



University of Wisconsin
**SCHOOL OF MEDICINE
AND PUBLIC HEALTH**

Manifolds Data

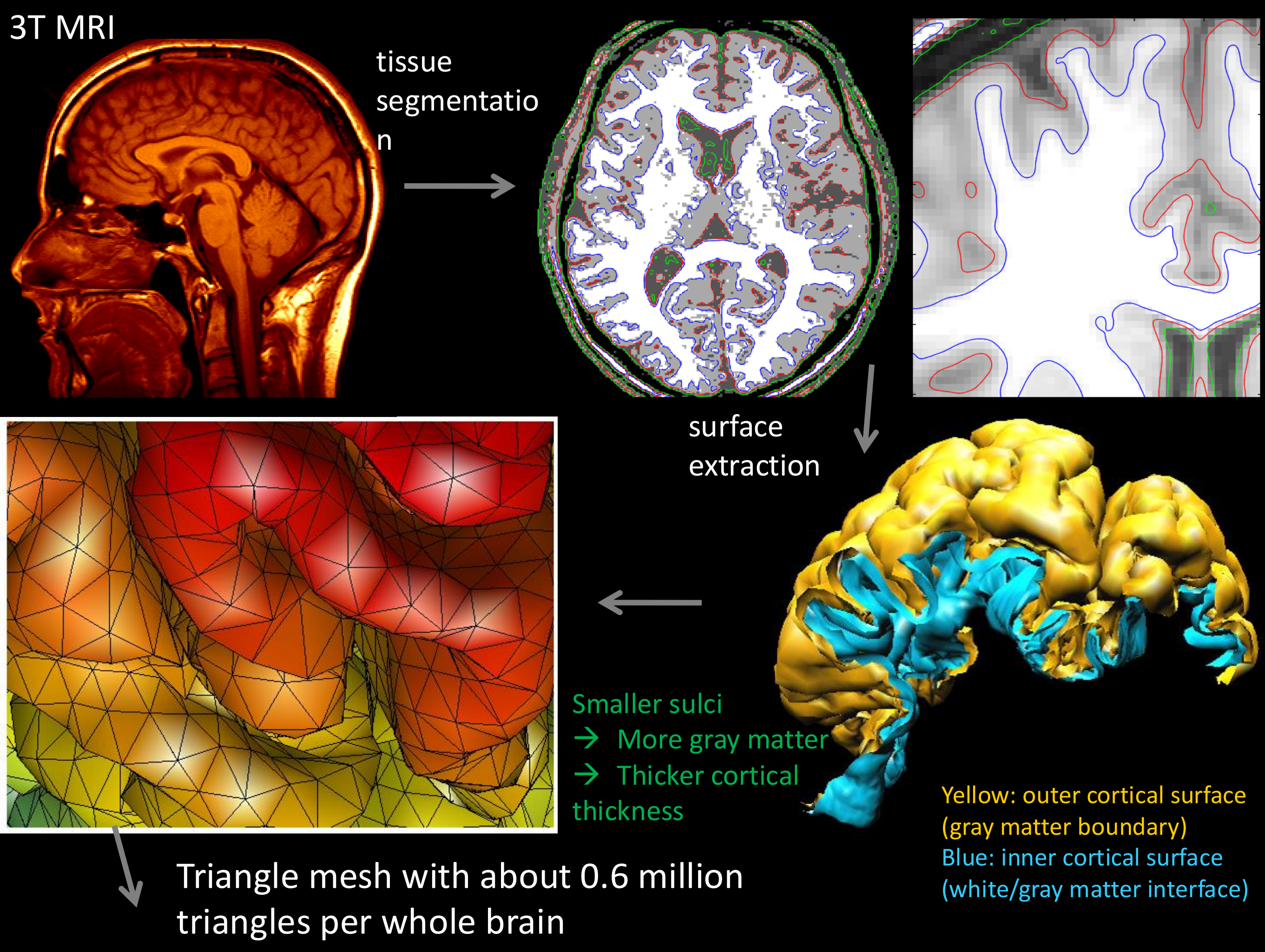
Moo K. Chung

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www.stat.wisc.edu/~mchung

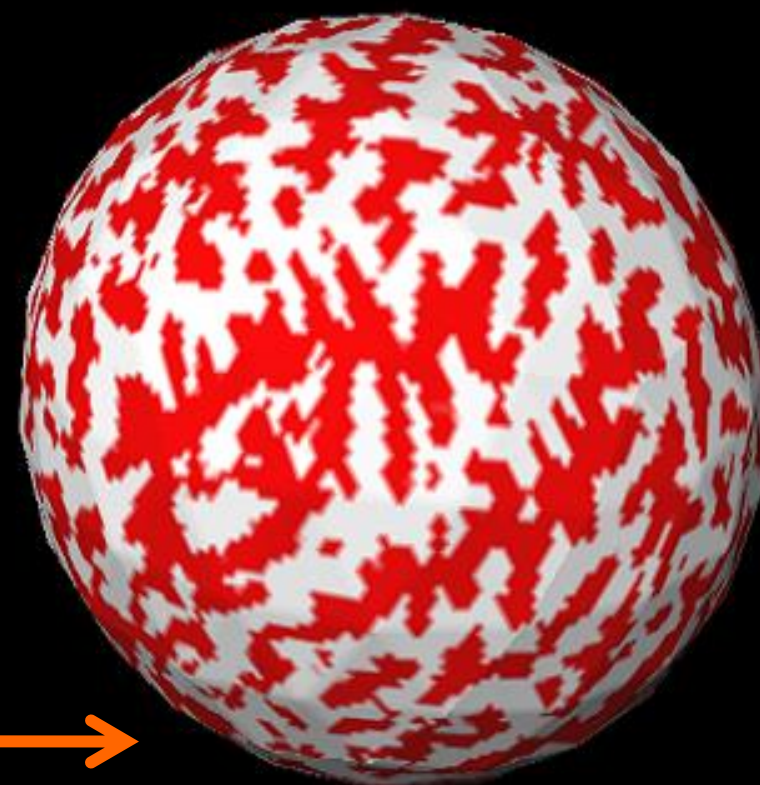
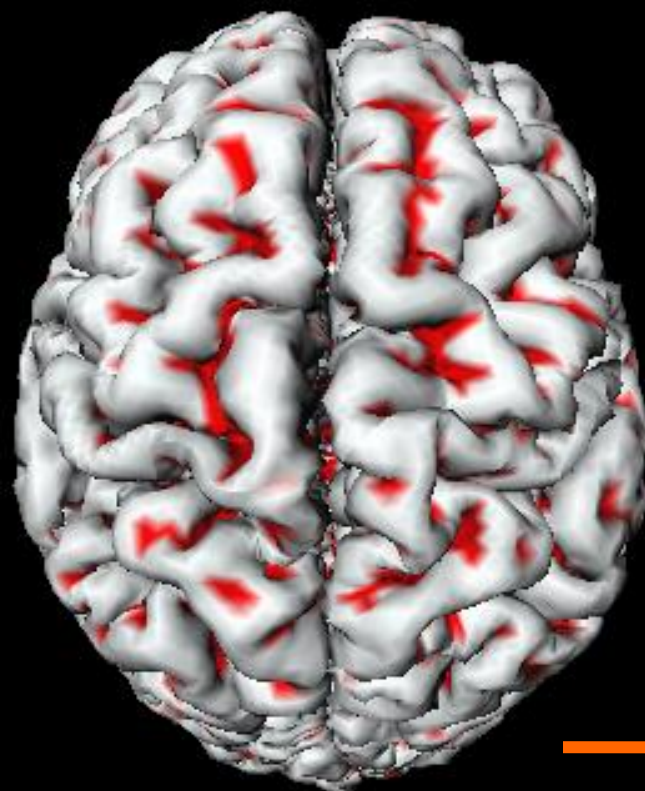
3T MRI scanner



