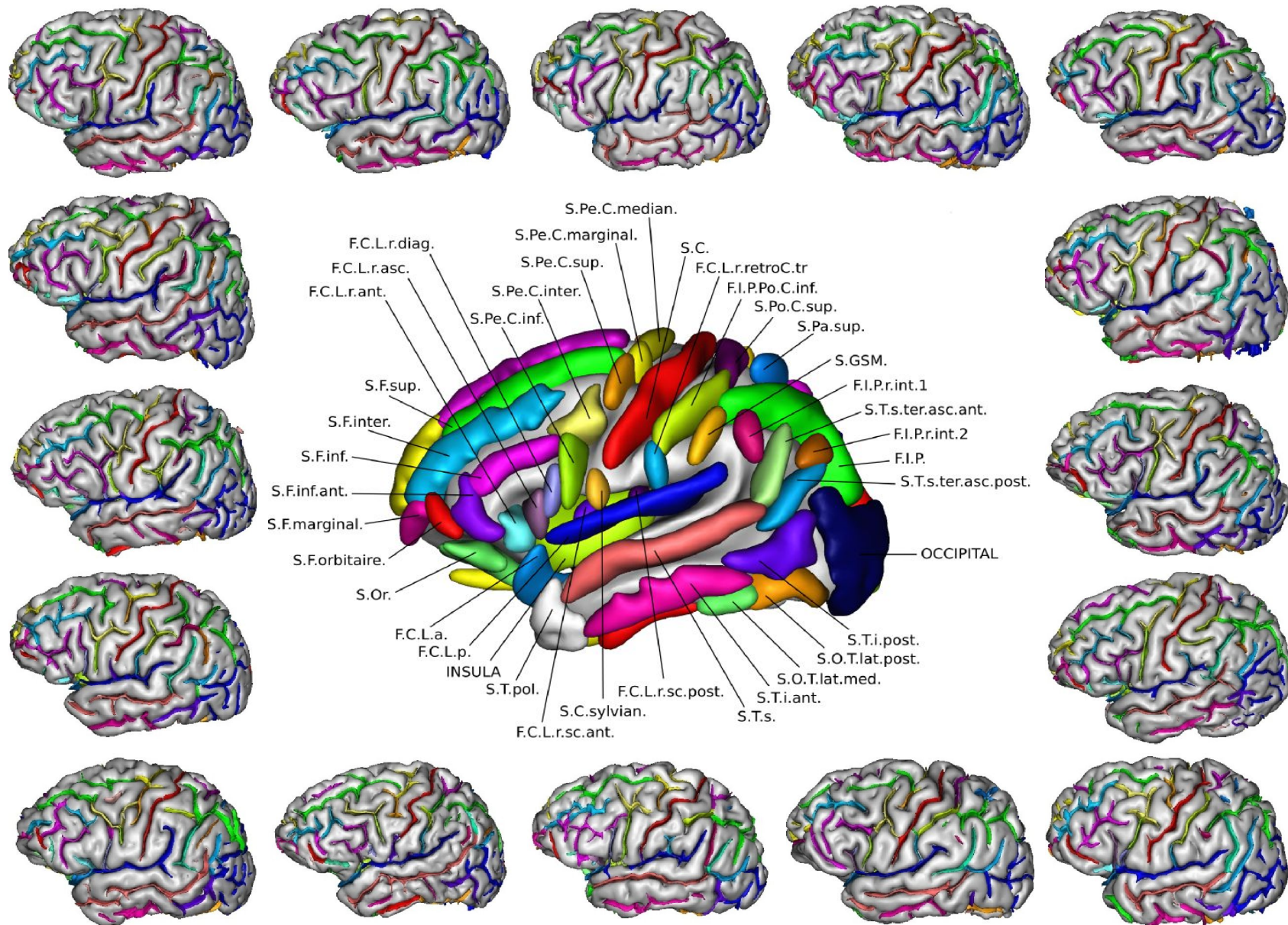


Duvernoy

Un neuroanatomiste artificiel dédié aux sillons corticaux



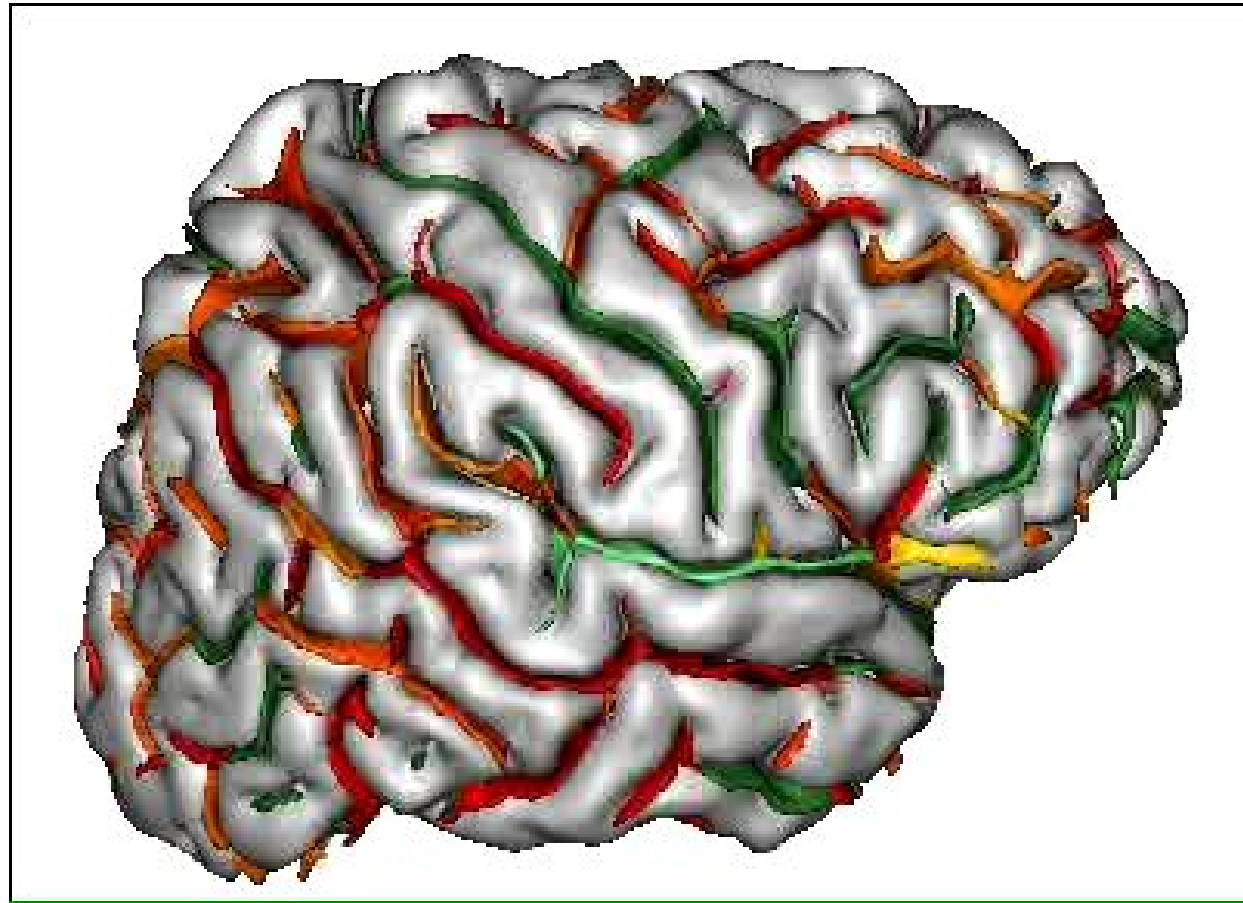
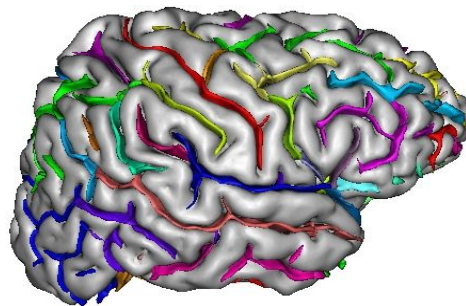
Apprendre la variabilité des circonvolutions



