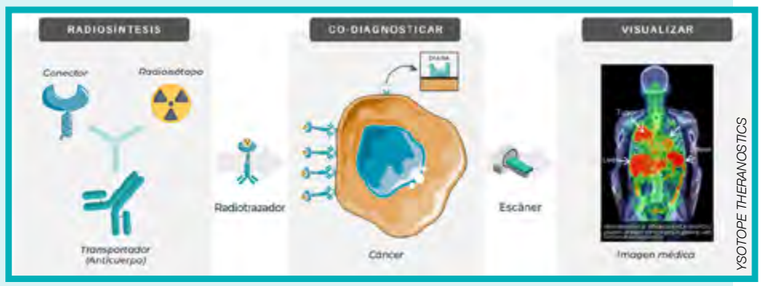
Deep TECH

Catalonia is home to almost 300 start-ups which may be classified as deep tech – companies centered around scientific knowledge and cutting-edge technological leaps such as biotechnology, artificial intelligence or frontier materials. Barcelona is the most important hub in Southern Europe if we take into consideration the amount of funding raised by emerging deep tech firms: they have amassed 457 million euro in the last five years. It's a dynamic ecosystem the essence of which is to provide solutions to social problems and global challenges.

The Agency for Business Competitiveness (ACCIÓ) has studied the major tendencies in this sector, and their findings on the deep tech start-up ecosystem in Catalonia can be consulted in the analysis they published recently

YSOTOPE THERANOSTICS

Ysotope Theranostics (ysotope.com) is a deep tech spin-off company working on the production of personalized drugs for the improvement of currently available immunotherapy treatments. To do so they resort to developing diagnostic tools for neuroblastoma – the most common pediatric tumor – thanks to which they can identify patients prone to related diseases and monitor the tumor's progress *in vivo*. As of now biopsy is the most widespread method to achieve detection, but it is not without its shortcomings: the data it provides concerns only one part of the tumor, it is invasive, and the information is rendered only in 2D. By contrast, Ysotope Theranostics modifies an antibody by incorporating to it a radioactive isotope, making it possible to conduct an *in vivo* detection of the biological target and to visualize the tumor fully and in 3D, without the need to perform biopsies on the patient. It is akin to carrying out a virtual biopsy of the tumor. "There's still a long way to go, the company is barely one year old and we'll need 10 to 12 years to develop a working prototype that can be used for the evaluation in clinical care", admits Raul Herance, the firm's technical director, who is also the head of molecular imaging at the Vall d'Hebron Research Institute and main coordinator of the eCORE of personalized medicine at Vall d'Hebron Hospital.



YSOTOPE THERANOSTICS

NUAGE TX

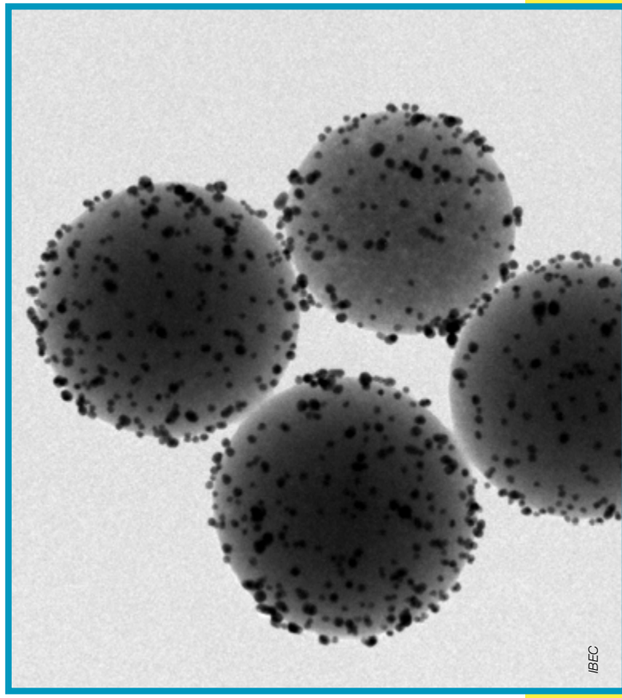
Nuage Therapeutics (nuagetx.com) is a relatively young firm; it was founded in July 2021 by researchers Xavier Salvatella, Mateusz Biesaga and Denes Hnisz. It is a corporate spin-off where synergies are sought between biophysics and cellular biology, birthed in the Institute for Research in Biomedicine (IRB) and ICREA with the financial support of Asabys. Their technological platform is centered in the discovery of new drugs, therapeutic molecules against intrinsically disordered proteins, which play a role in several diseases such as prostate cancer. Up until recently, it was not known how to approach them pharmacologically, now Nuage platform is already working to produce therapeutic alternatives for patients who, until now, had no other options. The products, for now still at a preclinical stage, are being tested in cellular models and animals, and the company plans on testing them on humans three years from now on.