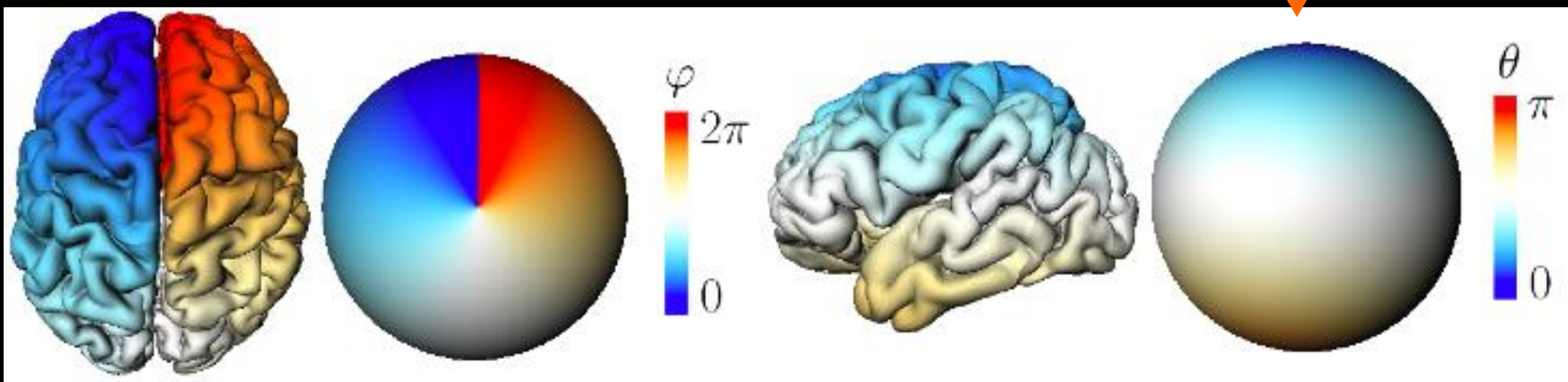


Cortical surface flattening

3T MRI



FreeSurfer deformable surface algorithm



Spherical
angles

Data structure for triangle mesh

```
>>surf =
```

```
    vertices: [1282x3 double]
```

```
      faces: [2560x3 double]
```

structured array

```
>>surf.faces
```

```
ans =
```

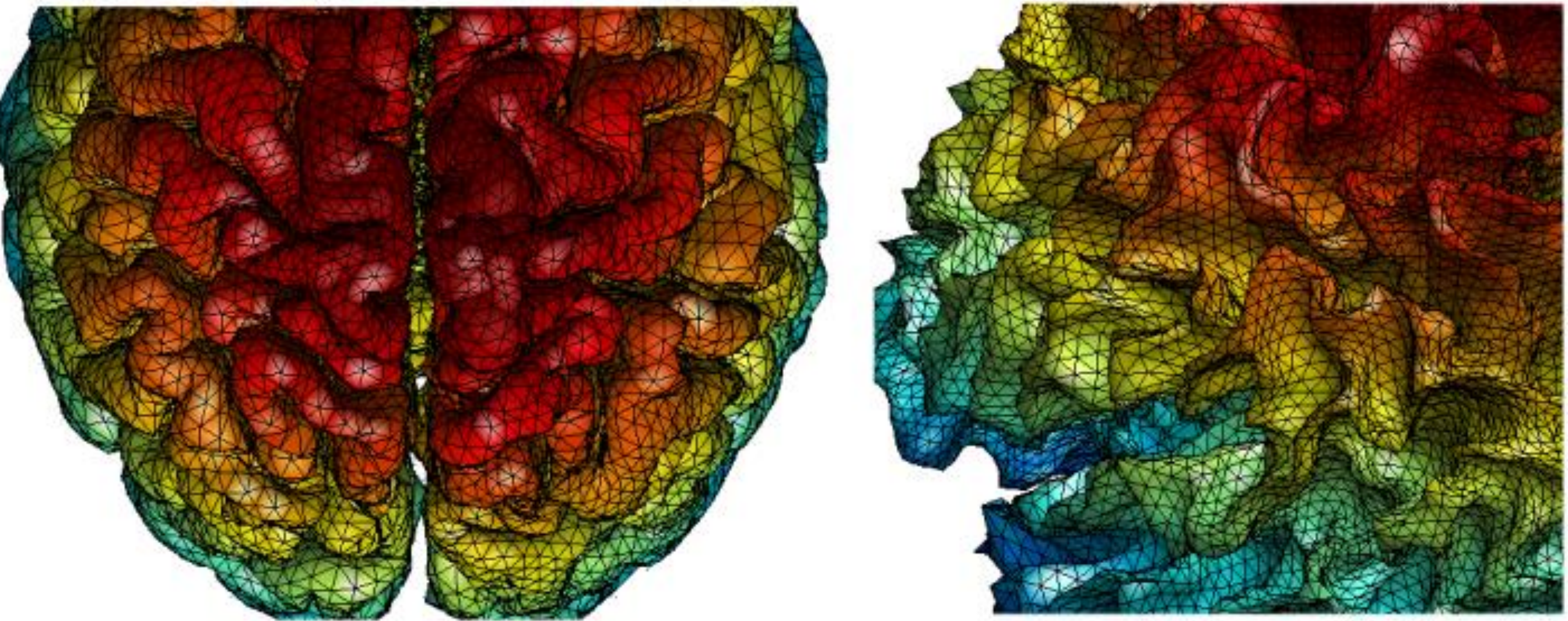
1	2	3
1	4	2
1	3	5
...		

```
>> surf.vertices
```

