

# JuGEx

*DIFFERENTIAL GENE EXPRESSION ANALYSIS*

FORSCHUNGSZENTRUM JÜLICH GMBH



**CYTOARCHITECTURE LINKED  
TO GENE EXPRESSION USING  
PROBABILISTIC BRAIN MAPS**



## TECHNOLOGY DESCRIPTION

Decoding the chain from genes to cognition requires detailed insights how areas with specific gene activities and microanatomical architectures contribute to brain function and dysfunction. The *Allen Human Brain Atlas* contains regional gene expression data, while the *Julich Brain Atlas* offers three-dimensional cytoarchitectonic maps reflecting the interindividual variability.

JuGEx offers an integrated framework that combines the analytical benefits of both repositories towards a multi-level brain atlas of adult humans. JuGEx is a new method for integrating tissue transcriptome and cytoarchitectonic segregation.



PROVIDES A USER-FRIENDLY  
WORKFLOW DIRECTLY INTEGRATED INTO  
THE INTERACTIVE ATLAS VIEWER OR AS A  
LOCALLY INSTALLED MATLAB OR  
PYTHON VERSION



JUGEX LINKS CYTOARCHITECTURE AND  
GENE EXPRESSION TO INVESTIGATE  
MULTILEVEL HUMAN BRAIN  
ORGANIZATION

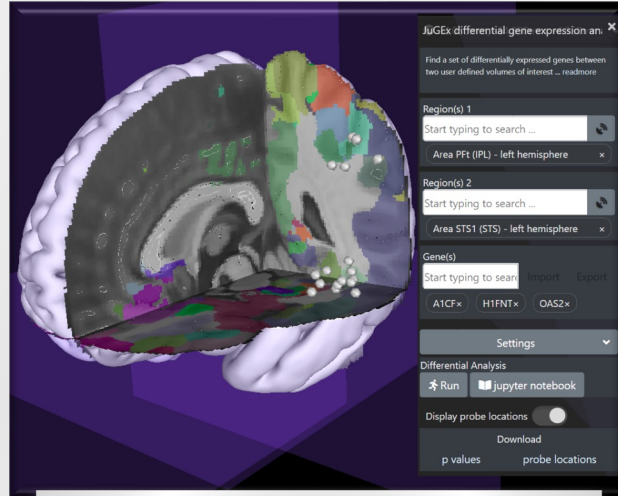
## AREAS

Brain Atlases | Neuroanatomy | Genetics | 3D Visualisation



## COMPETITIVE ADVANTAGES

The added value of JuGEx is that different levels of information on brain architecture, e.g. structural and functional connectivity, brain activations, and neurotransmitter receptor density, can now be supplemented by transcriptional information to enlighten biological aspects of brain organization and its diseases, spatially referring to the cytoarchitectonic Julich Brain atlas. Such type of analysis properly distinguishes functionally different microstructural areas, going beyond conventional approaches which rely only on the traditional segregation of the brain into sulci and gyri.



COMBINE THE ANALYTICAL BENEFITS OF ESTABLISHED SCIENTIFIC PLATFORMS JUBRAIN ATLAS AND ALLEN BRAIN MICROARRAY DATA



## APPLICATION & MARKET POTENTIAL

JuGEx allows to **compare transcriptomic and cytoarchitectonic data** from two human brain atlases, Allen Human Brain Atlas and Julich Brain, in a common space



The algorithm is published as a Matlab application, and now accessible as a plugin of the EBRAINS Interactive Atlas Viewer, as well as part of the atlas Python API

JuGEx is publicly available to empower research from basic, cognitive and clinical neuroscience in further **brain regions and disease models** with regard to gene Expression



## REFERENCES

JuGEx identified a significant upregulation of risk genes for depression in a region of a neuronal network model which is affected by atrophy and dysfunction in patients (Bludau et al. 2018). In a second use case, JuGEx found evidence for differential expression of candidate genes for phonological processing in two regions which show key roles in language and learning disorders (Unger et al. 2020, under review).

## CONTACT

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## TECHNOLOGY READINESS LEVEL



Tech sheet designed and co-developed by Universidad Politécnica de Madrid

July, 2022