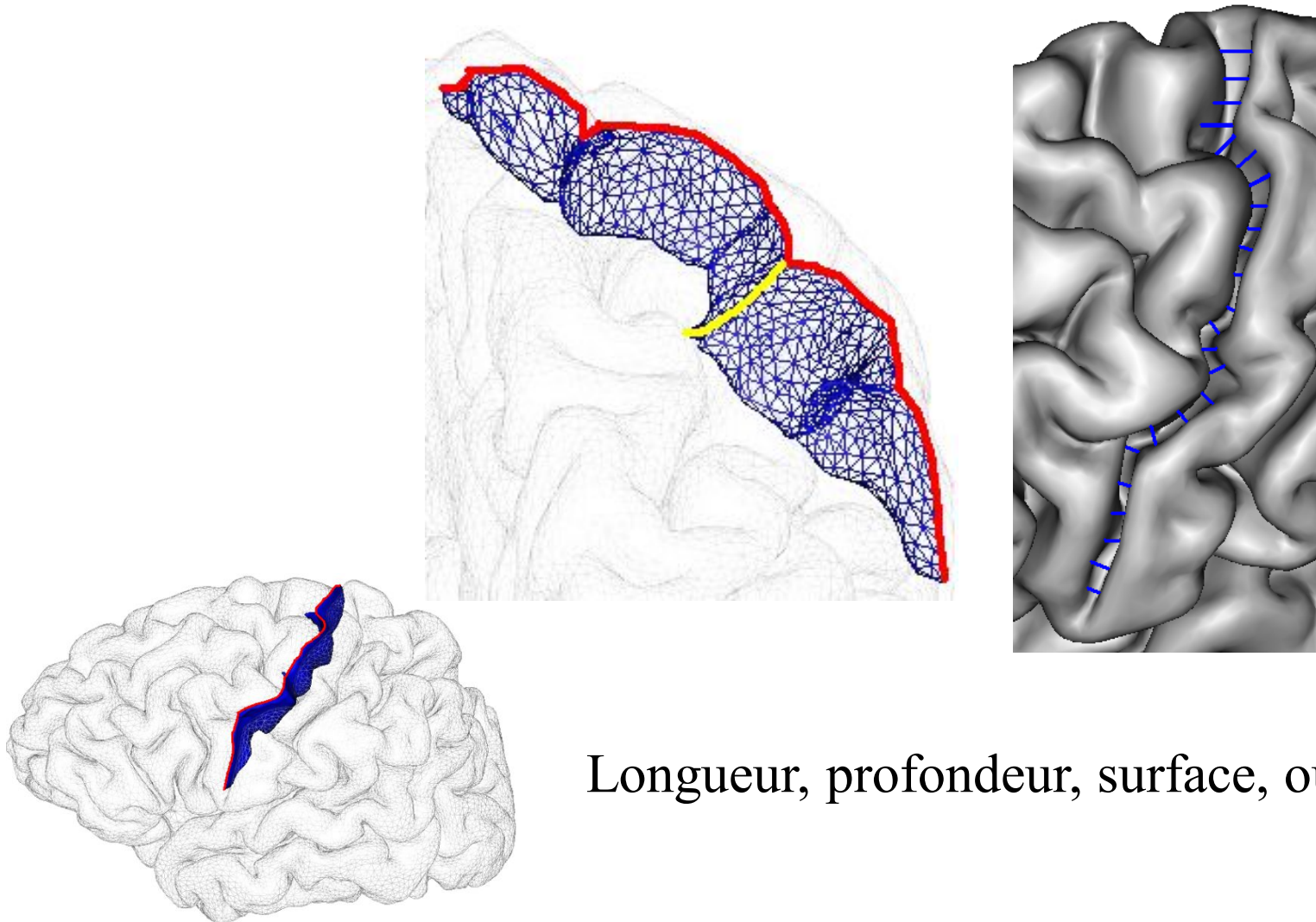
Négociations au sein d'une assemblée de réseaux de neurones artificiels



> 15000
Cerveaux
analysés



La géométrie des plissements



Longueur, profondeur, surface, ouverture...

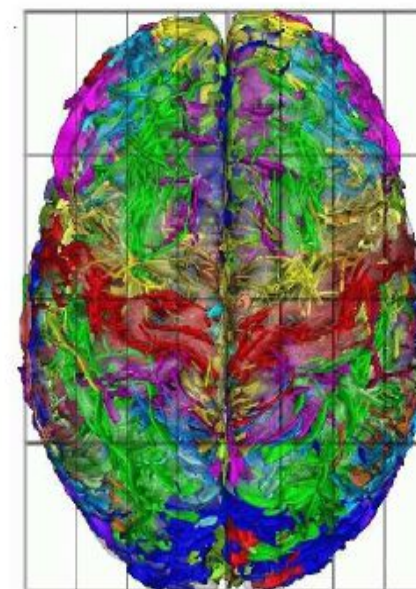
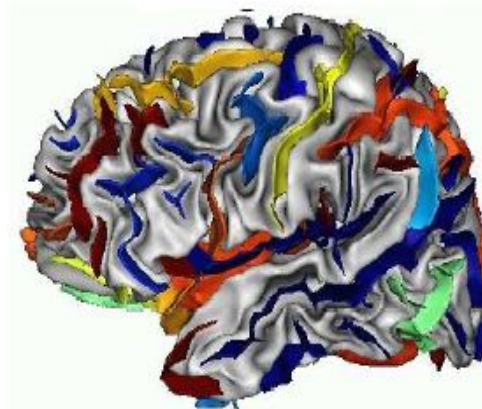
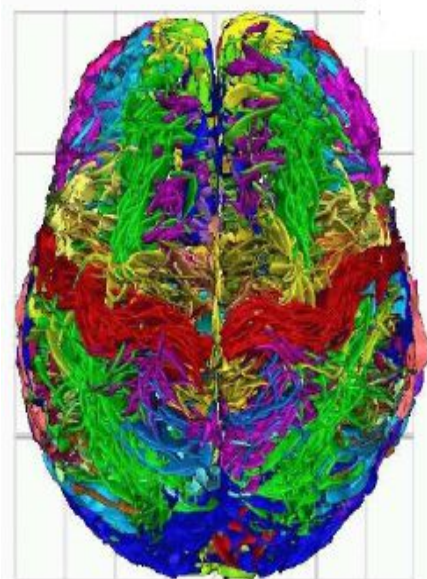
Corrélat de la latéralité manuelle



14 gauchers

128 droitiers

Index d'asymétrie

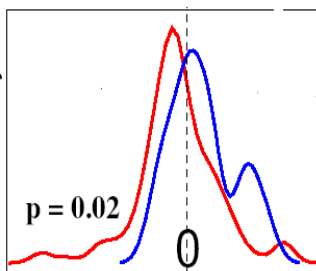


$p < 0.05$

gauche droite



0



Le sillon central est plus grand dans l'hémisphère dominant

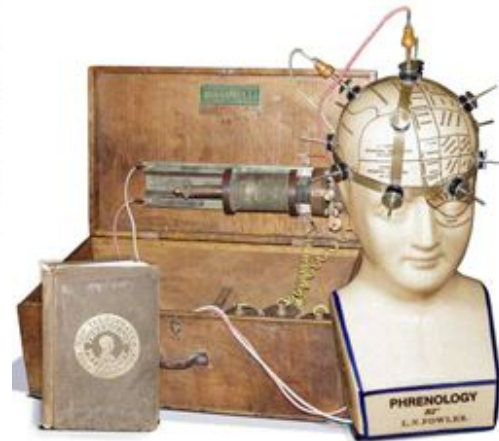
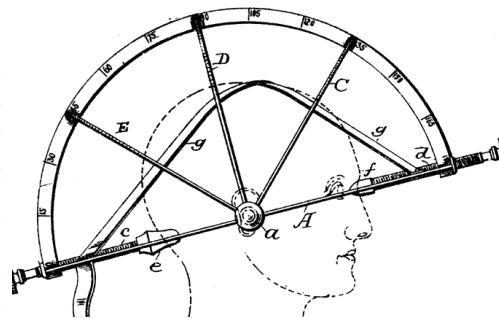
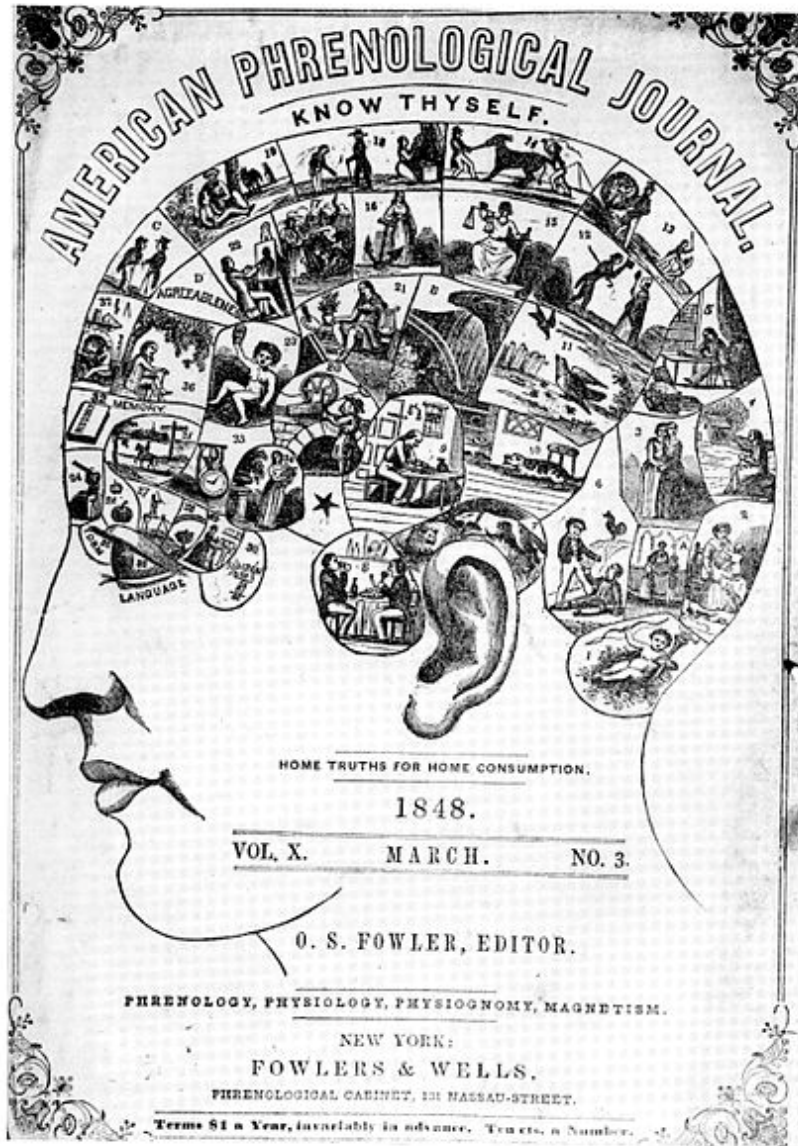
(Mangin et al., IEEE TMI, 2004)

