



SILICOMICS: AN INNOVATIVE THERANOSTIC PLATFORM FOR NEURODEGENATIVE DISEASES (ND)

Endorsed by: CEA-INSERM-UJF-CHU GRENOBLE

Focus: Healthy ageing



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<http://www-leti.cea.fr/fr/Decouvrez-le-L...>

Brief summary:

We validate a new micro-nano-interface technology paving the way for targeted therapy in ND. Patent, human validation and international network strongly support the project.

Project / initiative description (context and objectives):

Neurodegenerative diseases (ND) will become the main pathology of the exponentially increasing aging population, becoming in 2040 the main European death etiology. To date, we do not have strategy to detect ND early, as well as no efficient therapy is available. We are still dreaming of targeted therapies to slow down neurodegeneration. Neurodegenerative brain remains inaccessible, only post-mortem brain being available with inherent biases due to agonal and postmortem interval processes. In oncology, direct access to fresh tissues has paved the way for molecular deciphering of oncogenesis providing dramatic therapeutic progress. Moreover, to date most biomarkers strategies did not reach the low concentrated proteome that could be indicative and relevant for the brain pathological state. We urgently need technologies providing access to these inexorable territories to detect ND early, find personalized therapeutic targets and monitor them easily.

Our objectives are:

- (i) To implement a low cost high High-throughput screening compatible technology for biomarker detection.
- (ii) To access to the inaccessible neurodegenerative tissues to decipher mechanisms of diseases paving the way for active therapies in ND.
- (iii) To develop an integrated “translational technology” approach to reach these objectives associating early anticipation of the clinical prerequisites, compatibility with aging population quality of life, medico-economic evaluation and combined medical, academic and industrial development for an efficient dissemination at the bedside.

Clinatec center is a devoted translational technology center developed to accelerate and secure translation at the bedside of innovative technologies coming from micro-nano-technologies and electronics.

Description of the existing or potential collaboration:

This multidisciplinary project is supported by a unique network already implemented at the international level associating physicians, surgeons, biologists, technologists and SME. It associates: **silicon technologists and platforms** from MINATEC first European micro-nanotechnology campus, several **SME** (Alcys, Dker, promise, ALACRIS Theranostics GmbH, integragene, Bruker, Biotem, Scils), **neurosurgeons** (AL Benabid, S chabardes-Grenoble, A Lozano-Toronto, S Palfi, B Devaux, C Karachi- Paris, P Menei-Angers), **neurologists** (H Moro-Grenoble, P Burkhard-Geveve), some of the best **polyomics groups** (H Lehrach-Max planck-Berlin, U Landgren-Uppsala University), **big data experts** (N Benabid-LIST-Paris, M Marcus-Tel Aviv) and **medico-economics** experts (EPEMED).

Biovision opportunity is major to reach other collaborations especially pharmaceutical and biotech companies.



Project / initiative assets (type, originality, innovation...):

The technology platform supporting this project took its origin from the micro-nano-electronics MINATEC platform emerging from the unique situation of clinatéc "technology translational" center. It emerged from the association of a crucial medical need in aging populations (exploring the inaccessible brain to benefit from targeted therapy in ND disease) with the first discovery of micro-brain samples recovery at the contact with the stylet introduced in the brain during neurostimulation. A serendipitous contact with micro-nano-fabrication processes and related technologists gave us the idea to use this innovative interface to implement a more clever and spatial oriented brain bio-harvesting. This technology was fully patented in all its declinations: (i) micro-chemo-modified silicon for brainPrint technologies with different organs applications (ii) The second emerging idea was to use it also to catch the deep very low concentrated proteome employing this time nanoporous silicon with specific fabrication processes not developed before. This defines a highly original strategy, fully patented at the international level.

We also validated the full clinical and industrial prerequisites to translate this approach in the human brain in an industrial and CE norm compatible format. Preclinical validation in primates and pigs was done as well as the biocompatibility demonstration. Industrial fabrication was implemented in the MINATEC clean rooms in association with Alcys, supporting a new industrial sector. The first human validation of the use of micro-chemo-modified silicon in the human brain had the approval of the French ANSM in glioblastoma patients. To date safety and operability is demonstrated. Extension to neurodegenerative brain is now ethical. It defines a new "brain-fingerprint" medical procedure beside the classical micro-invasive biopsy strategy.

To accelerate the development of this innovative strategy we succeed to implement an international network of excellence to favor industrial and medical dissemination.

Citizen benefits:

This project will bring major benefits for citizens, providing:

(1) A unique modality to access to the human brain. The micro-nano-brain print technologies developed in this project provide an efficient strategy to reach molecular and cellular informations in brain area inaccessible to biopsy. We demonstrate access to brain tissue obtained during neurostimulation in patients with Parkinson and psychiatric diseases, extension is ongoing in Alzheimer disease in Toronto. Moreover, we developed a more efficient technology using micro-nano-modified silicon demonstrating the safety and efficacy in human patients in our gliomaBrainPrint trial paving the way to ethically translate this trial in neurodegenerative diseases. This strategy could become the mandatory micro-invasive strategy to define personalized targets in ND as well as brain or organ biopsy is mandatory in cancer pathologies. The main and major benefit will be to enter the targeted personalized therapy opportunity for patients with ND pathologies.

(2) Beside this micro-invasive non-lesional access to the disease, we developed a unique technology to reach the deep low concentrated proteome using a low cost technology compatible with High-throughput screening. Integration in paper and finger blood capillary compatible device provide an easy modality to detect early brain pathology and to monitor response to therapy, compatible with « at home » screening and good quality of life. The biobarcode technology is perfectly compatible with large dissemination, as demonstrated by our recent application in emergent diseases in developing countries

We provide a panel of technologies coming from electronics industry harboring high robustness, low cost and perfect medico-economics compatibility. It provides, beside the innovative approach, a major guaranty to be able to afford this for the large number of healthy aging population.

Planned schedule:

1) BrainPrint Technology for brain cell and molecular fingerprint

- Completion of the human glioBrainPrint trial: 2 years : after feasibility demonstration, safety and CE norm validation (2014 objective) the demonstration of the polyomics exploration of the peri-tumoral brain will be done to find new biomarkers and more curative targets in glioblastoma.

- Extension of the strategy in neurodegenerative brain in association with neurostimulation using the new NanoBrainPrint technology (safety and regulatory agreement end 2014, clinacal trial 2015).

- Extension in international countries (Europe, India, china, Canada and US) permitted by the CE-norm agreement.

- Medico-economic evaluation and reimbursement discussions (2016)

- Start-up creation 2014.

- Association to biotech and pharmaceutical companies (2014)

2) Pathological fluids exploration using nanoporous technology

- Industrial production validated (2014)

- Validation in CSF and blood exploration (2014)

- Development of a blood capillary fingerprint strategy (2014)

- Parkinson and Alzheimer validation in association with large national or international cohorts (2015-2016). Bio barcode approach in association with Bruker. Innovative data mining comparing individualized brain and blood data to define a personalized target and remote blood biomarker strategy (2015)

This project planning is strongly supported by the success of the first human validation as well as by several international patents and grants.

What are you expecting from BIOVISION Catalyzer?

- 1 Visibility
- 2 Meeting potential partners
- 3 International reach
- 4 Other: find investors