Altered connectivity in individuals with 22q11.2 deletion syndrome and association to psychotic symptoms

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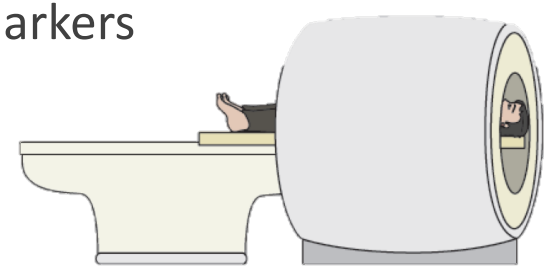
Towards predictive biomarkers of psychosis

22q11 expose to a high risk to develop psychosis

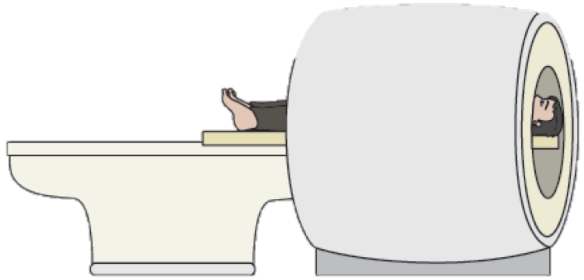
Identify **predictive biomarkers**: objective measures that could predict the development of psychosis

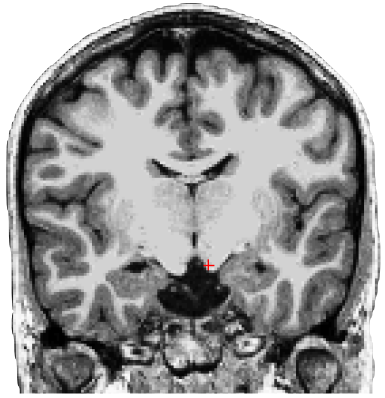
Magnetic resonance imaging as a tool to find biomarkers



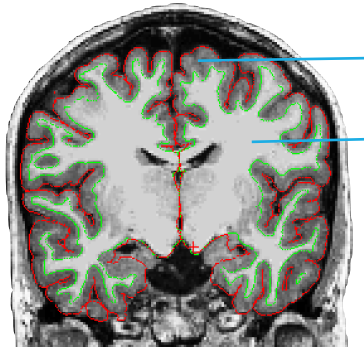
Identify biomarkers using MRI

MRI: a tool to study biomarkers of psychosis



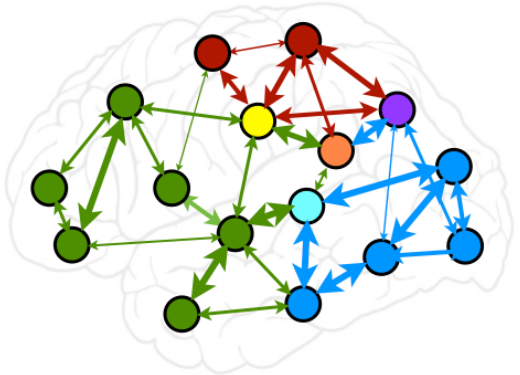


Brain morphology



- Brain volume
- Cortical thickness
- Gyrification

Brain connectivity



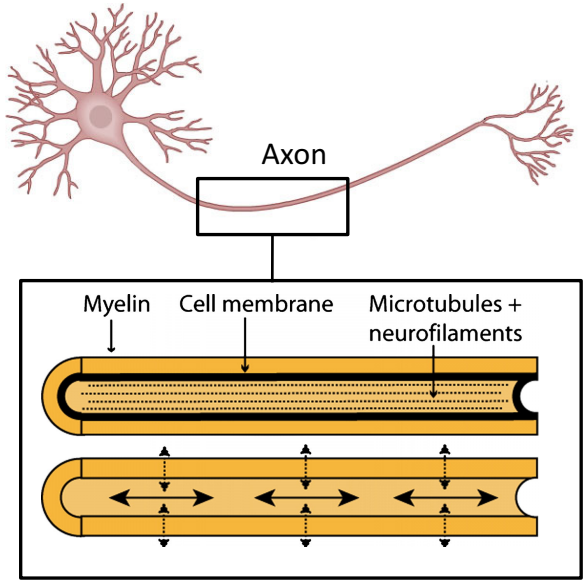
Identify biomarkers using MRI

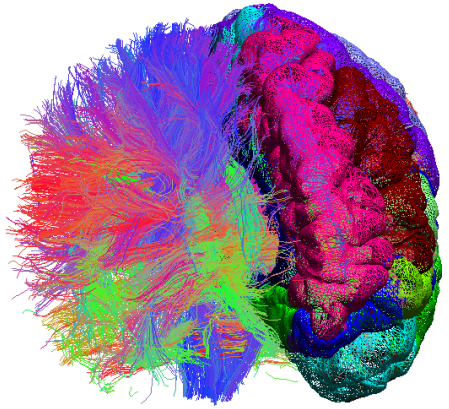
Structural connectivity:

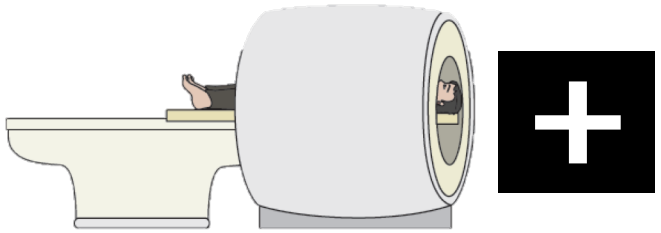
- Reflects the axonal connections between brain regions
- Is measured with Diffusion Tensor Imaging – sensitive to the movement of the water molecules in the brain

Functional connectivity:

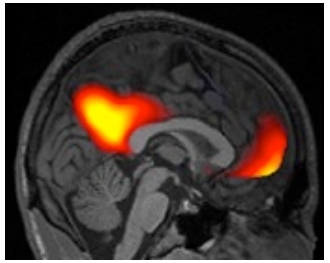
- Reflects the co-activation between brain regions
- Can be measured with resting-state fMRI – intrinsic brain connectivity







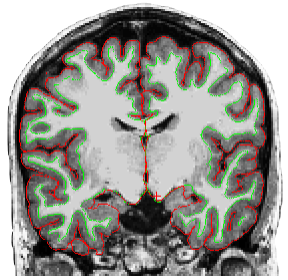
Networks

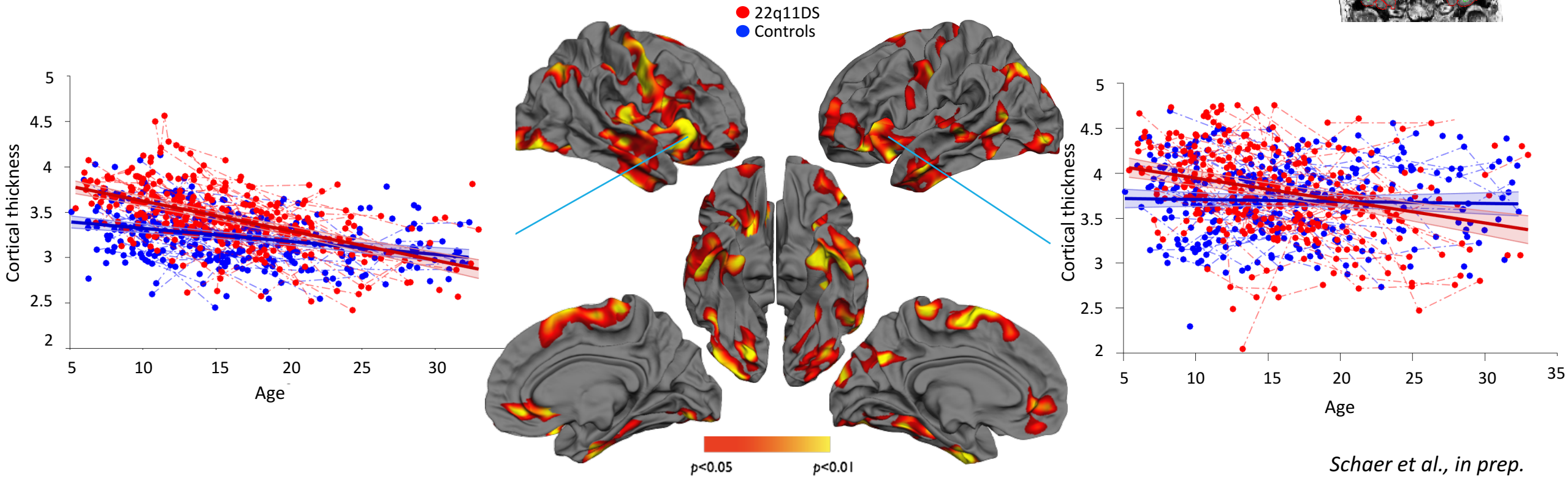


Changes in brain morphology

Accelerated cortical thinning in individuals with 22q11.2 deletion syndrome compared to typically developing individuals