Inversion de l'asymétrie chez les gauchers contrariés

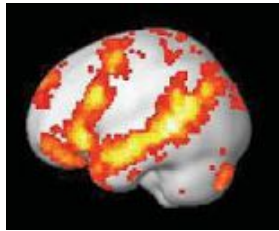
(Klöppel et al. J. Neuroscience, 2010)

La phrénologie et ses phrénomètres

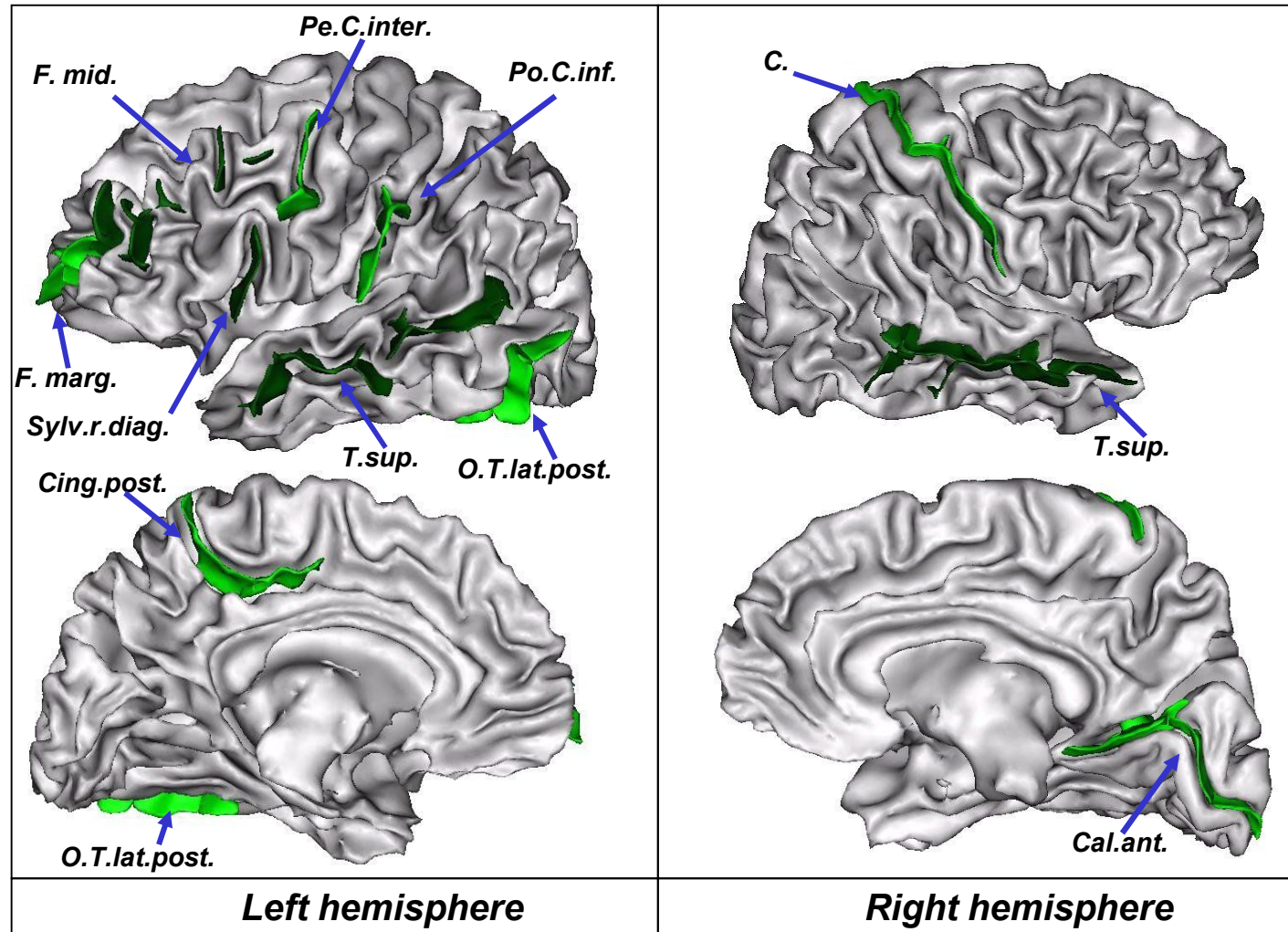
F.J. Gall 1808



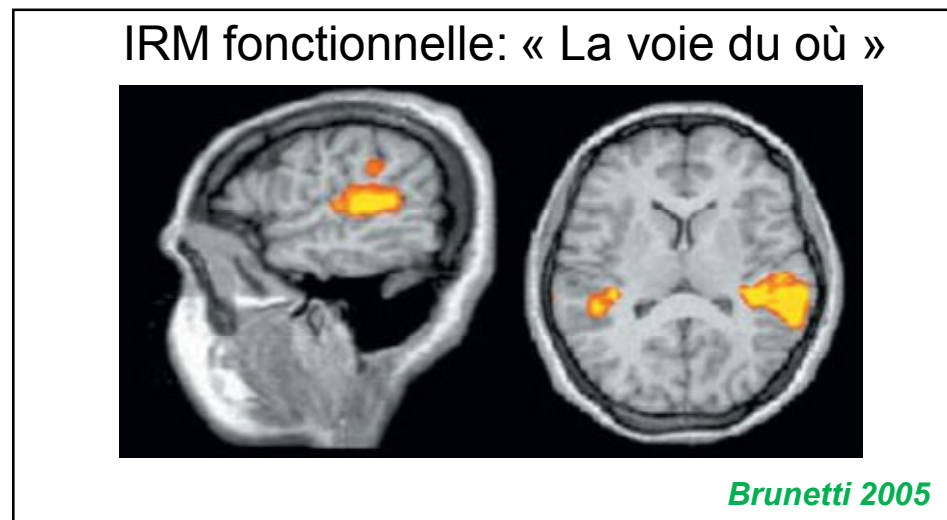
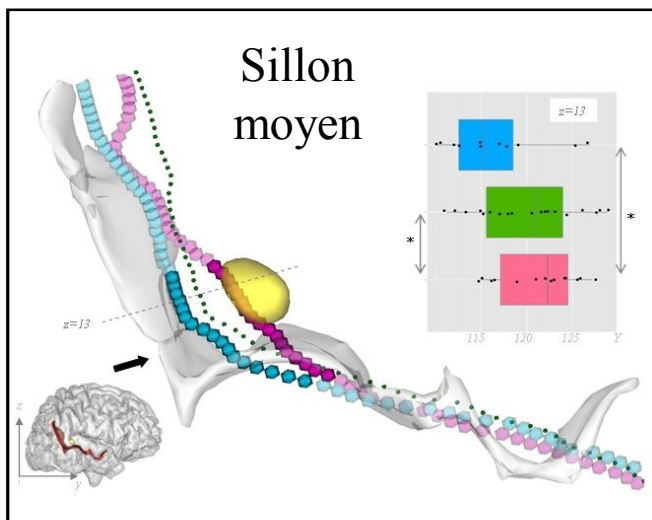
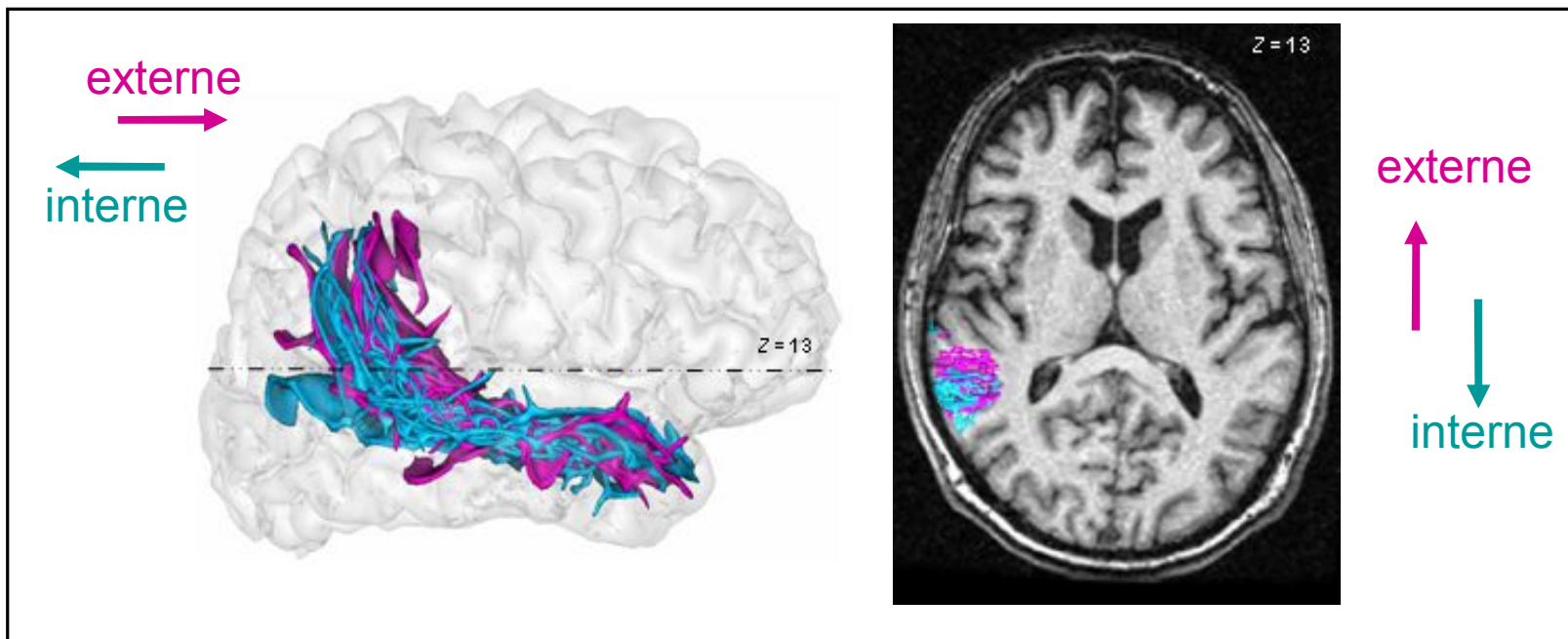
Le plissement des schizophrènes hallucinés est moindre dans les aires du langage