vertex coordinates

```
ans =
```

75.0000	93.0000	51.5050
74.5050	93.0000	52.0000
75.0000	92.5050	52.0000
...		



How many edges in surface mesh?

Since two adjacent triangles share the same edge, the total number of edges is $2E = 3F$.

How many edges in surface mesh?

Example.

surface =

struct with fields:

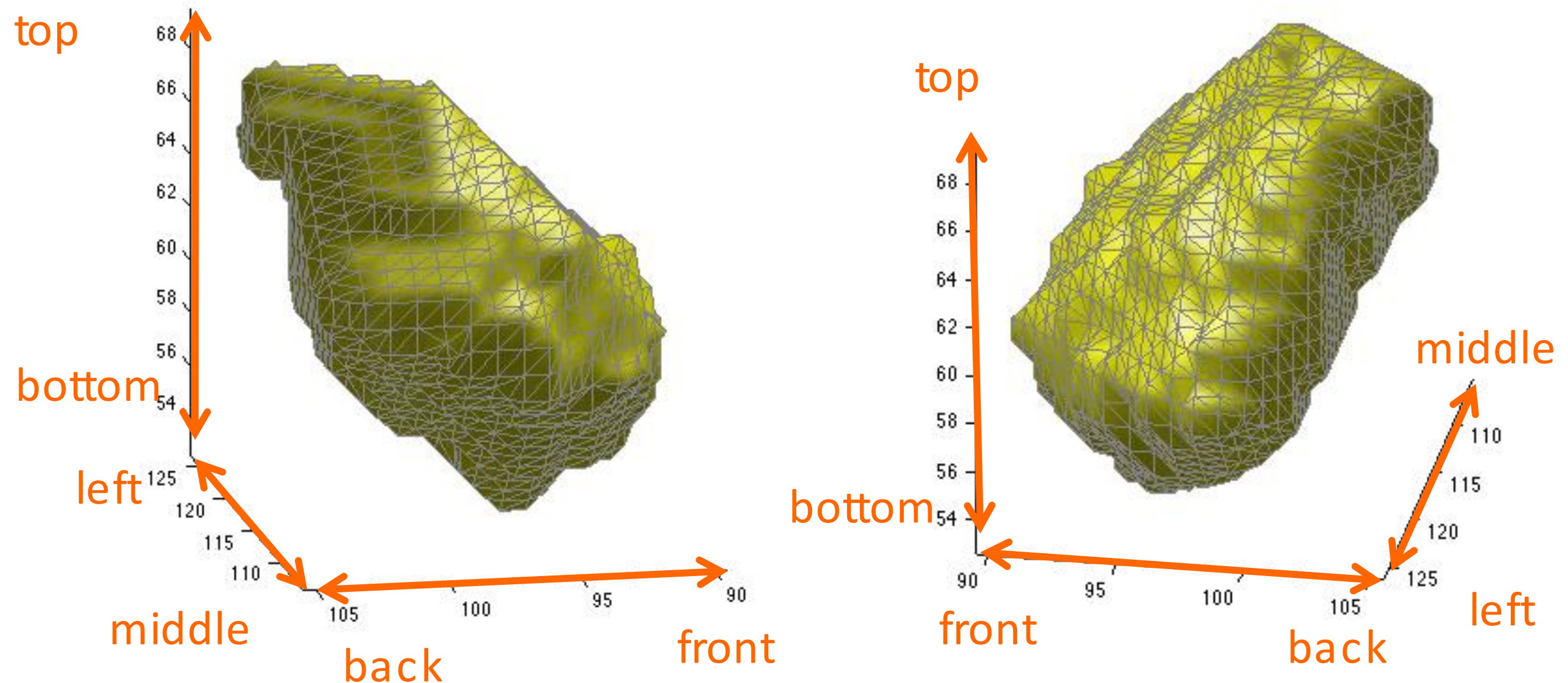
vertices: [5916 × 3 double]

faces: [11824 × 3 double]

edges: [17736 × 2 double]

Check $2E = 3F$

2D surface mesh of the left amygdala



Functional regression: Filter out geometrical noises.

