



TRANSLATIONAL BIOMARKERS FOR THE DIAGNOSIS AND MONITORING OF AGING-RELATED DEGENERATIVE DISEASES

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ACTIVITIES

Subtask 4.7.3 Sviluppo di specifici approcci terapeutici: messa a punto di metodiche e modelli innovativi che consentano di definire, oltre a biomarker precoci di stadi patologici, nuovi bersagli terapeutici.

Subtask 4.8.2. Elaborazione delle immagini acquisite con tecniche di segmentazione, di radiomica o altre tecniche di feature extraction per l'estrazione di indicatori morfologici, di texture, metabolici e funzionali.

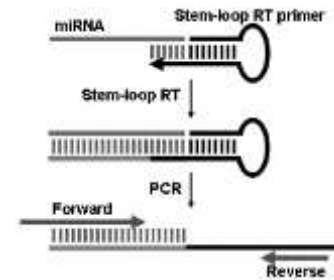
TECHNOLOGIES



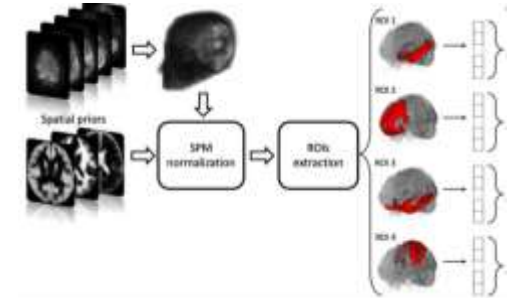
In-silico screening
(Dr Gallivanone lab)



Molecular imaging for small animals
(Dr Belloli lab)



miRNA/mRNA quantitation
(Dr Bertoli lab)



Biomedical Image Processing and Analysis
(Dr Comelli lab, Ri.MED)