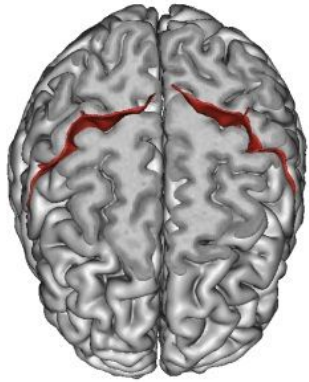


Aires
du
langage
(FMRI)

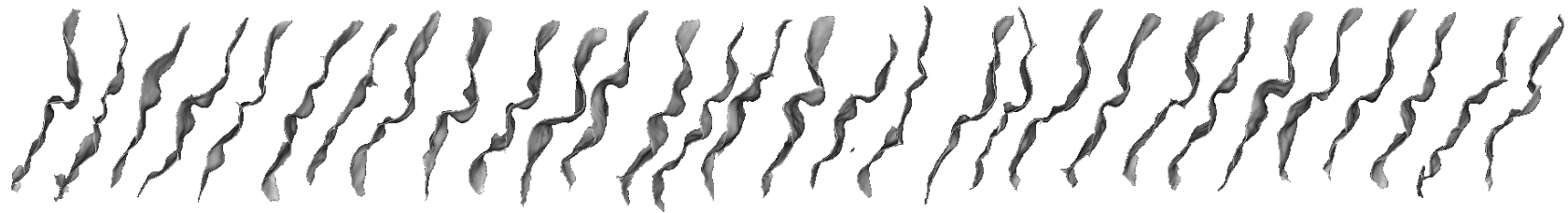
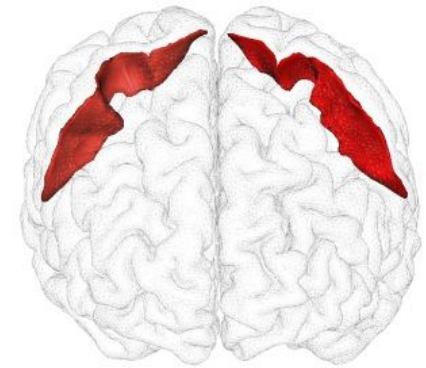


Entendre des voix internes ou externes

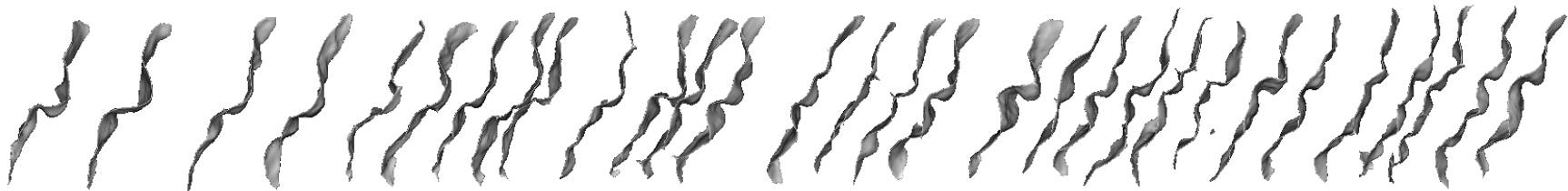




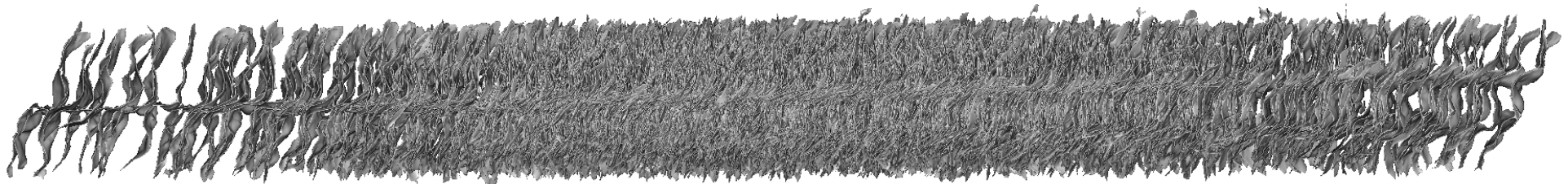
La forme des sillons



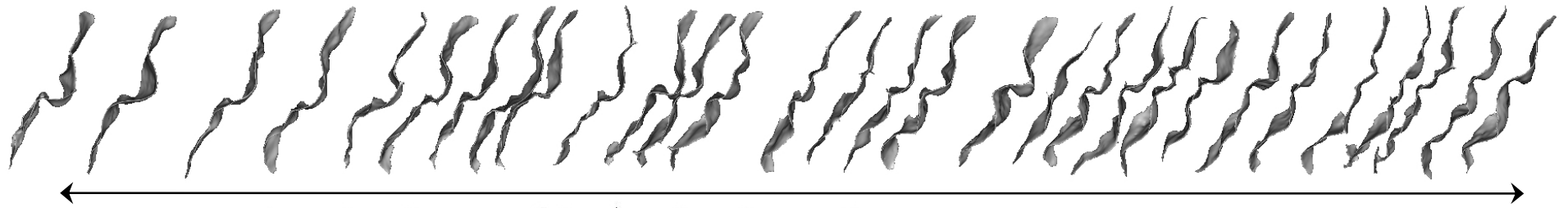
30 sillons centraux dans le désordre



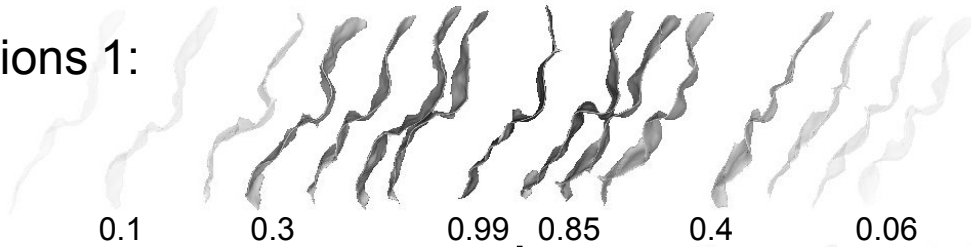
Les mêmes sillons centraux dans l'ordre



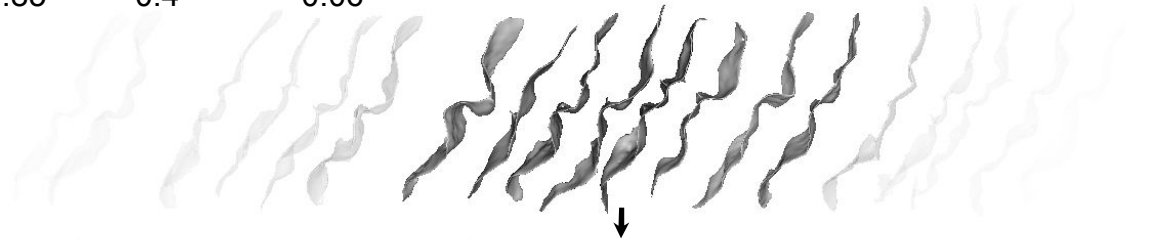
Moyennes glissantes le long de la variété



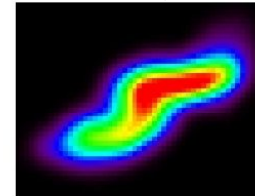
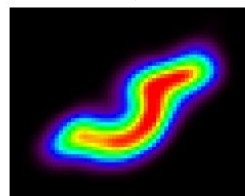
Pondérations 1:



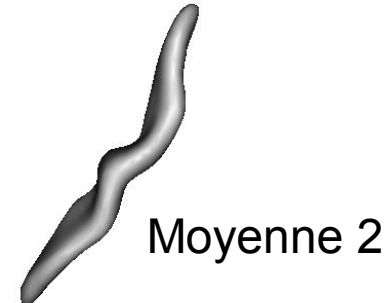
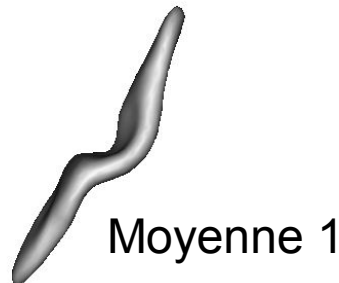
Pondérations 2:



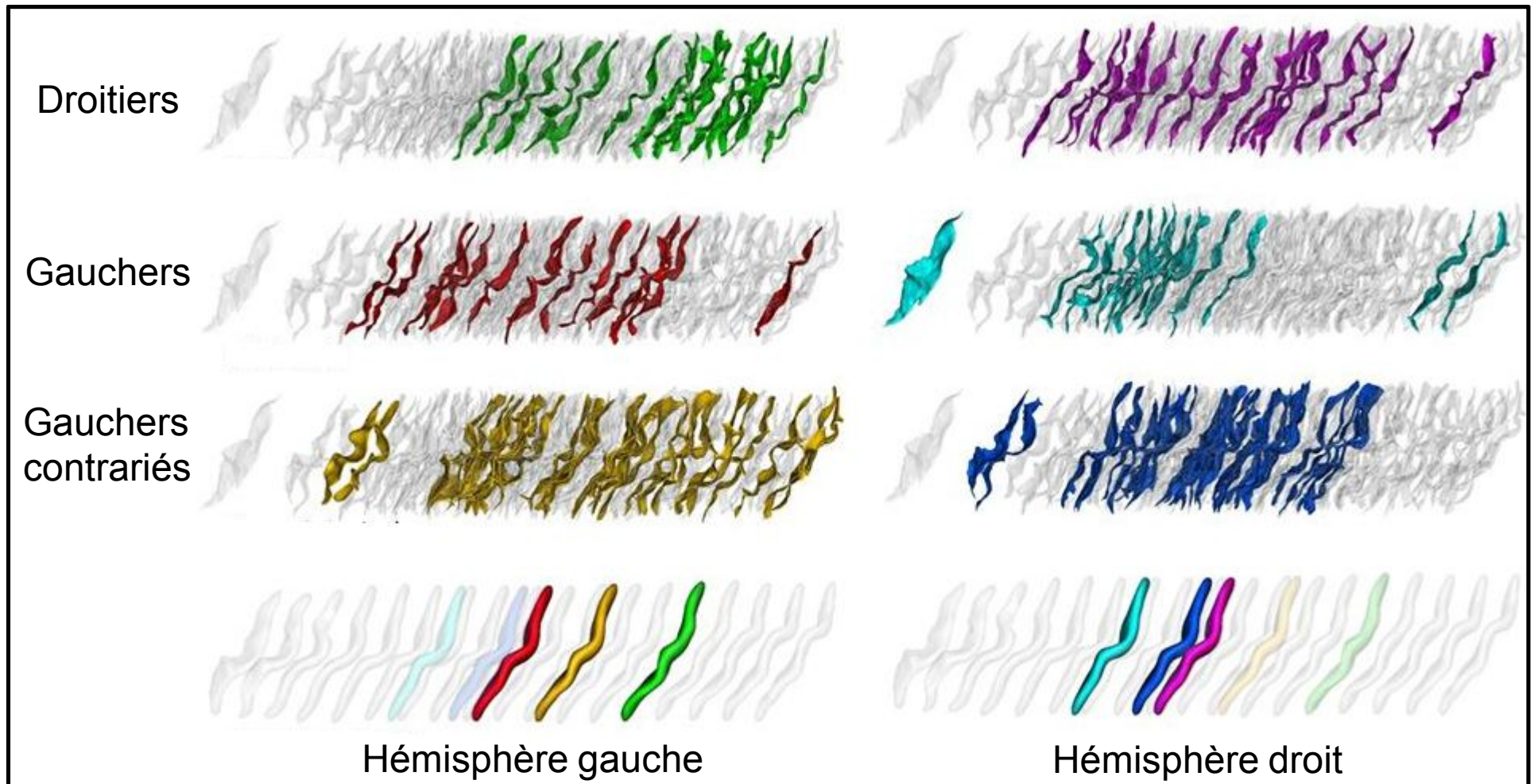
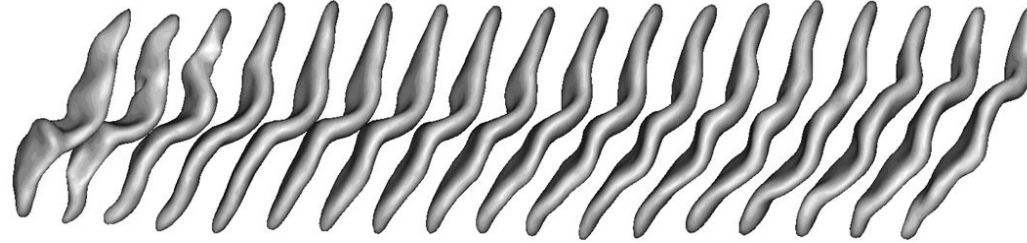
Moyenne glissante:



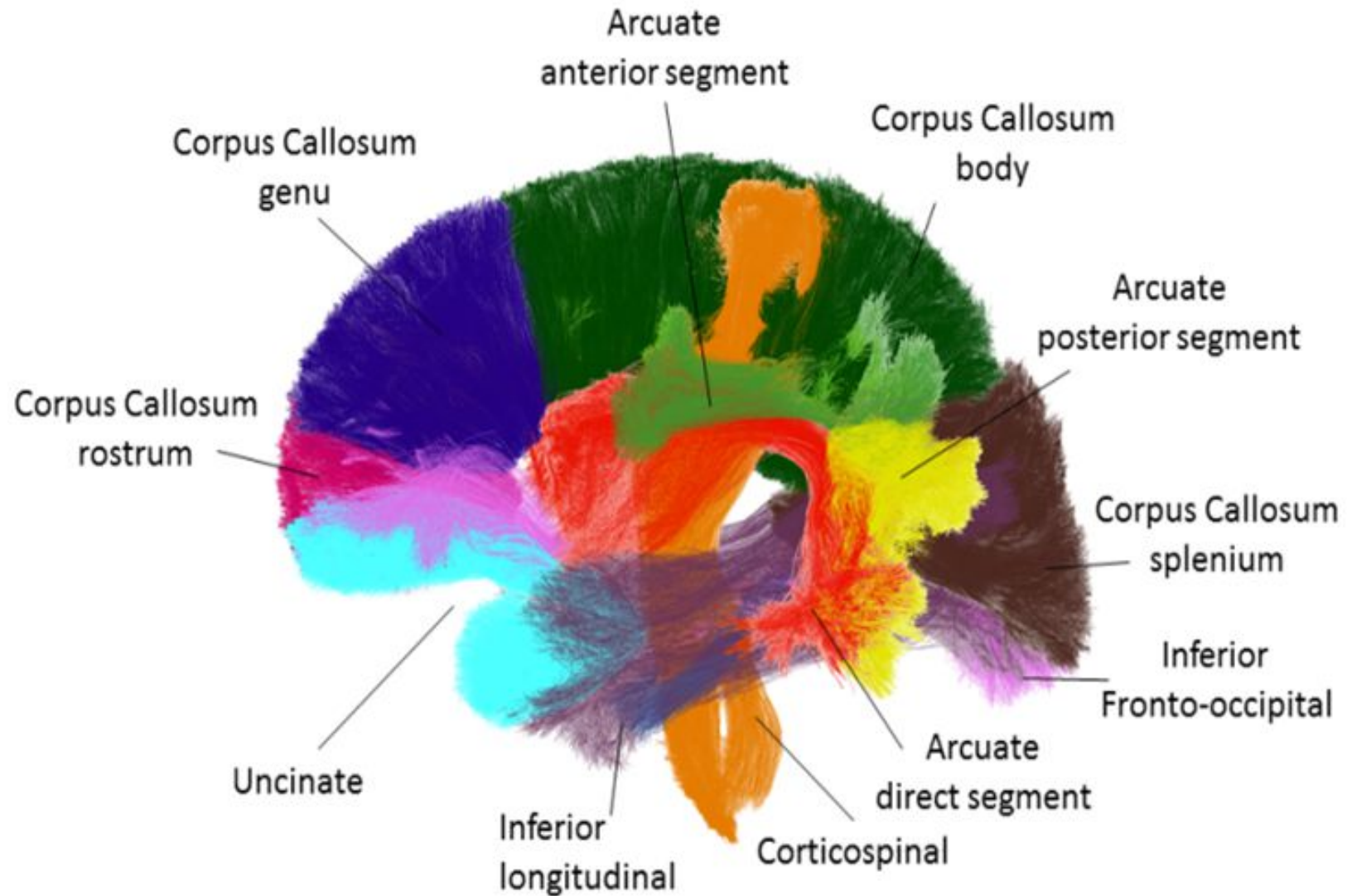
Iso-surface
de la moyenne glissante:



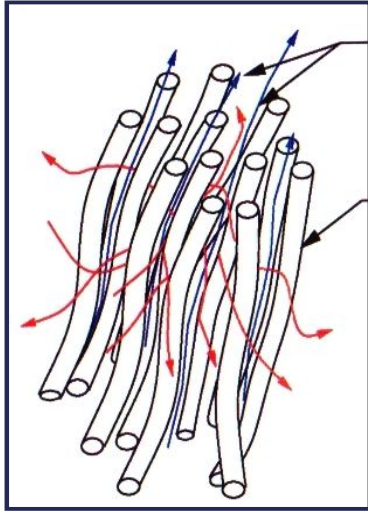
forme et latéralité manuelle



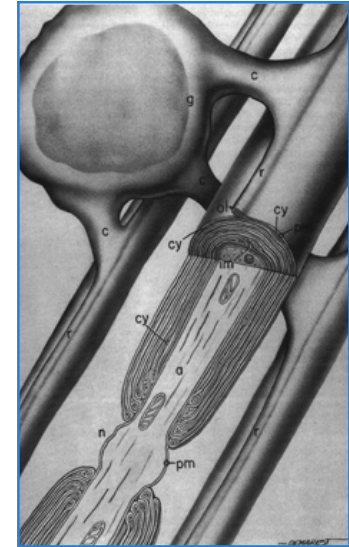
Les faisceaux de fibres



L'imagerie IRM de diffusion



Un faisceau de fibres idéal



La réalité biologique

Diffusion de l'eau dans la substance blanche...