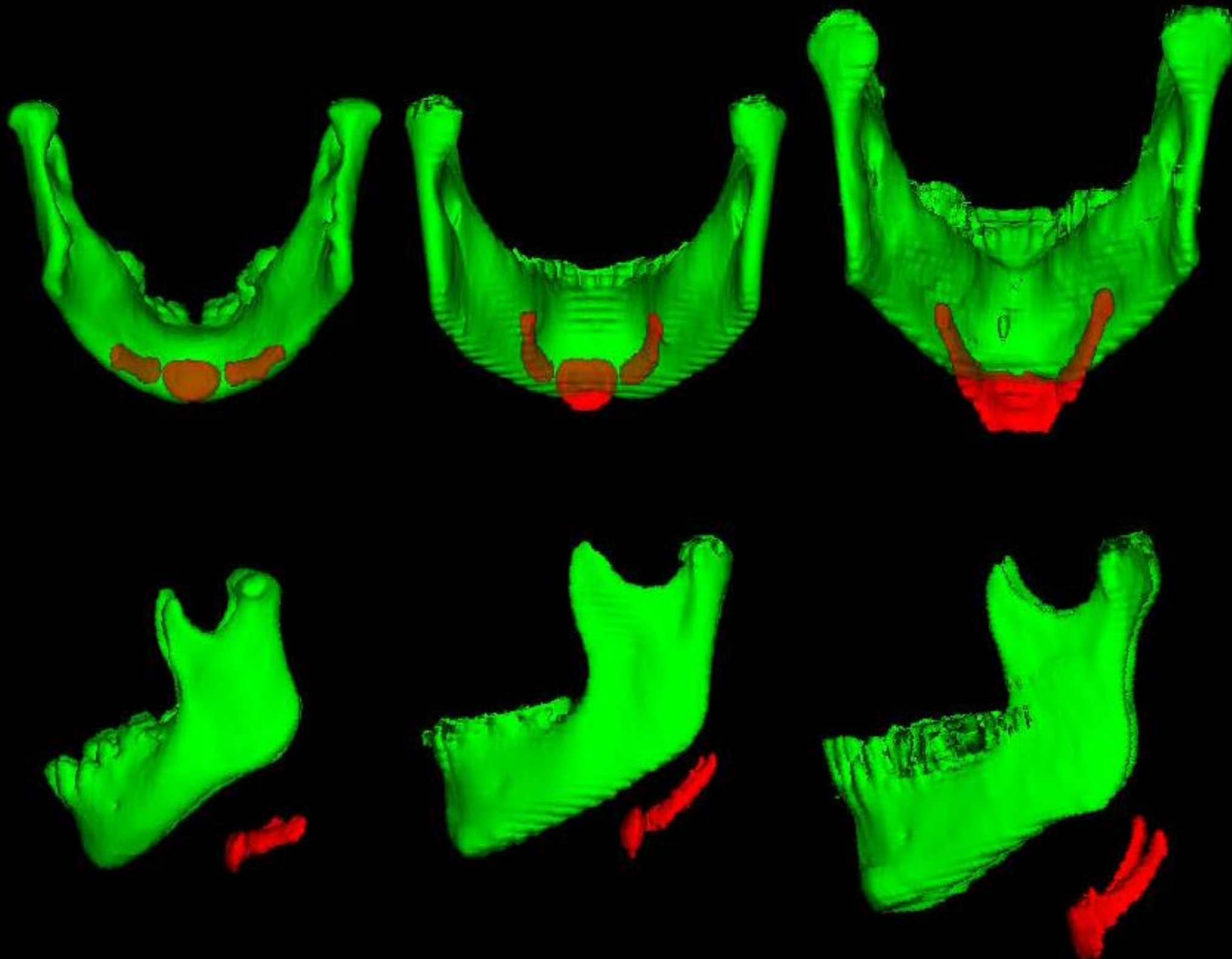
Functional registration: Align functional data in a common space

Topology changing bone fusion

DS; 10 yrs, 6 mo.

TD; 10 yrs, 11 mo.

TD; 44 yrs, 1 mo.