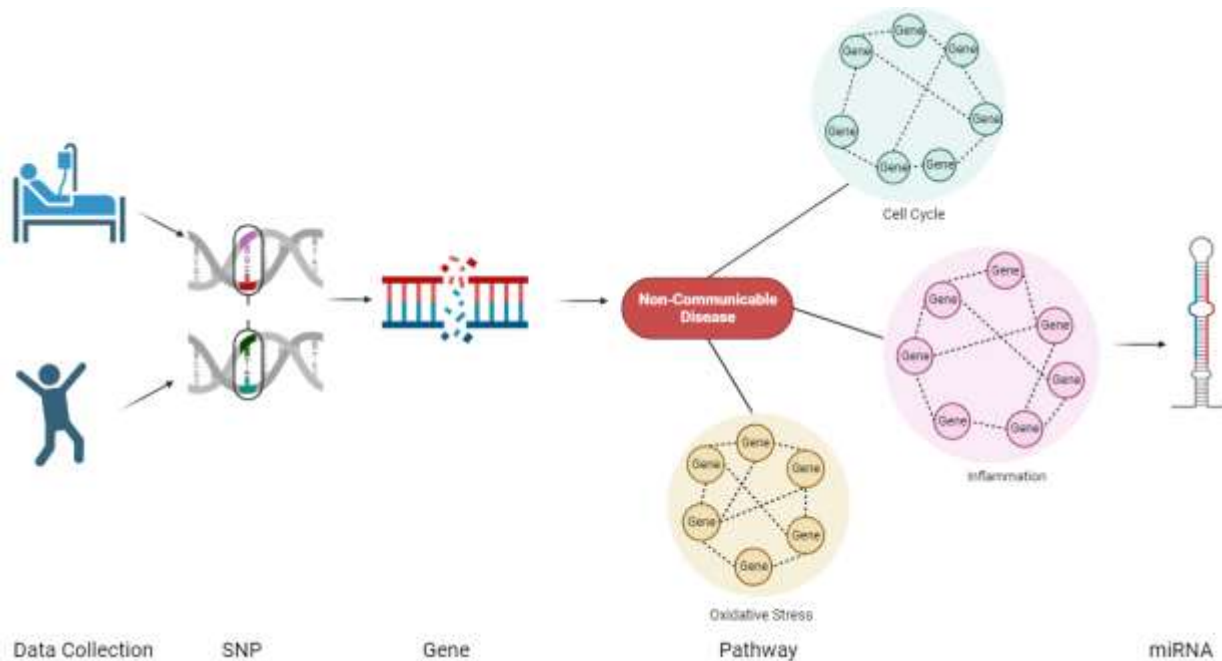
NCDs – Key facts

- Disease as heart disease, stroke, cancer, diabetes, neurodegenerative disorders and chronic respiratory diseases are defined as Non-Communicable Diseases (NCDs).
- NCDs are the result of a combination of genetic, physiological, environmental and behavioral factors.
- These are increasingly augmented by the secondary consequences of worldwide trends such as rapid unplanned urbanization, globalization of unhealthy lifestyles, and ageing.
- We need health systems and social services that support all people to live long, healthy, productive lives;
- We need strategies to promote healthy ageing:
 - screening
 - biomarkers



Screening

AIM: the set up of a computational approach (Genome-Wide Association) for the analysis of NCDs vs healthy population.



In silico analysis identified 6 microRNAs (miR-21-5p, -103a-3p, -195-5p, 16-5p, 148a-3p, 106a/b-5p) differentially expressed between healthy subjects and suffering from degenerative diseases (solid tumors, multiple sclerosis, psoriasis and type 2 diabetes).



Validation in a mouse model of colon cancer (human HT29 cells implanted in the flank)



- PET-CT imaging with [¹⁸F]FDG;
- Sampling of plasma, tumor and other tissues
- RT-PCR for miRNAs analysis





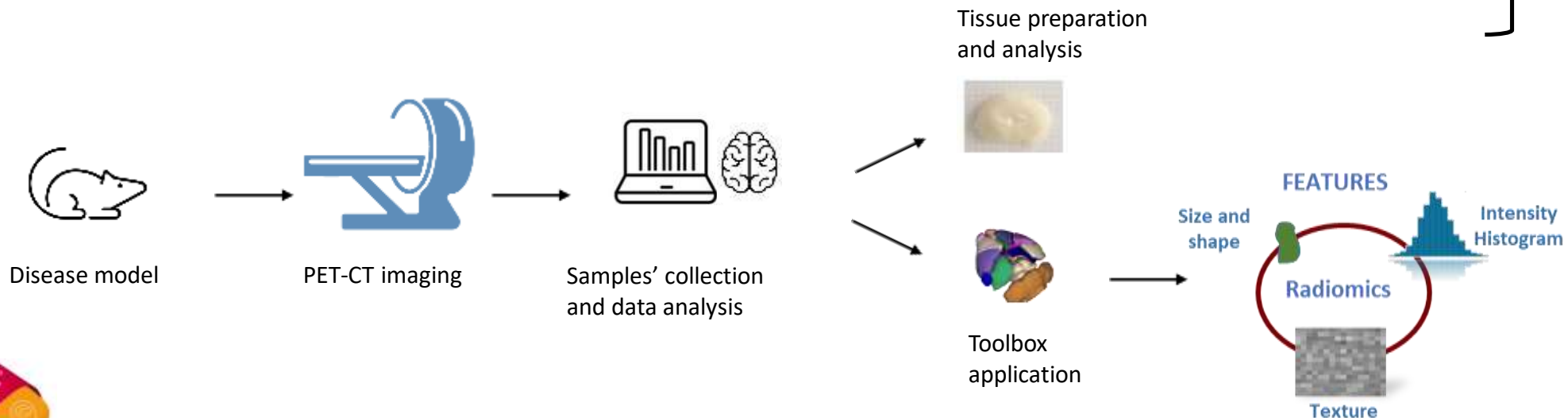
Biomarkers

AIM: the identification of specific pathology biomarkers, linked to neuroinflammation and neurodegeneration, which are responsive to lifestyle (e.g. dietary patterns).

New analysis strategies: in silico prediction, radiomics.