L'imagerie IRM de diffusion



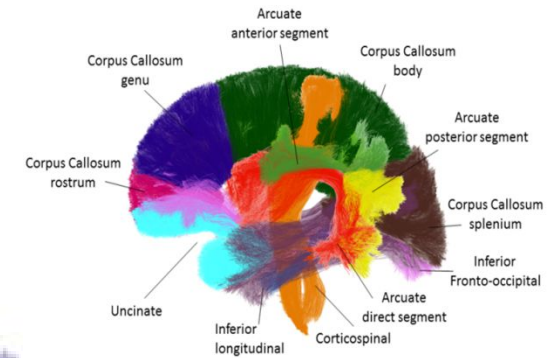
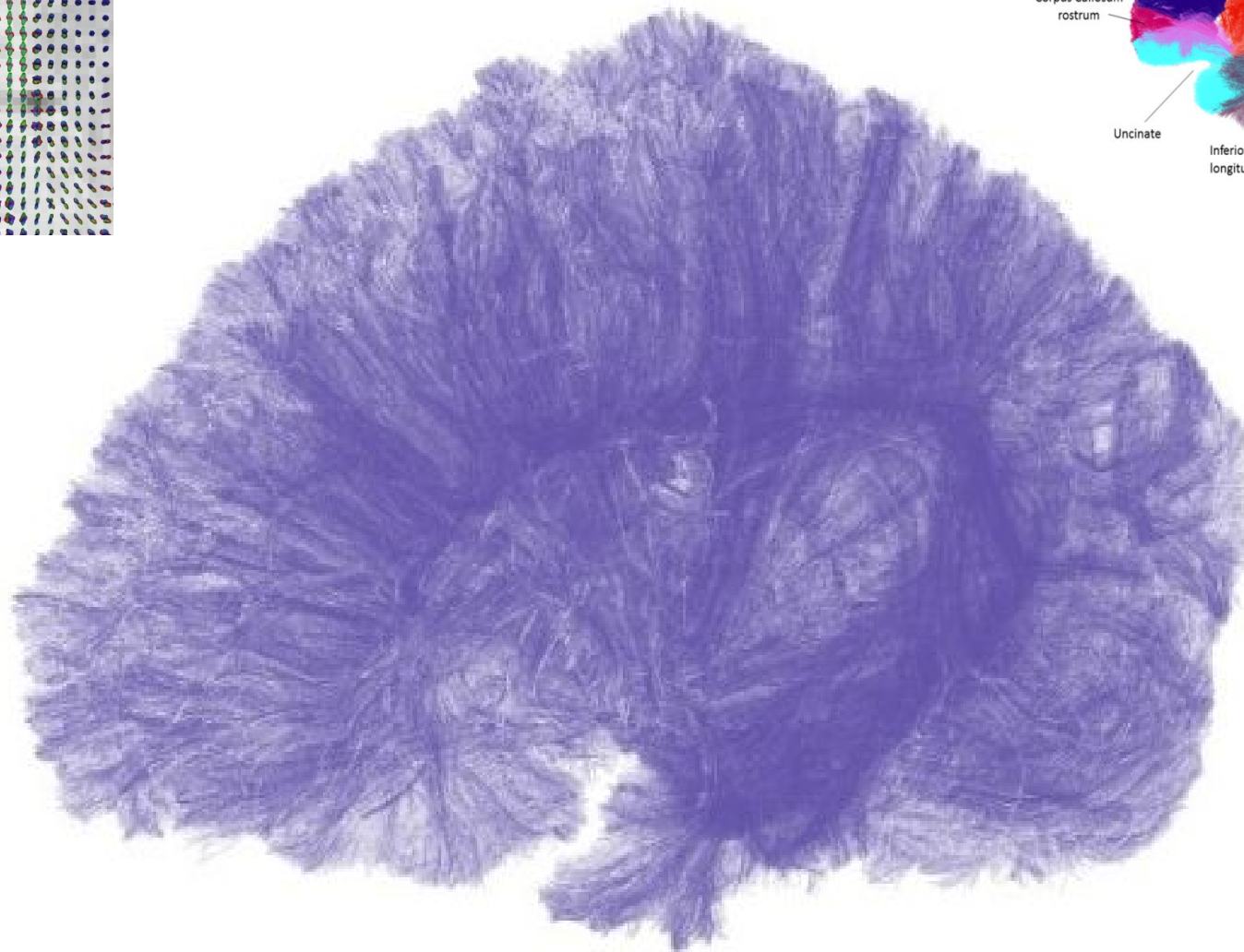
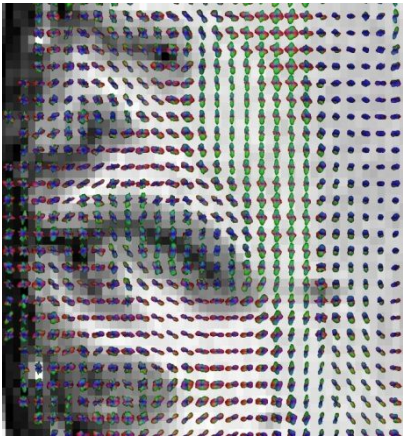
Un grand faisceau de fibre

Un croisement de fibres

Un faisceau détruit

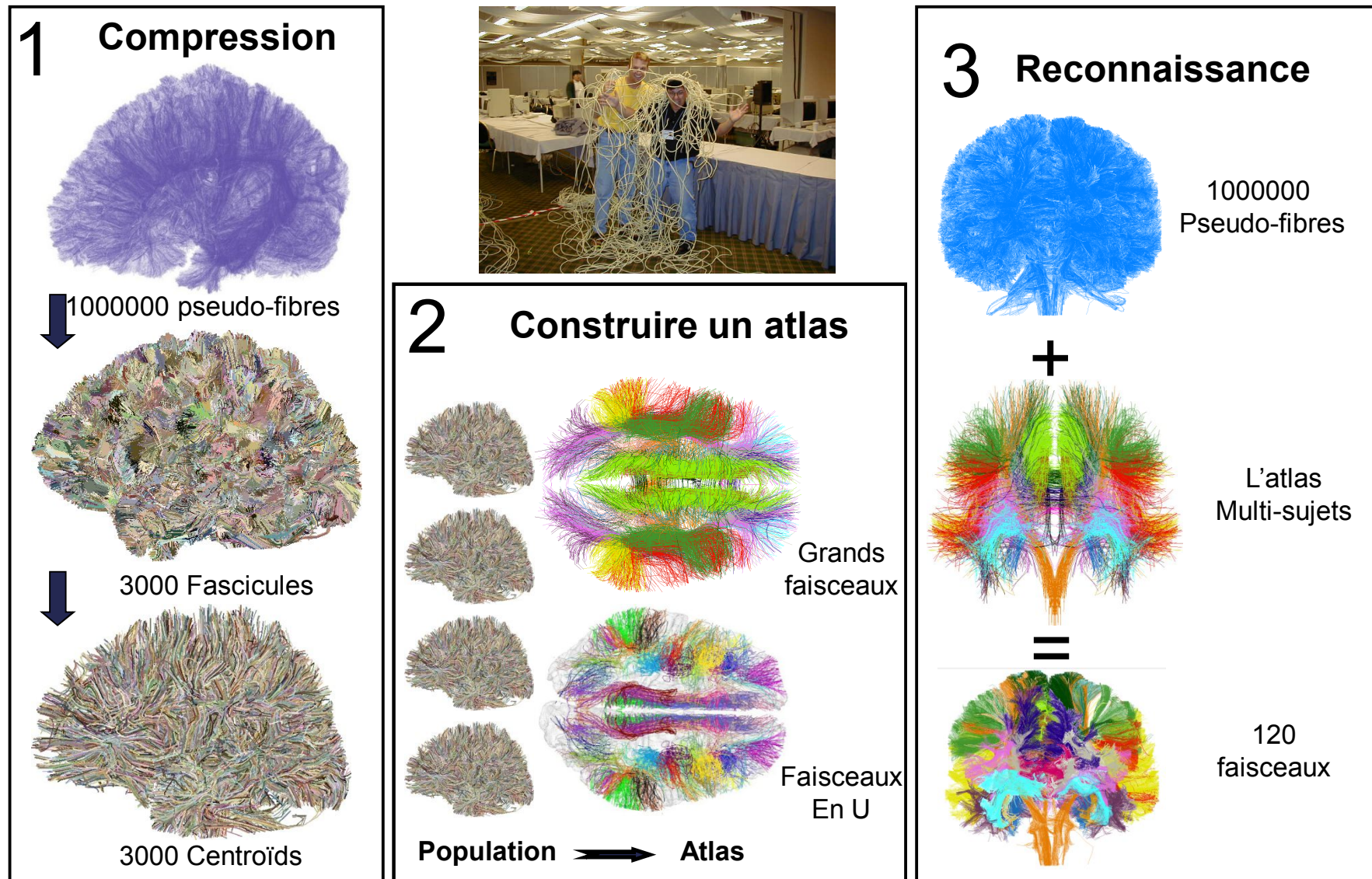
Diffusion des voitures dans le réseau routier...