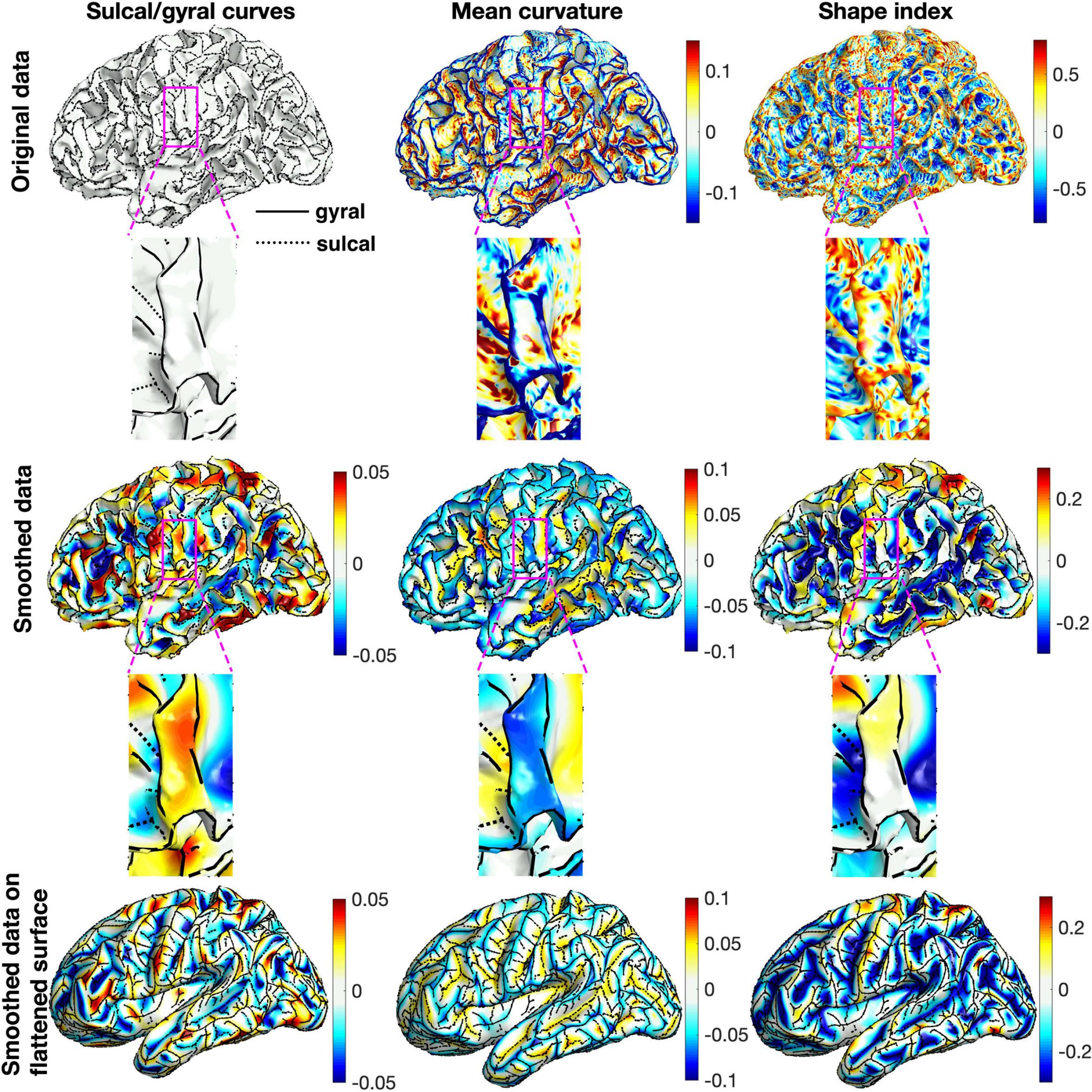


DS: down syndrome

TD: typically developing

[*Chung et al.*](#)