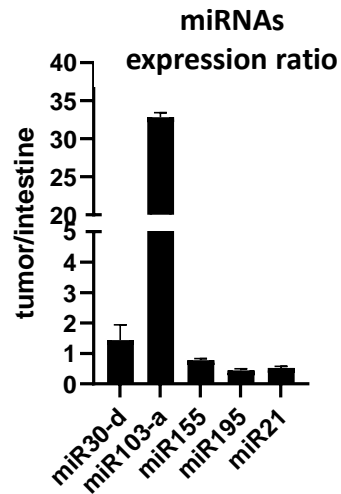
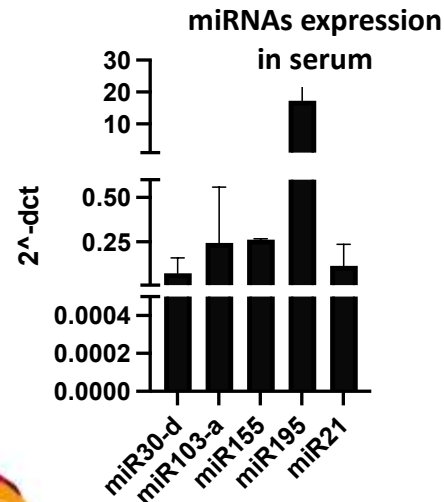
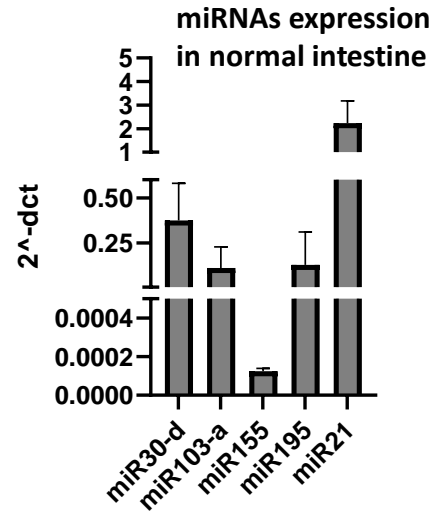
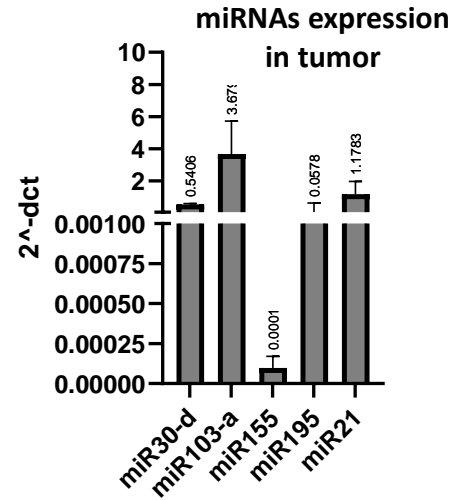
NCD animal models:

- 1. Colorectal cancer → PET/CT imaging → Tissue sampling → miRNA analysis
 - 2. Parkinson's disease model → MRI/PET/CT imaging → Postmortem analysis/radiomics
- } Disease biomarkers

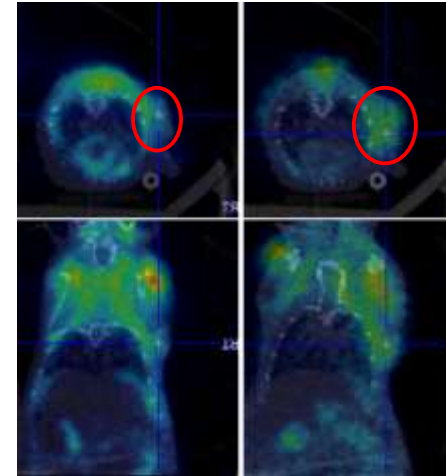


RESULTS 1

RT-PCR quantification



PET-CT I PET-CT II



PET imaging evidenced a higher glucose accumulation (¹⁸F-FDG uptake) at tumor site compared to background tissue.

RT-PCR performed in HT29 model fit with the in silico data and we identified an induction of three common miRNAs, which are typical to colon cancer.