La tractographie

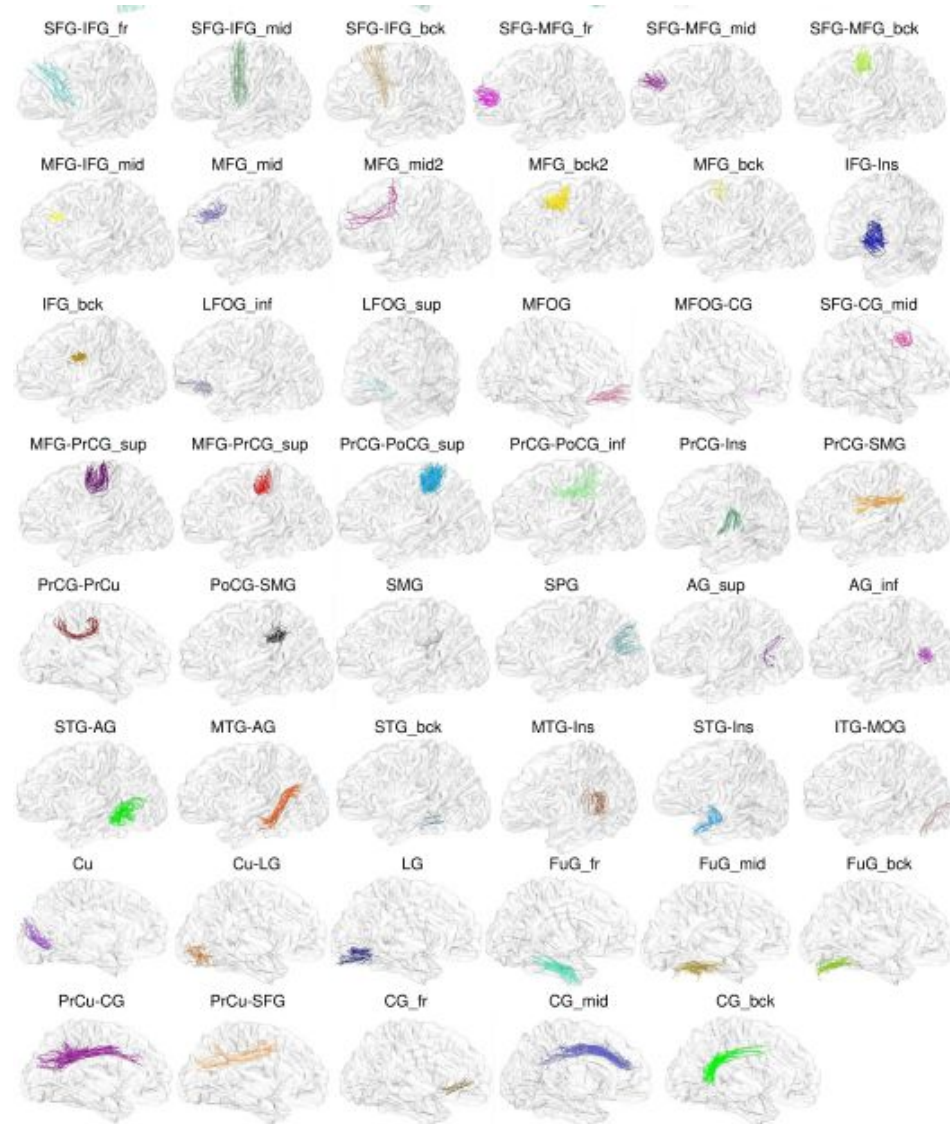
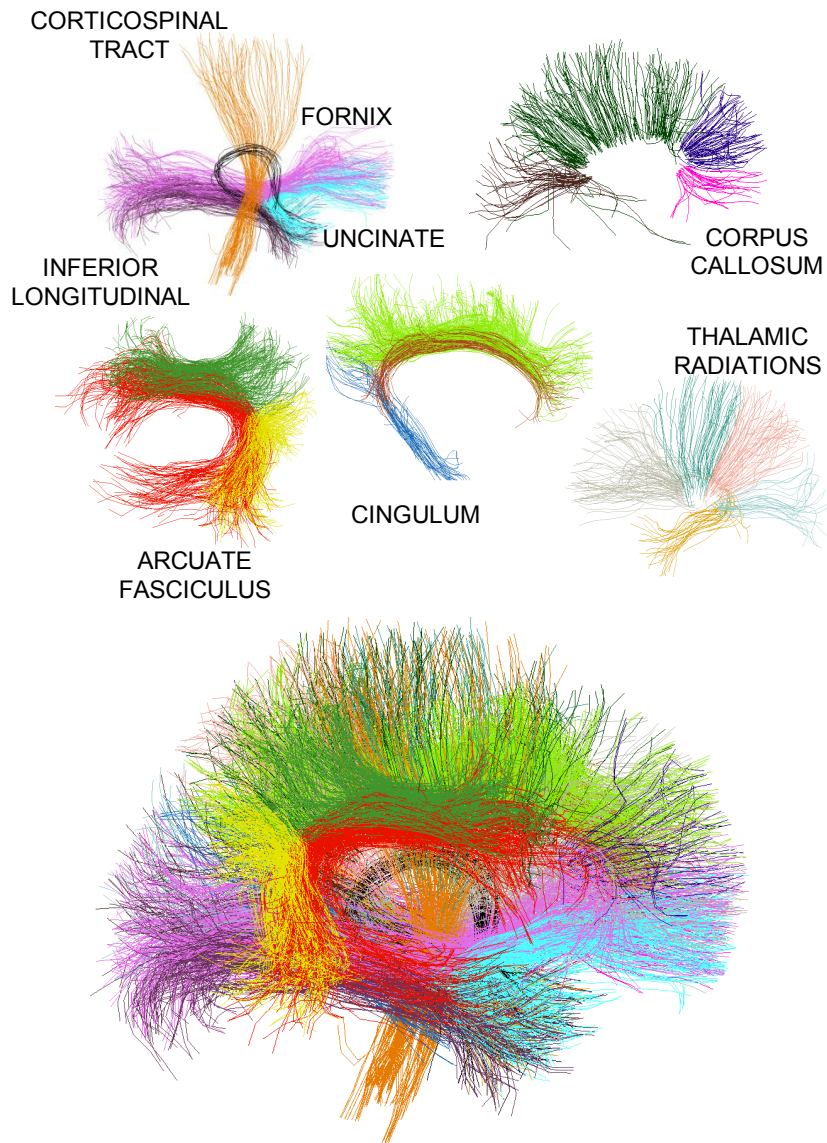