Brain morphology

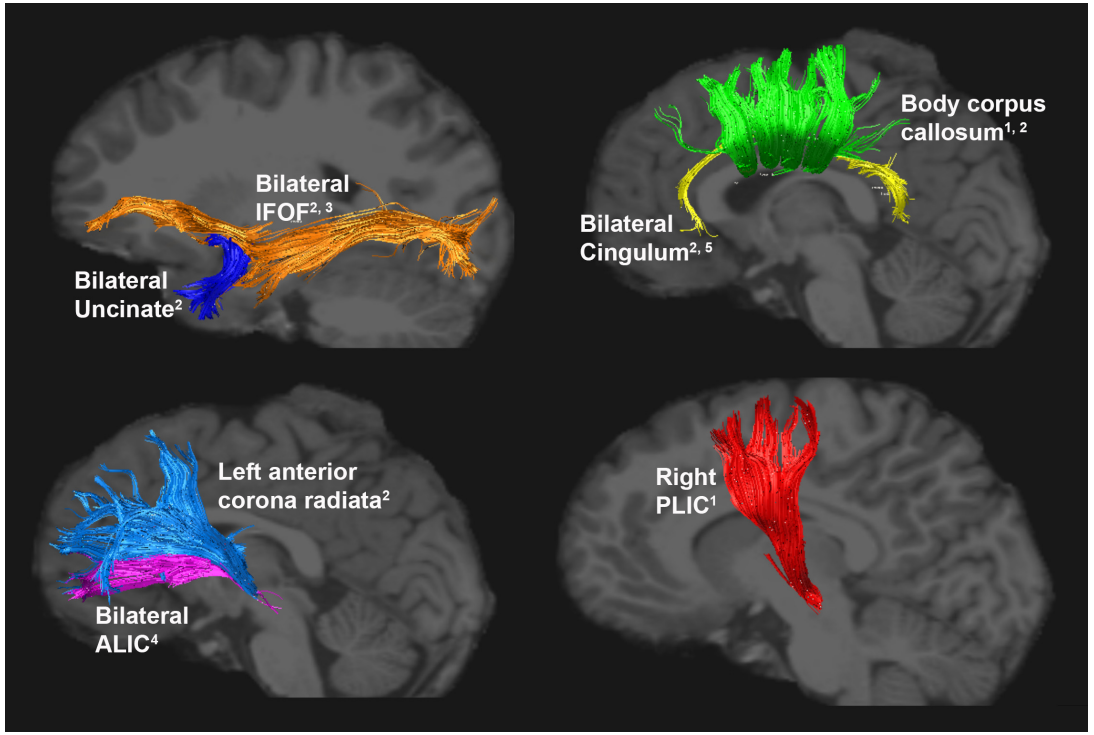




Schaer et al., in prep.

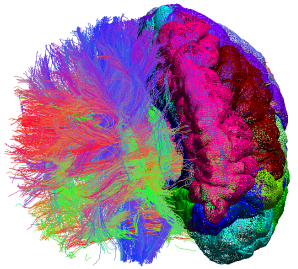
Changes in brain connectivity

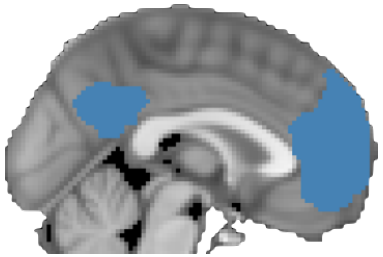
Differences in frontal and long-range connectivity in individuals with 22q11DS compared to typically developing individuals



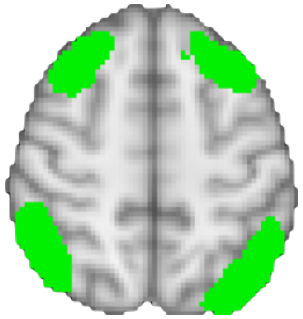
Scariati & Padula et al., 2016

Structural connectivity

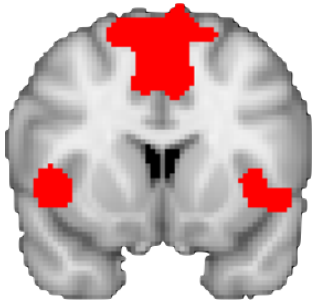




Default Mode Network



Central Executive Network

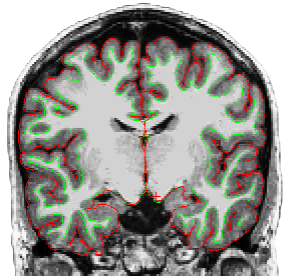


Saliency Network

Padula et al., 2016, 2017

Changes in brain morphology associated to higher symptoms

Brain morphology

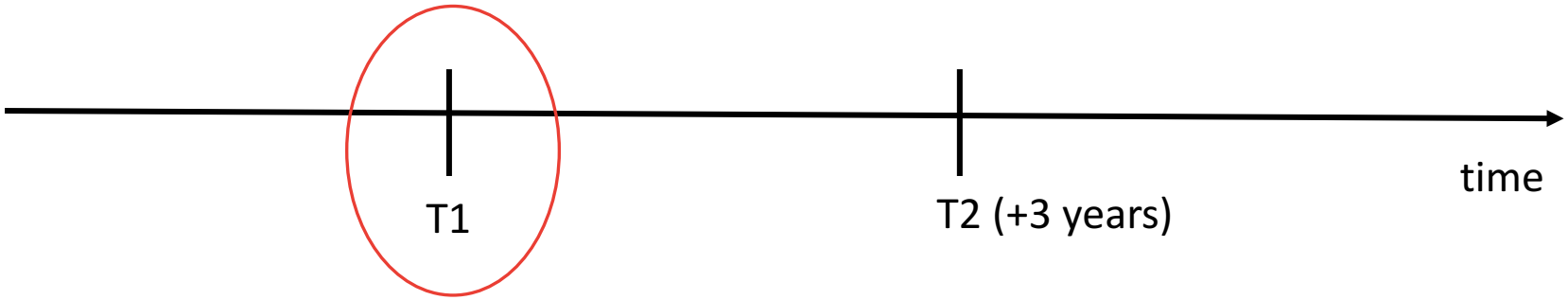


Padula et al., psychological medicine, submitted

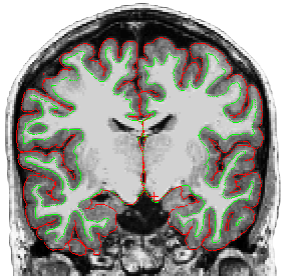
Changes in brain morphology associated to higher symptoms

Objectives:

- Identify differences in brain morphology (volume, thickness, gyrification) in individuals with higher psychotic symptoms
- Investigate if changes in brain morphology predict changes in symptoms scores, cognitive scores and global functioning after 3 years
- Investigate the developmental trajectories of brain morphological measures