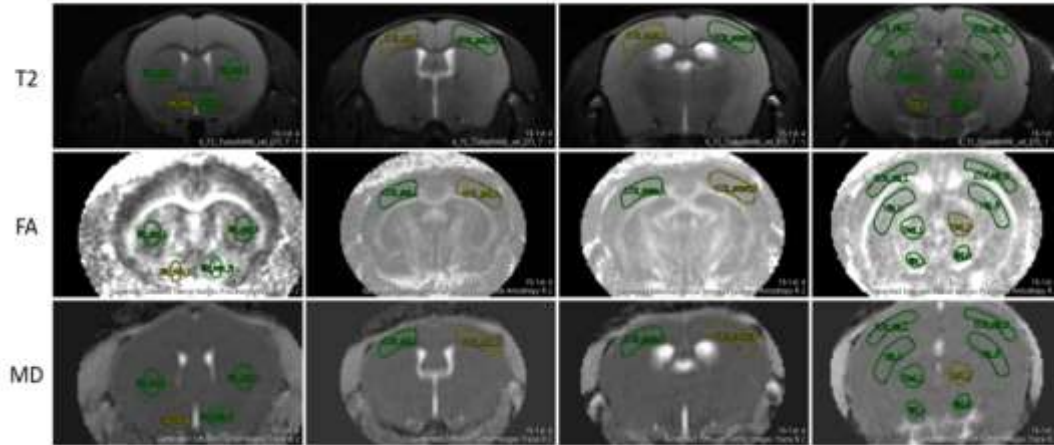
In particular, miR195-5p were highly expressed in serum of tumoral animals while miR103a-3p was hyper expressed in tumoral mass compared to normal colon tissue.



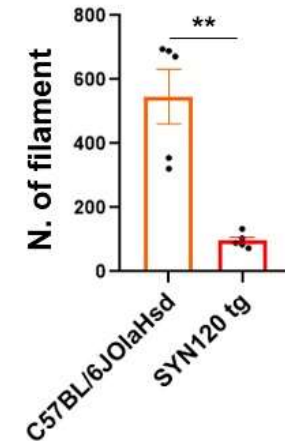
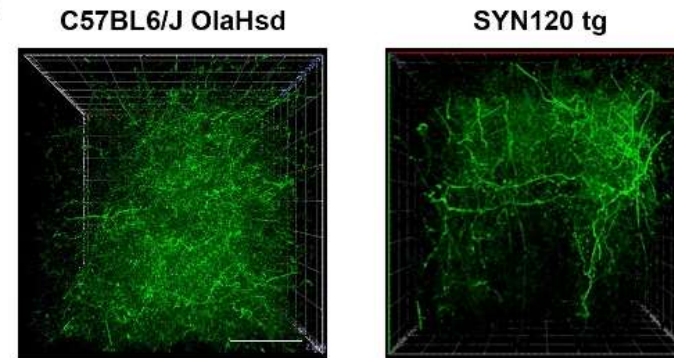
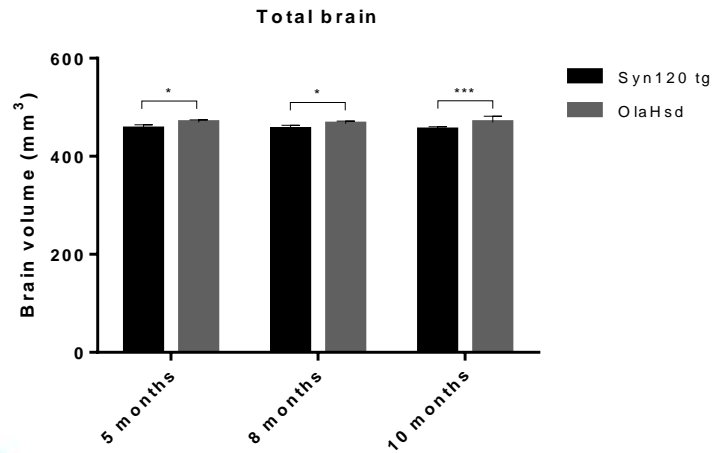
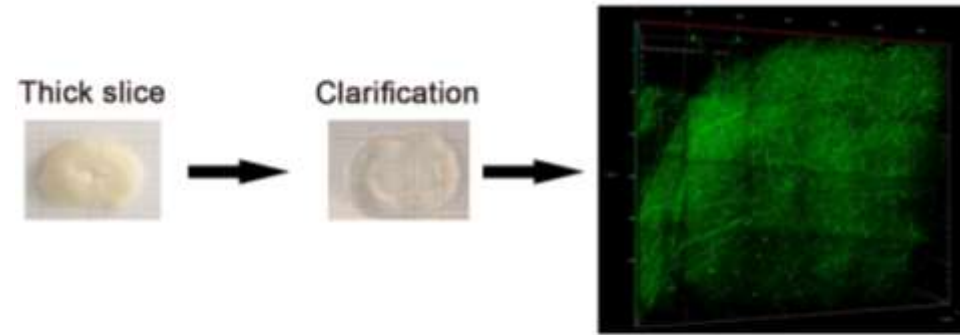
RESULTS 2