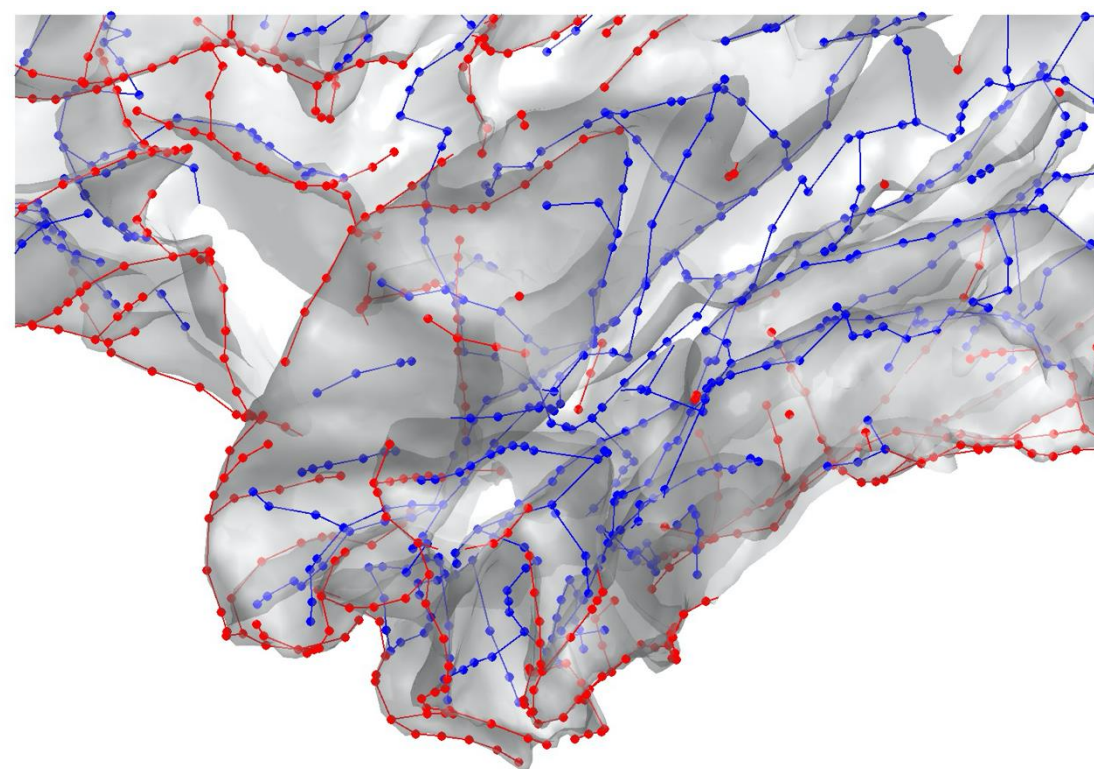
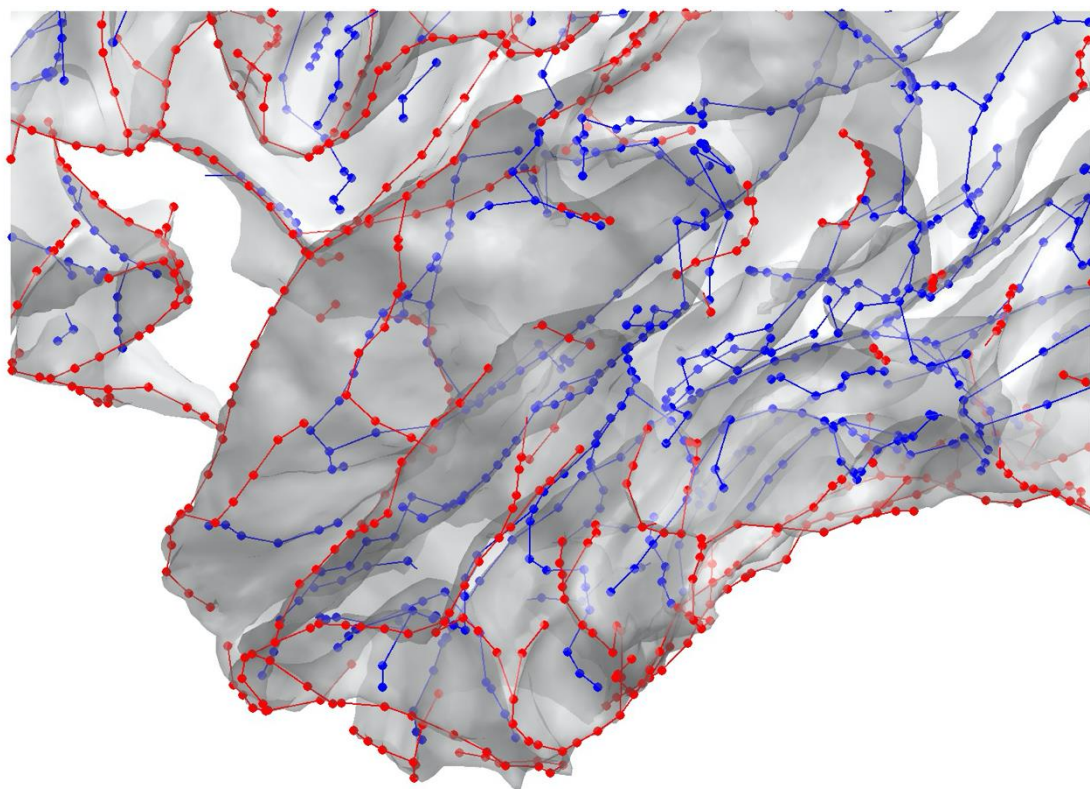