What is fundamental for research to find its way to the marketplace?

"Research must be of high quality, disruptive and innovative", asserts Judit Anido, CEO and founder of the company. "Without those elements, no scientific business project can succeed". The working environment at Nuage Therapeutics is diverse and refreshing; there's a substantial amount international talent (50% of the staff is comprised of foreigners), and more than half of the board of directors are women.

NANOBOTS TX

The scientists working in the labs of Samuel Sánchez, Founder and Scientific Director of Nanobots TX, have been pioneers in the creation and application of nanorobotics to medicine. They've developed a disruptive technology: they insert drugs inside moving nano-vehicles that can efficiently reach the tumor. For now, they've tested it on animals: they inject millions of nanorobots into mice sick with bladder cancer, and the robots move collectively inside the bladder carrying the drug as if they formed a whirlwind. "We want to transport drugs into tumors in an efficient and guided manner", explains the professor. "More than 95% of the nanorobots manage to reach the tumor and penetrate it". What this new method shows is that with a single injection of millions of nanorobots 93% the tumor is reduced. Quite the upgrade compared to the 6-14 doses of chemotherapy required to treat bladder cancer. Each sphere-shaped nanorobot is around 300 nanometers in diameter – 1,000 times smaller than the diameter of a human hair. The drugs are inserted in their pores – measuring between 2 and 3 nanometers – or, alternatively, glued to the nanorobot's surface. The robots are set in motion by the chemical reaction produced by the urine in the bladder. They carry themselves without letting go until they have penetrated the cell, and then leave the body alongside the urine. Even though they're focused in this specific research, Sánchez is adamant in that the technology can be used for other purposes, which is why the platform Nanobots Therapeutics (nanobotstx.com) was established as an IBEC corporate spin-off.


IBEC

INBRAIN NEUROELECTRONICS

The goal of INBRAIN Neuroelectronics (inbrain-neuroelectronics.com), a spin-off of the Catalan Institute of Nanoscience and Nanotechnology (ICN2), is to develop a new generation of brain implants – devices acting as interfaces and used to treat neurological diseases such as Parkinson's or epilepsy in cases in which patients do not respond positively to pharmacologic treatments. The late 90s saw the introduction of neuromodulation, a therapy that manages to mitigate the effects of neuronal diseases through the implantation of small electrodes in the brain, even though it doesn't always work properly and it may cause side effects. "At INBRAIN we introduce graphene into flexible electronics", explains Jose Antonio Garrido, ICREA professor and vicedirector of the ICN2, as well as the founder and scientific director of INBRAIN. "We resort to the properties of the graphene to create a new generation of brain implants: smaller, less invasive, capable of measuring the brain's electric activity and stimulating more efficiently particular areas in the brain, thus avoiding side effects". Other than working on neuronal interfaces, they focus on the production of electronic technology and advanced semiconductors, resorting to machine learning to understand which brain signals need to be interpreted and consequently decide on the therapy that should be implemented. After having conducted preclinical studies to guarantee their technology is safe and biocompatible, they plan on initiating trials on humans by the end of 2023.


INBRAIN Neuroelectronics