MRI images

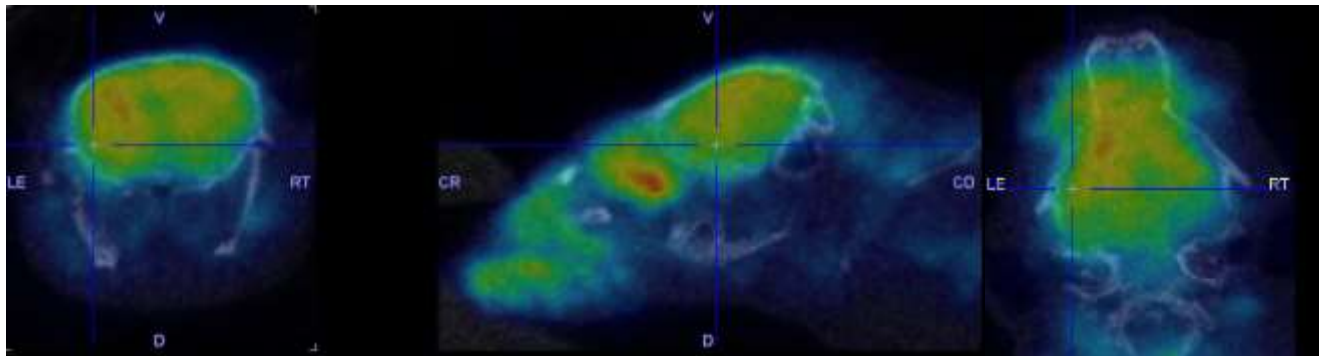
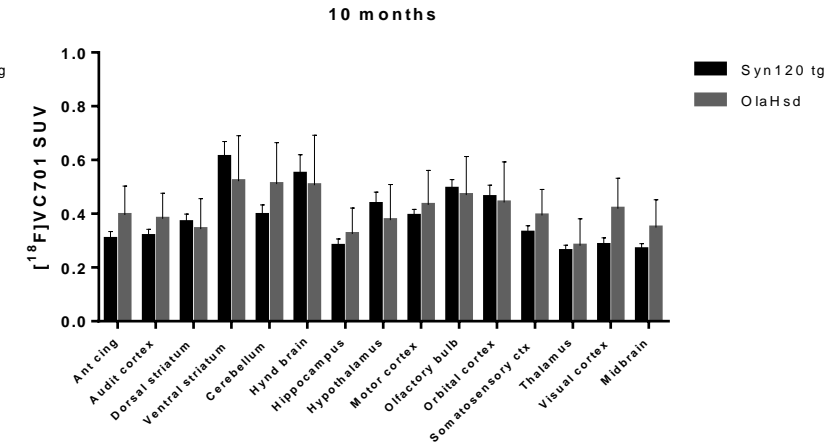
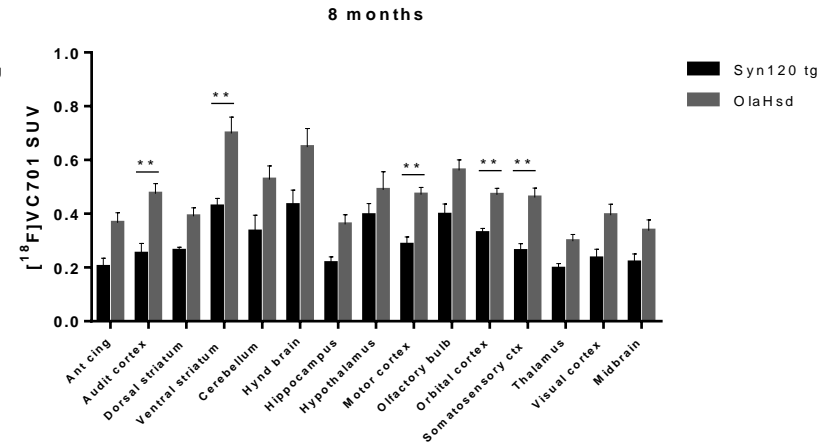
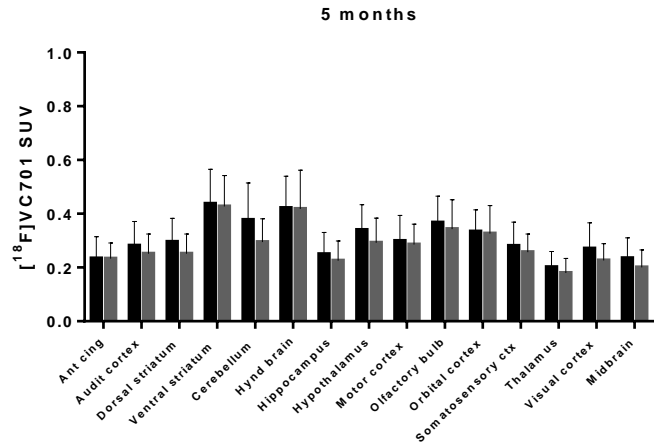