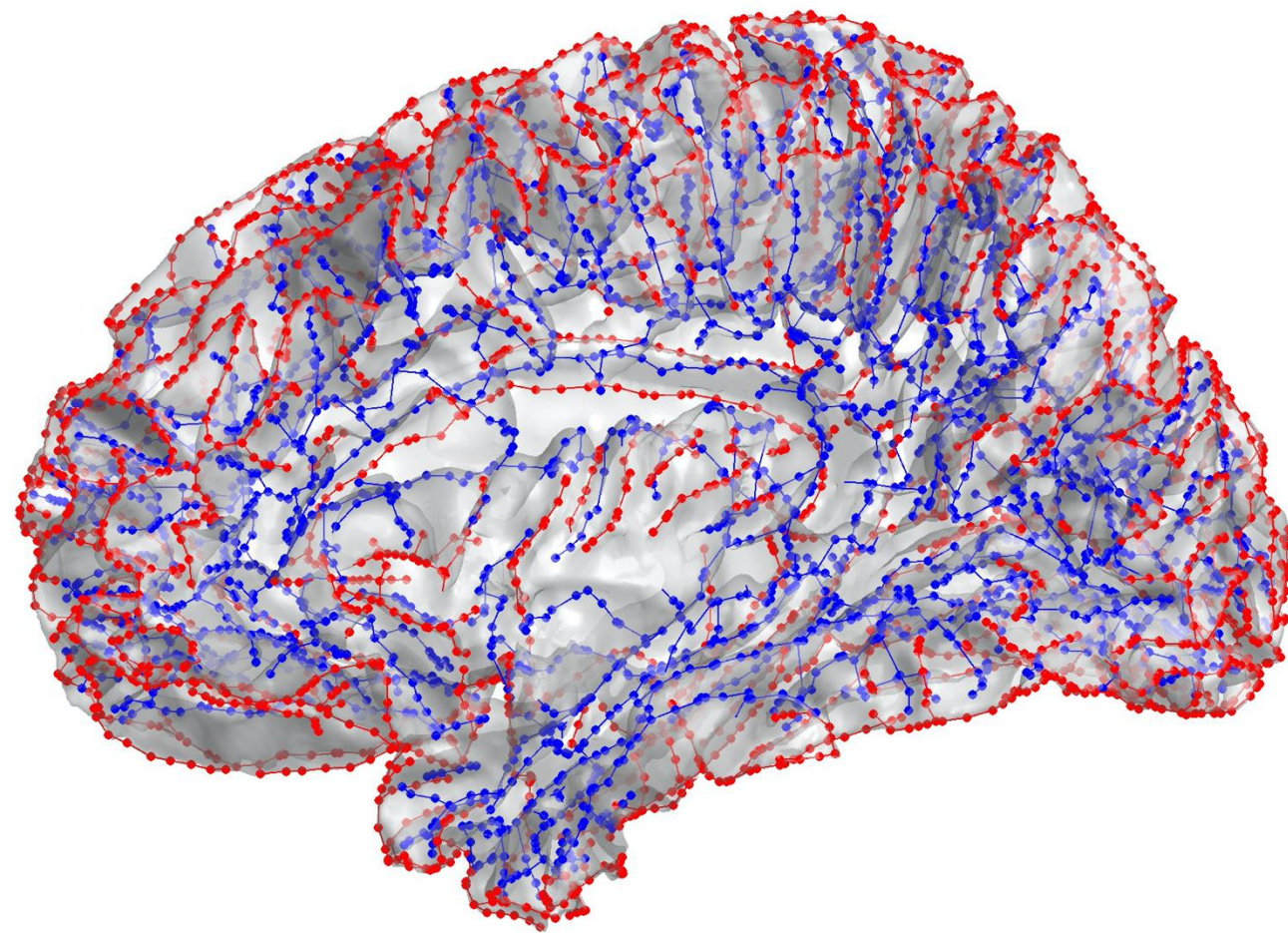
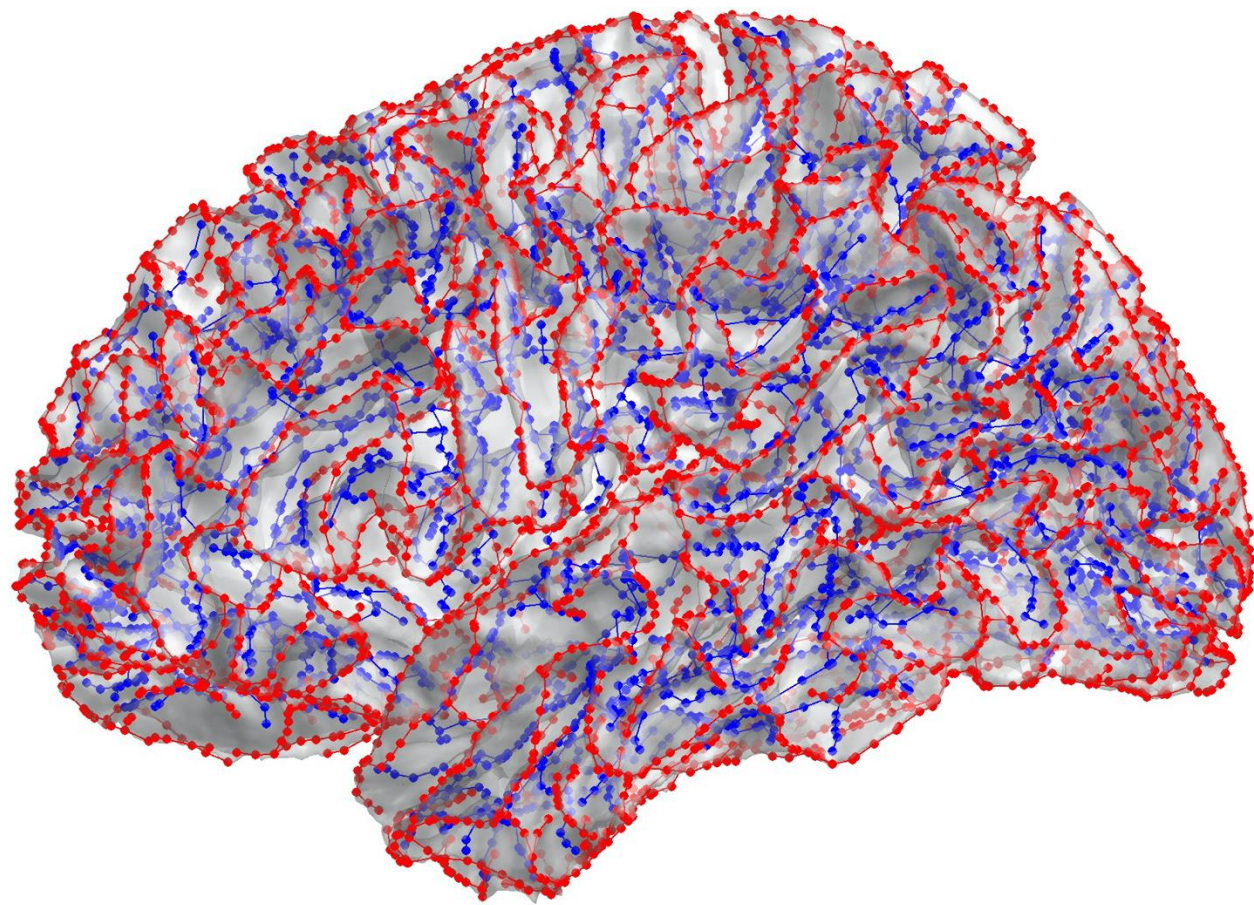
2020