Brain morphology



Padula et al., psychological medicine, submitted

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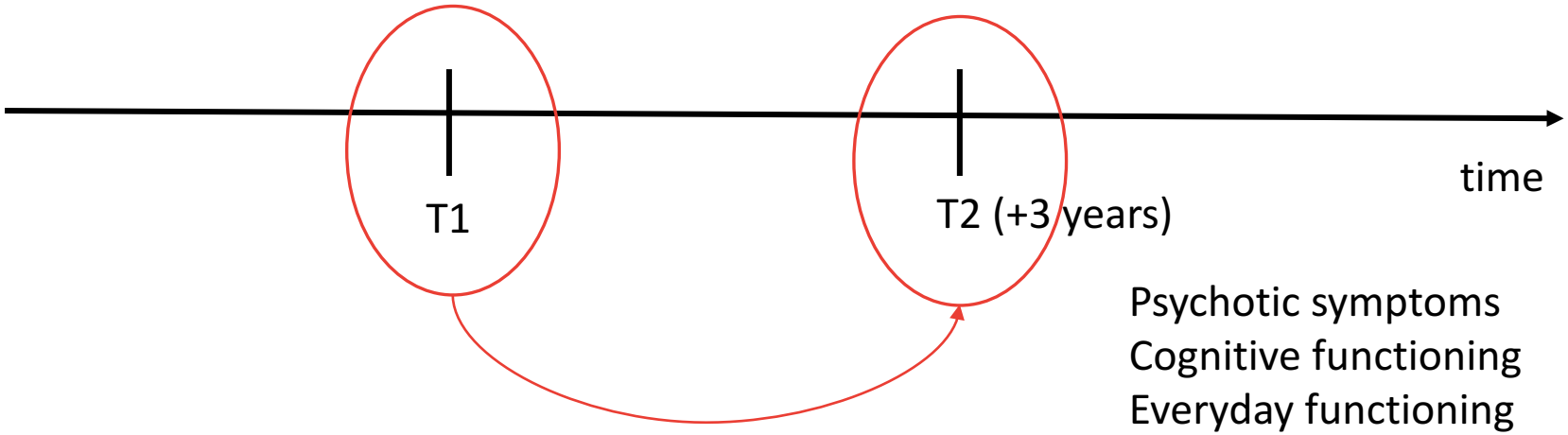
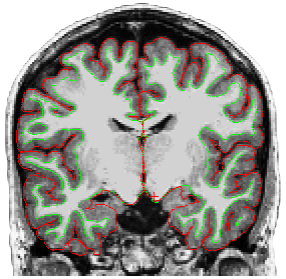


Brain morphology



Psychotic symptoms
Cognitive functioning
Everyday functioning

Padula et al., psychological medicine, submitted

Changes in brain morphology associated to higher symptoms

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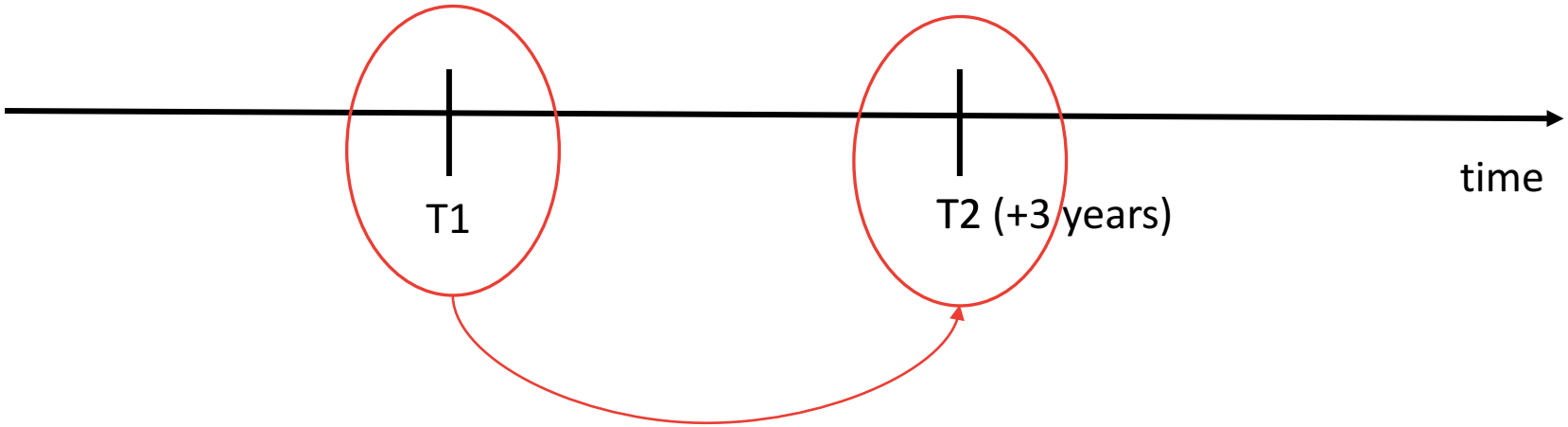
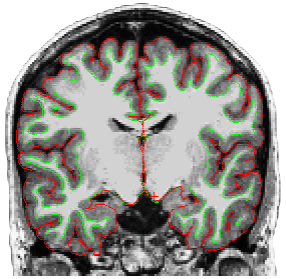