Une myriade de trajectoires indiquant des faisceaux potentiels

Cartographier les faisceaux du cerveau humain

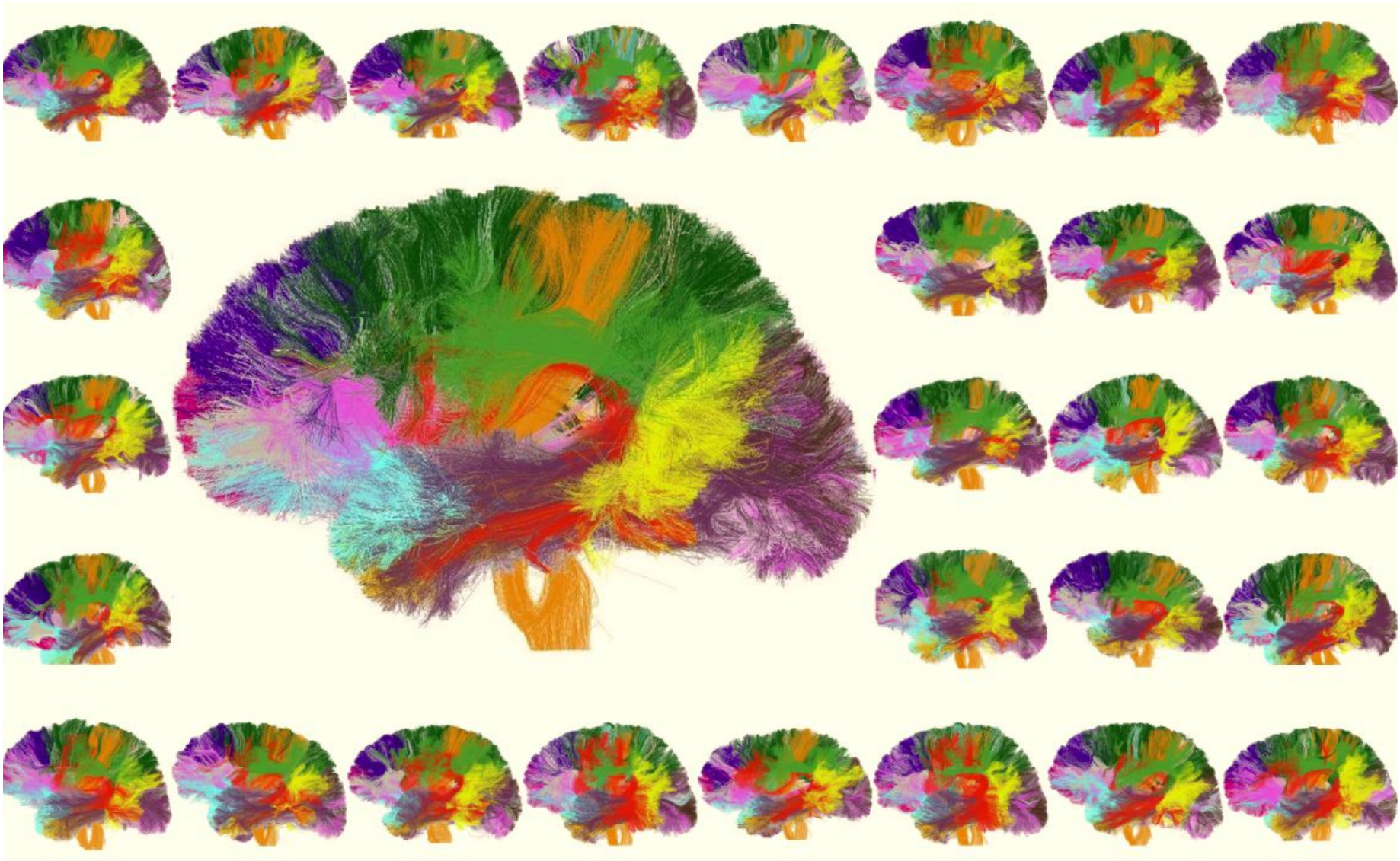


Atlas de l'hémisphère gauche



FAISCEAUX D'ASSOCIATION DITS EN U

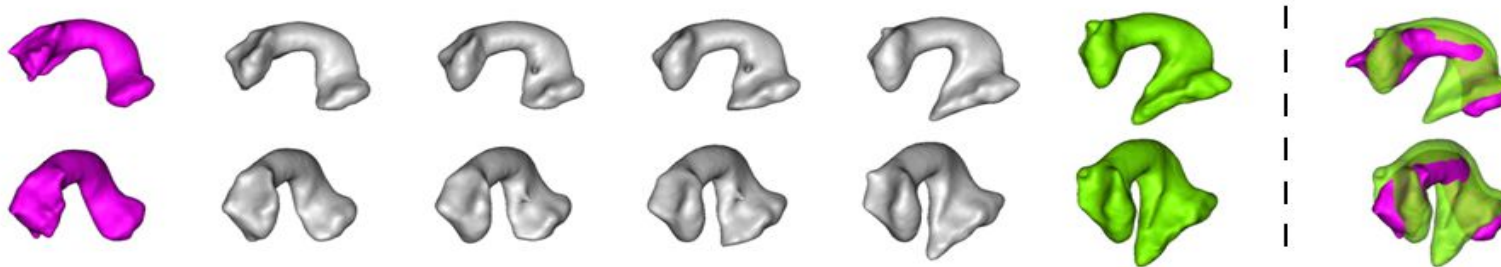
Reconnaissance automatique des faisceaux



117 patients bipolaires / 86 controles

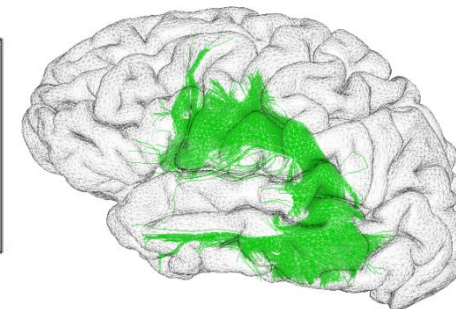
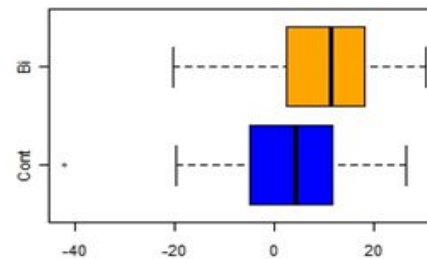
Une extension spécifique du faisceau arqué chez les bipolaires

Moyennes glissantes le long de la variété du faisceau



Hémisphère gauche

Control vs Bipolar



Bipolaires

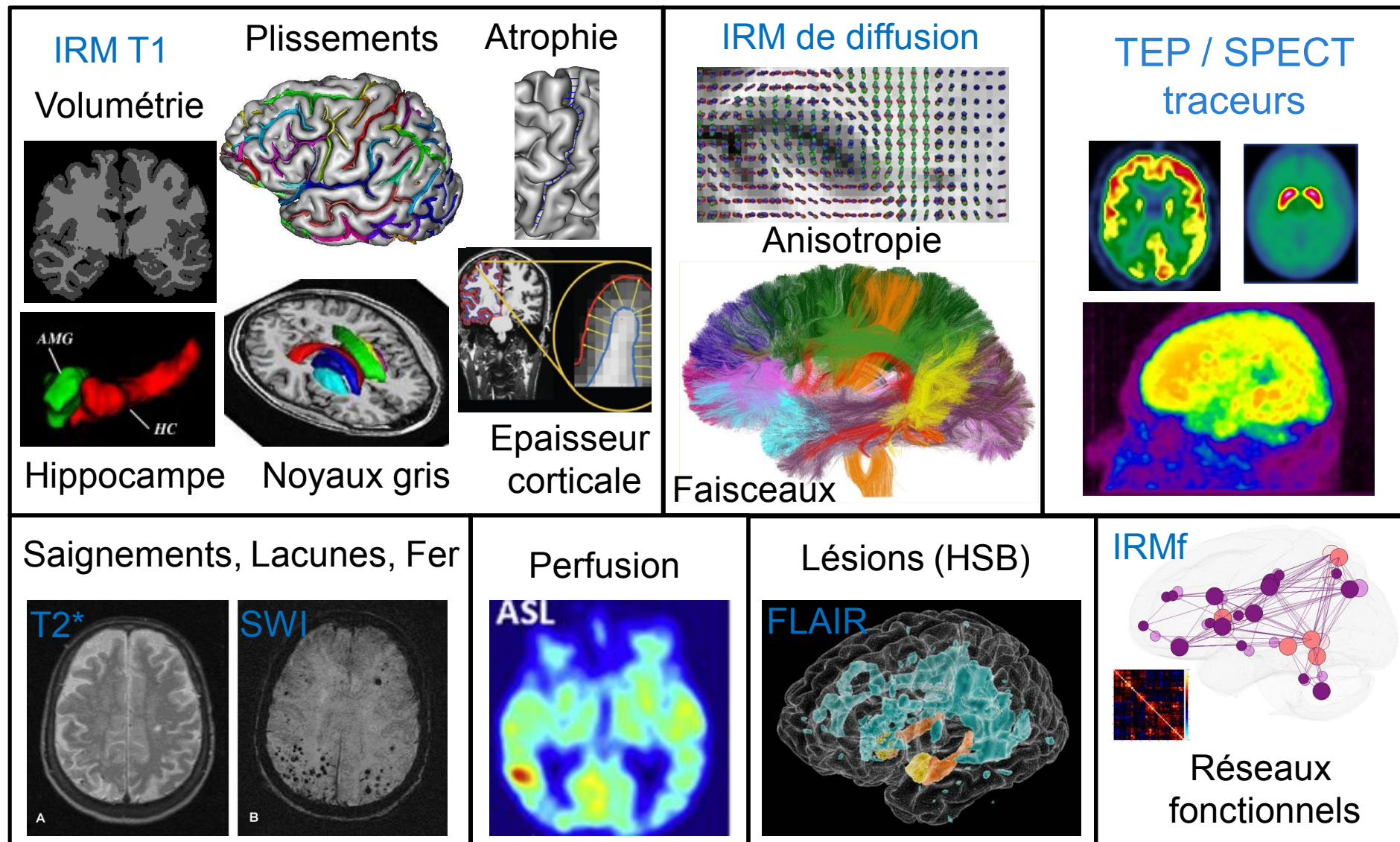


Contrôles



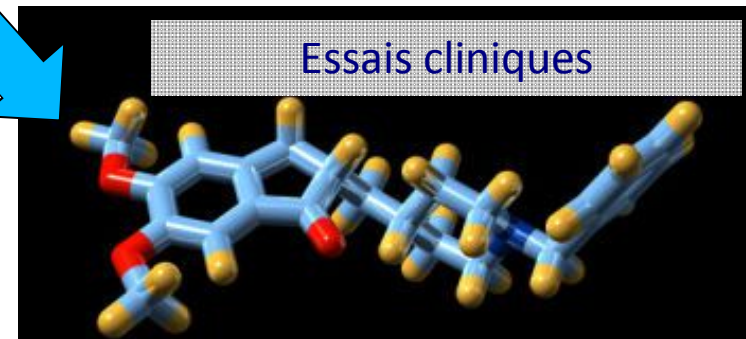
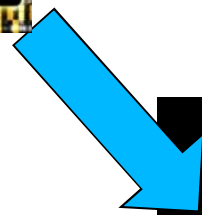
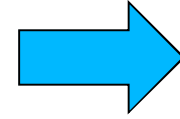
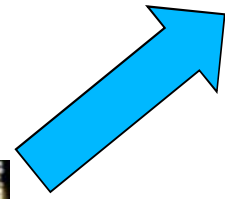
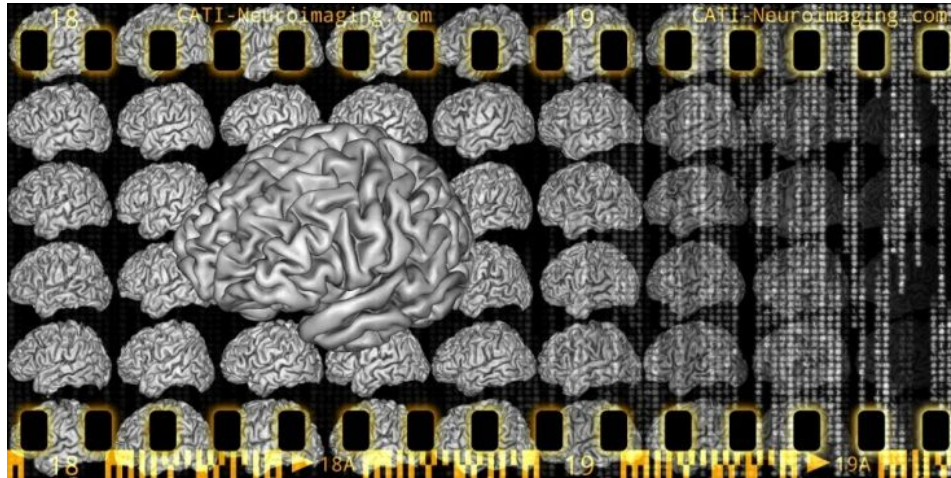


Une myriade de mesures d'imagerie





Fouille de données / Apprentissage



Plateforme Wild, LRI, université Paris 11