Two-photon microscopy (UNIBS)

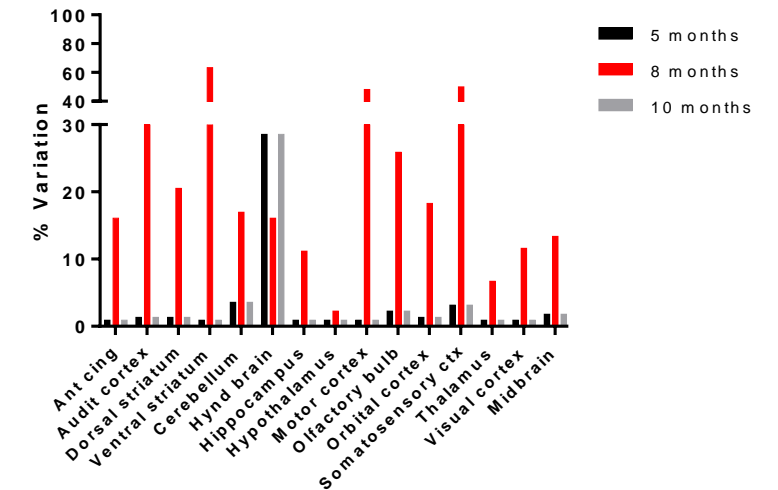




PET images - neuroinflammation



Radiomic analysis





CONCLUSIONS AND PERSPECTIVES

- RT-PCR analysis in colorectal cancer model confirmed the panel of miRNAs identified with in silico screening, which is useful to characterize colorectal cancer compared to healthy subjects. These miRNAs are related to inflammation and proliferation.
- The panel will be validated in additional animal models and correlated with PET imaging markers.
- Radiomics analysis can improve imaging data analysis to select early biomarkers of disease.
- We are working to correlate radiomics with tissue characteristics as α -synuclein deposition in Parkinson's disease.



THANK YOU FOR THE ATTENTION!



NUTRAGE
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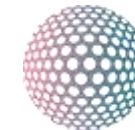


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