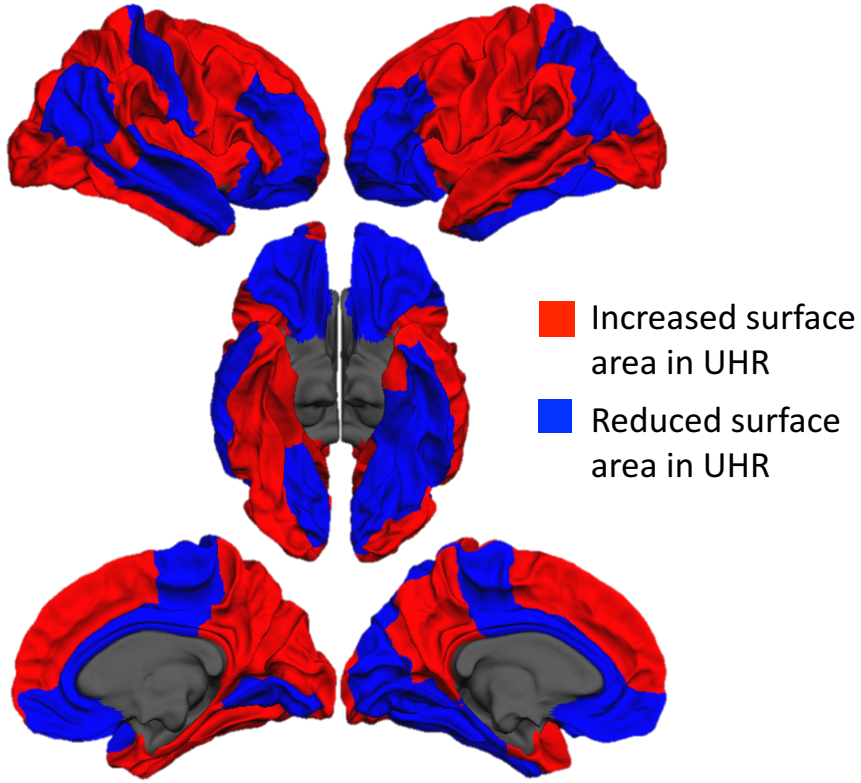
Brain morphology



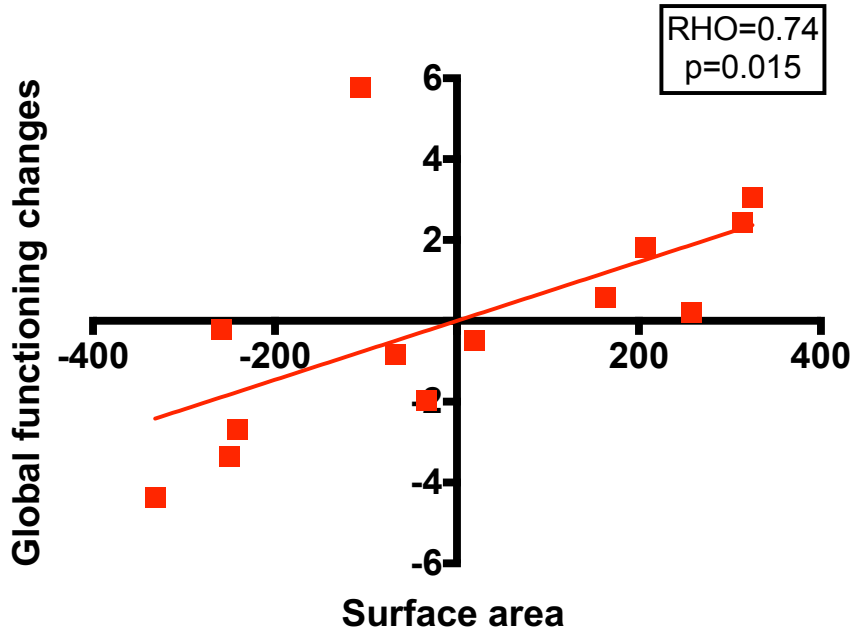
Padula et al., psychological medicine, submitted

Changes in brain morphology associated to higher symptoms

- Differences in surface area in individuals with higher psychotic symptoms
- Association between surface area and global functioning



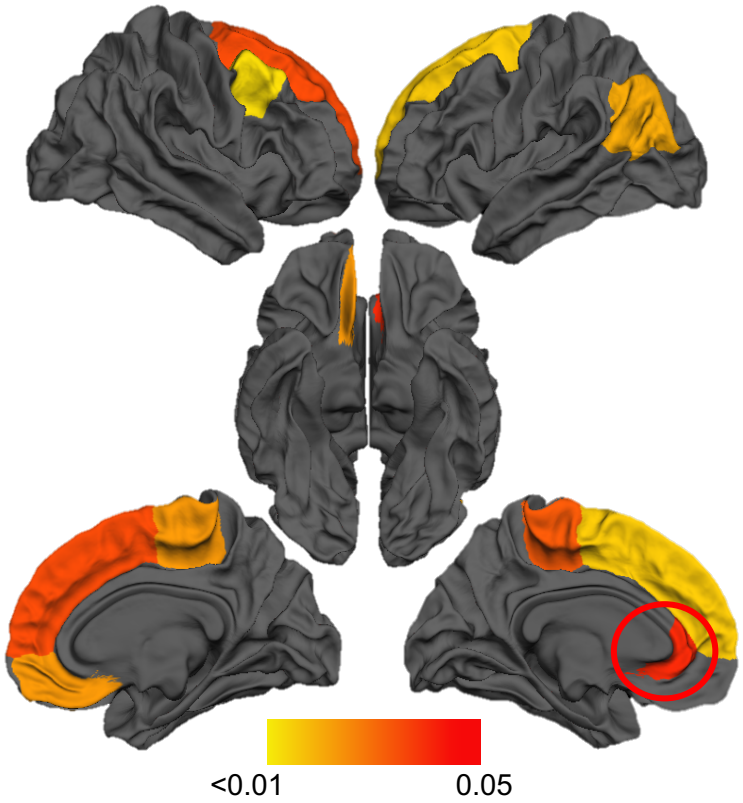
Accuracy=68.2%, CI: 53.4-80%,
sensitivity: 68.2%, specificity: 68.2%