Sulcal/gyral
curves
superimposed
on top of
other surface
indices

*Huang et al. 2019
IEEE Transactions on
Medical Imaging*

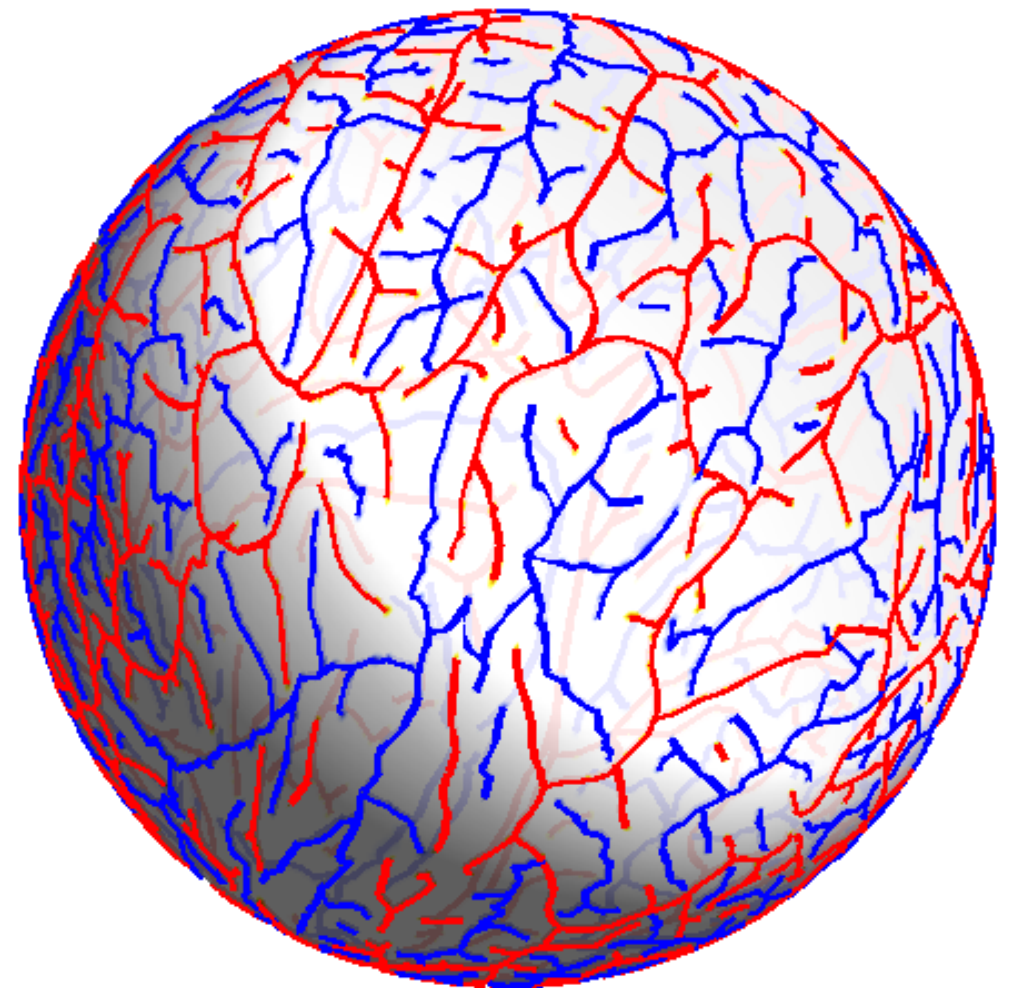
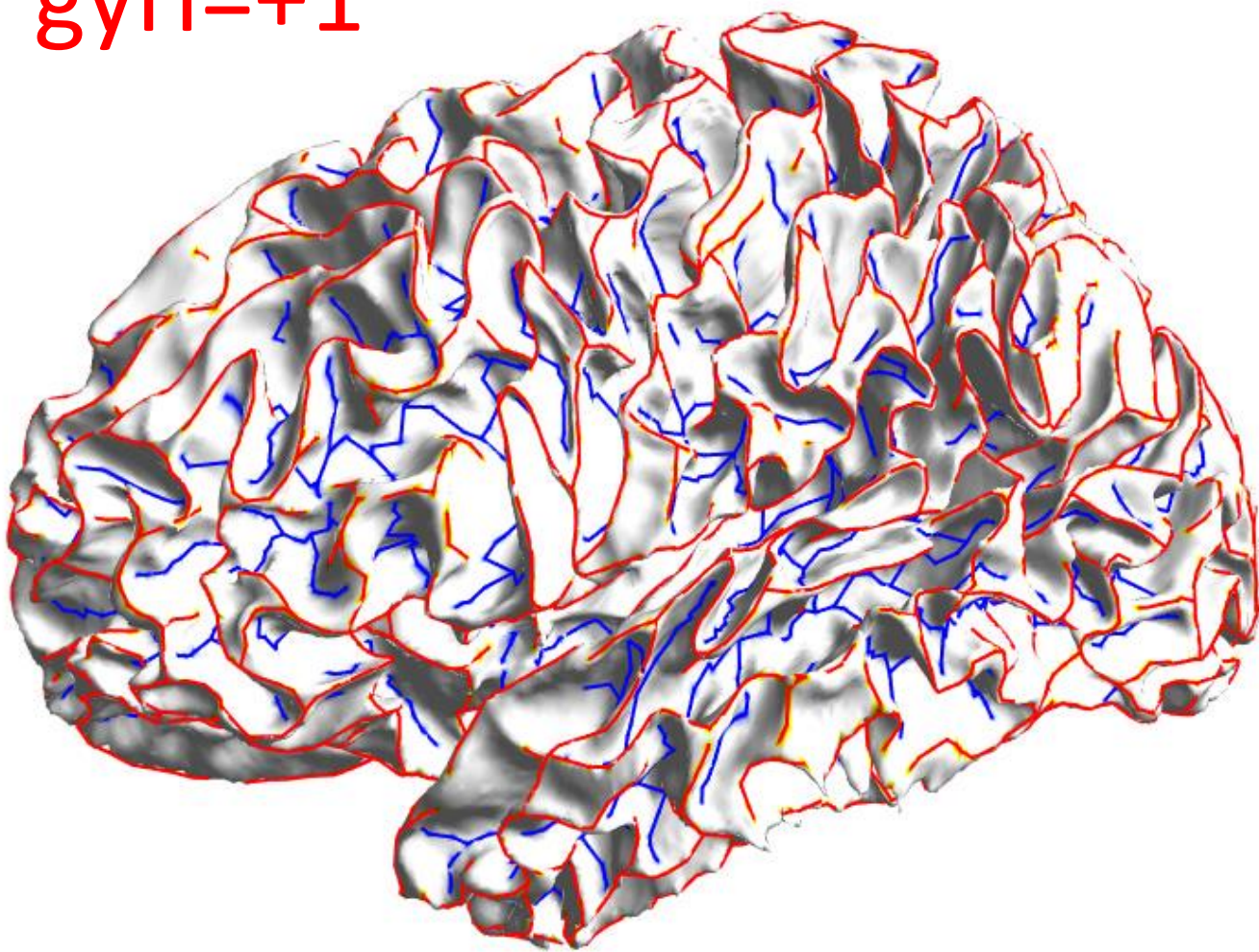
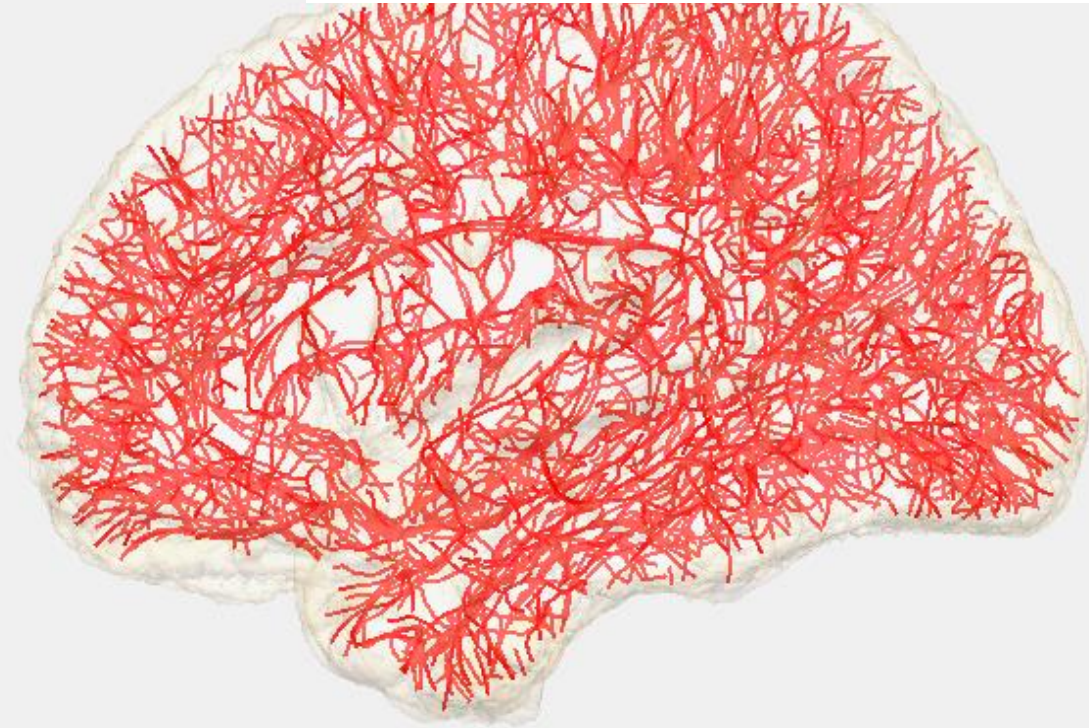
functional/gyral creases in two different subjects



Sulci = valley regions
Gyri = mountain regions

sulci = -1
gyri = +1

3D volume projection



White matter surface

Trees on 2-sphere