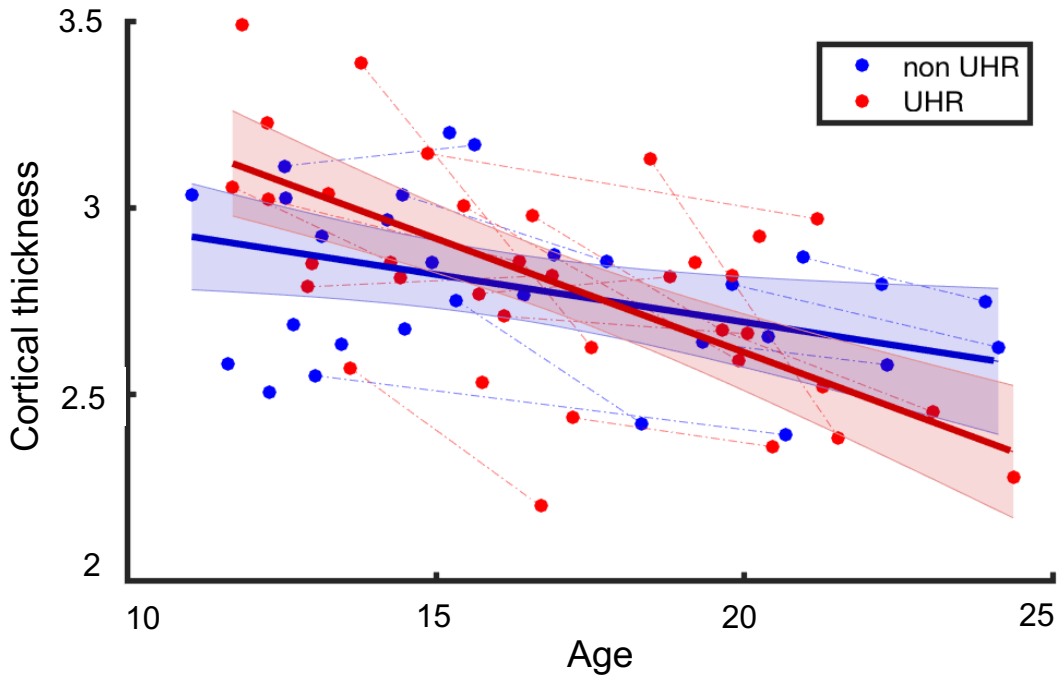


Padula et al., psychological medicine, submitted

Changes in brain morphology associated to higher symptoms

Different developmental trajectories of cortical thickness → accelerated thinning





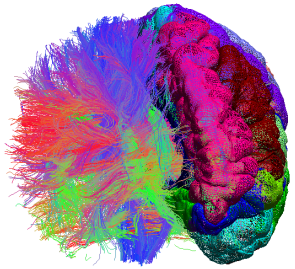
Padula et al., psychological medicine, submitted

Changes in structural connectivity associated to higher symptoms

Objectives:

- Identify differences in structural connectivity in individuals that have a higher psychotic symptoms

Structural connectivity



Padula et al., Neuroimage Clinical, 2017

Changes in structural connectivity associated to higher symptoms

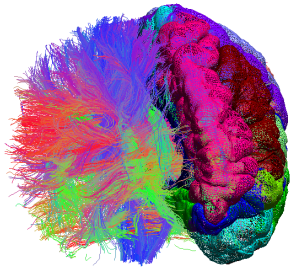
Objectives:

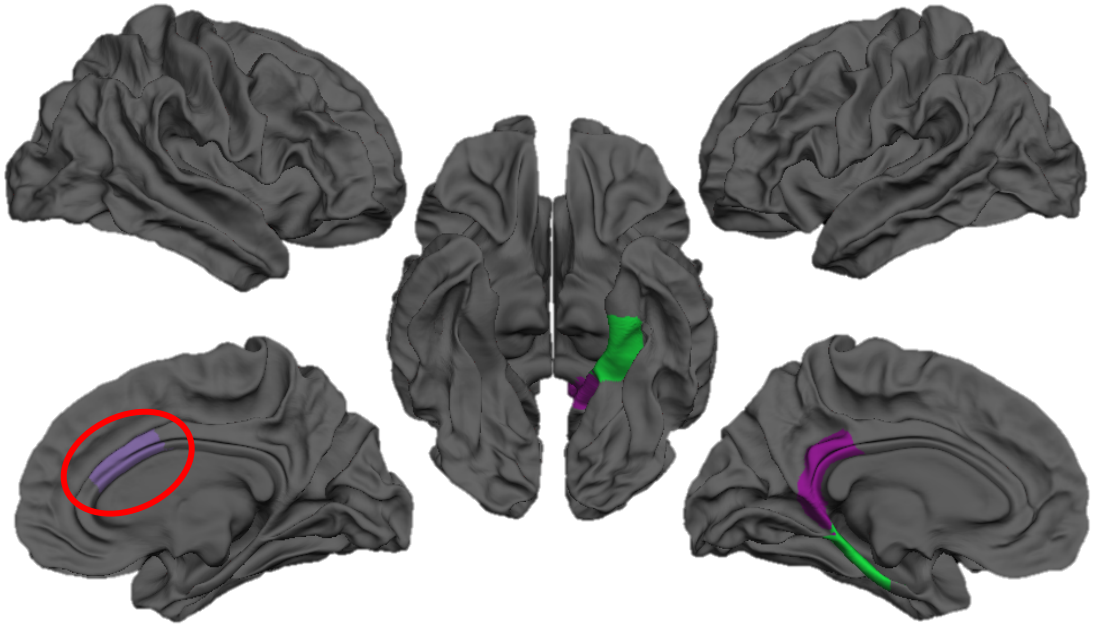
- Identify differences in structural connectivity in individuals that have a higher psychotic symptoms

Results:

- Changes in structural connectivity in individuals that have a higher psychotic symptoms (Accuracy= 67.7%, CI=55.4–78.0%, Sensitivity = 67.7%, Specificity = 67.7%)

Structural connectivity





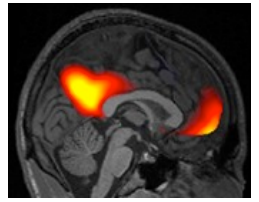
Padula et al., Neuroimage Clinical, 2017

Changes in functional connectivity associated to higher symptoms

Objectives:

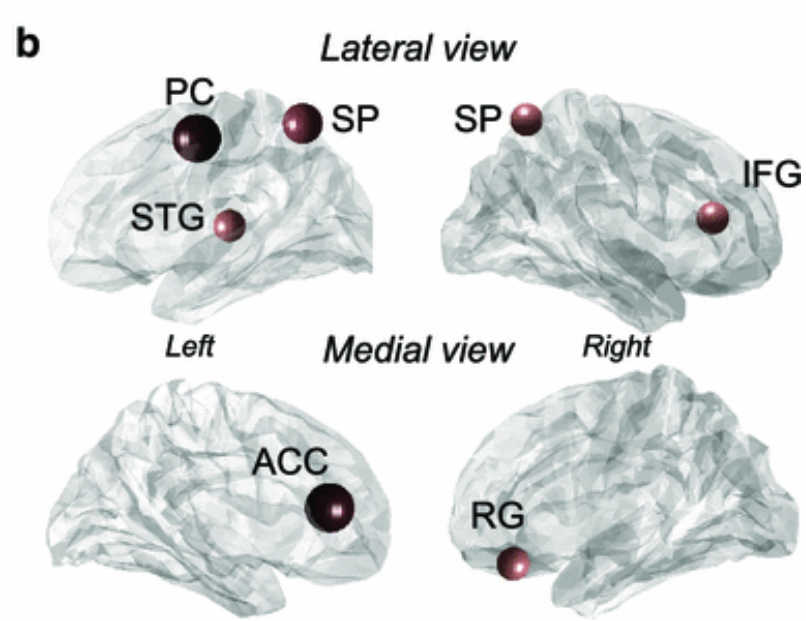
- Identify differences in functional connectivity in individuals that have a higher psychotic symptoms

Functional connectivity

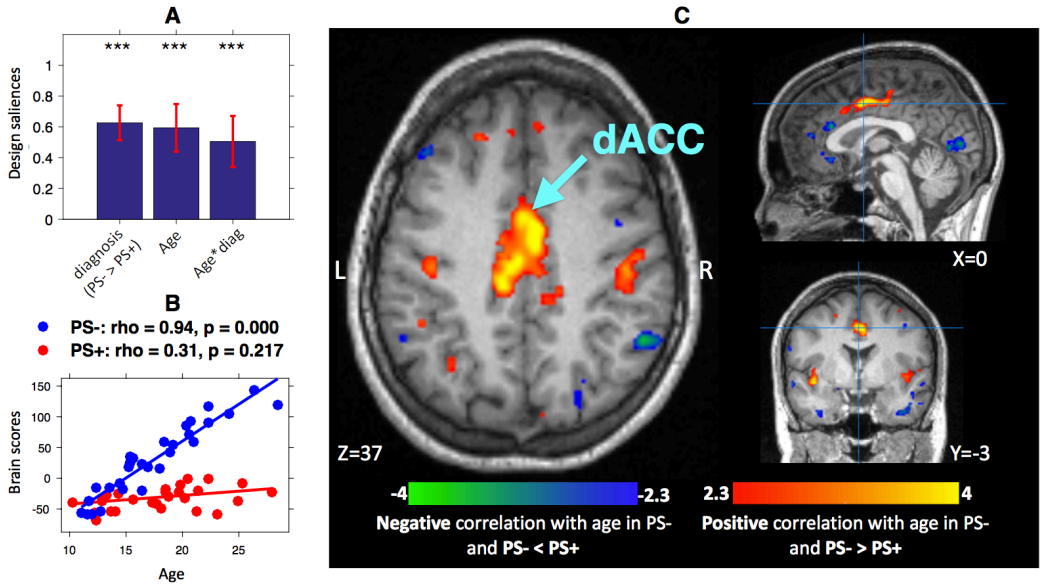


Results:

- Changes in functional connectivity in individuals that have a higher psychotic symptoms (Accuracy= 88%, Sensitivity = 92%, Specificity = 84%)



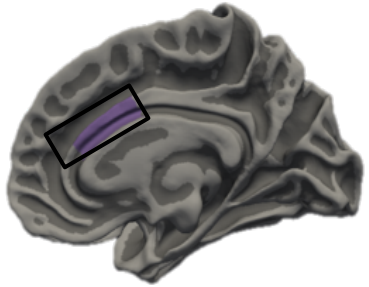
Scariati et al., Brain topography, 2014



Zoller et al., Schizophrenia Research, 2017

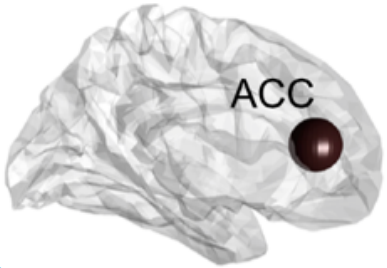
Conclusion

Structural connectivity



Padula et al., 2017

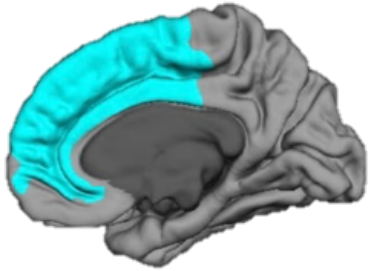
Functional connectivity



Scariati et al., 2014

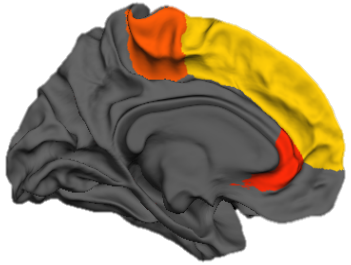
Changes in ACC connectivity in individuals with 22q11DS with higher psychotic symptoms

Covariance cortical thickness



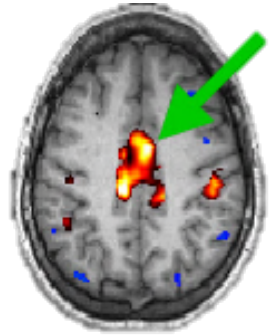
Sandini et al., 2017

Brain morphology



Padula et al., submitted

Resting-state signal variance



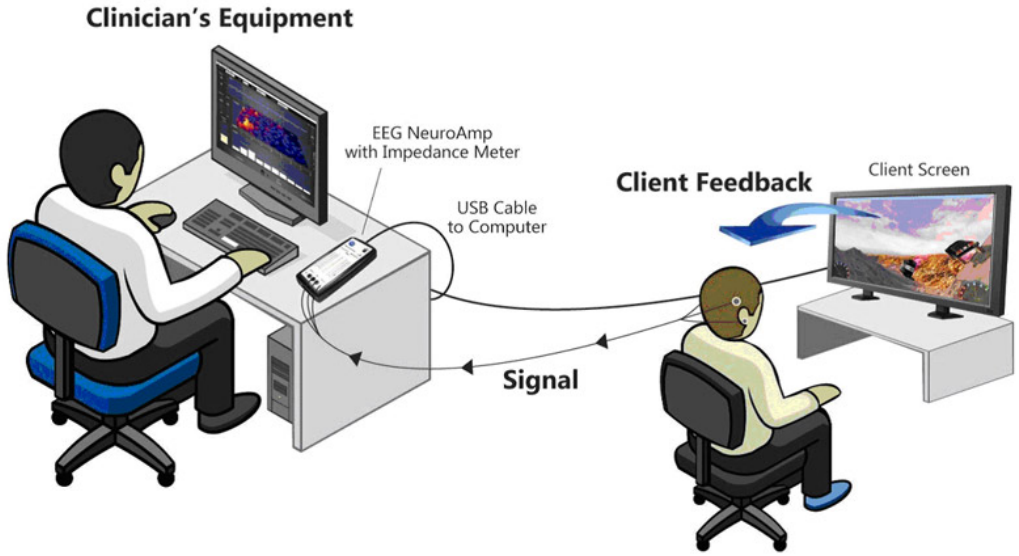
Zöller et al., 2017

Intervention strategies

Intervention strategies → target the ACC for treatment

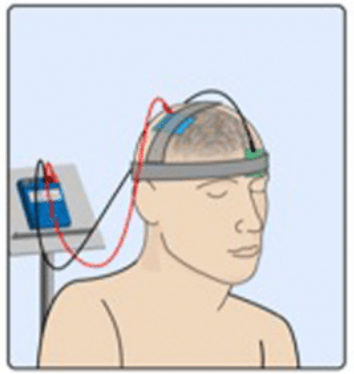
Pharmacological treatment

Neurofeedback



Transcranial magnetic stimulation

Transcranial direct current stimulation



Thank you to:

The families and the patients

Prof. Stephan Eliez and the DIP lab

Thank you for the attention!