



# Belgians send miniature heart into space for ageing research

AstroCardia develops artificial 'space heart' to study heart health

**Five Belgian companies and research centres are joining forces in the AstroCardia project. With that project, they are making it their mission to improve heart health. And they are doing so in a very special place: in space. This is where they are aiming to better study heart ageing and create a suitable research model for the heart. To do so, they developed an artificial miniature heart and associated circulatory system using 3D bioprinting. This so-called 'heart-on-a-chip' will be sent to the International Space Station (ISS) in 2025.**

Cardiovascular disease is one of the most common causes of death in the world. The risk of cardiovascular disease increases as we age. However, researchers are still partly in the dark as to why this is so. Science lacks any faithful models for revealing the underlying biological processes. Five Belgian partners – Space Applications Services, SCK CEN, QbD Group, BIO INX and Antleron – are now throwing their knowledge and expertise into the fray to develop a suitable study model. And they are doing so in an environment where scientists can better investigate heart ageing: space.

"Our heart changes as we age. It slowly gets bigger and stiffer, the arteries calcify and the pumping power deteriorates. In space, factors such as stress, microgravity and radiation cause those ageing processes to occur 20 times faster. So in space, we are speeding up time. And that gives us the unique opportunity to obtain research results that we simply cannot obtain here on Earth. The platform we will develop, will allow research into the mechanisms that drive cardiac ageing. This research will be fully automated and can be operated remotely," says Hilde Stenuit, researcher at Space Applications Services.

## **'Heart-on-a-chip': a 3D bioprinted heart model**

To examine a living human heart and all the processes associated with it in depth is practically impossible. That was why the researchers will bioprint a miniature heart on a chip and build an artificial circulatory system around it.

This 'heart-on-a-chip' is a chip of a few square millimetres on which heart muscle cells are printed. The 'ink' consists of biomaterials and stem cells that can develop into any possible cell in the body. The cells begin to divide and organise themselves into a developing human heart model – known as a cardiac organoid. An artificial circulatory system feeds that heart with stimuli, oxygen and nutrients until it matures and begins to beat. The scientists can conduct tests on it. The main test will be conducted in 2025, onboard the International Space Station.

This is when the heart-on-a-chip devices will be launched to space and kept alive for at least six weeks. During this period, they will be monitored in real time. Once the devices returned to Earth, researchers from the company QbD and the nuclear research centre SCK CEN will analyse them in detail. With this space experiment, the partners hope to investigate whether the exposure of the developed cardiovascular system to the space environment can work as a scientific model of heart ageing.

"The miniature heart, which is barely a chia seed's size, faithfully mimics its human counterpart. The innovative technique would make it possible to better investigate cardiovascular diseases and test out some potential medicines. The biggest advantage is that we can personalise them by using stem cells from the patient themselves. As such, we can grow a miniature version of the patient's heart. This would represent a great leap forward in personalised medicine. We are working towards that together!" says Dr Kevin Tabury, SCK CEN radiobiology expert. The nuclear research centre is not at its experimental stage with this project. It has long studied the effect of radiation on cardiac ageing and has done so in the context of both radiotherapy and space exploration.

## **Bio-ink**

To 3D bioprint a miniature heart model into a chip, specialist material is an absolute must. And that includes a 3D bioprinter with micrometric precision, living stem cells and 'bio-ink'. Those stem cells developing into a mini organ must be printable

and held together. For this, the consortium can count on the expertise of Belgian start-up BIO INX. "Compare it to bricklaying a wall. The stem cells are the bricks, the bio-ink the mortar. Bio-ink is a kind of gel, which makes cells printable and in which they can survive during and after printing," says Jasper Van Hoorick, CEO at BIO INX.

### Technological marvel

The artificial circulatory system will become a technological marvel, as soon as it is developed by the AstroCardia partners, along with the R&D company Antleron. "This project provides some valuable insights into the physiology of cardiac organoids. Therefore, it is very important that the chip on which we will print that miniature heart can handle the extreme conditions in space. We are honoured to be able to contribute to that with our knowledge," says Jan Schrooten, CEO of Antleron. "With this project, we are looking beyond the horizon. We are already concerned today with the problems society will face tomorrow. A healthy heart is important not only for those currently suffering from cardiovascular disease, but also for healthy astronauts exploring space," concludes Martijn Reniers, CIO at QbD.

### Financial support

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## Space Applications Services

Space Applications Services NV/SA is an independent Belgian company founded in 1987, with its headquarters in Sint-Stevens-Woluwe and a subsidiary company in Houston, USA. Our goal is to research and develop innovative systems, solutions and products and to provide services to the aerospace and related industries. Our activities cover manned and unmanned spacecraft, launch and re-entry vehicles, control centres, robotics and a wide range of information systems. The company has a strong focus on Research and Development with partners throughout Europe and a growing network on other continents.

The mission of our ICE Cubes Service is to unlock the benefits of research in microgravity by providing an in-orbit testbed for new concepts, research, applications, products and solutions. We support various customers in making their research & technologies in space easier and faster thanks to our proven end-to-end service.

**More info:** [www.spaceapplications.com](http://www.spaceapplications.com) and [www.icecubesservice.com](http://www.icecubesservice.com)

## SCK CEN

### 70 years of experience in nuclear research and technology

SCK CEN is one of the largest research institutions in Belgium. Every day, more than 850 employees dedicate themselves to developing peaceful applications of radioactivity. SCK CEN's research activities focus on three main topics: innovative nuclear systems, nuclear waste management and dismantling, and boldly combating cancer. World-renowned, SCK CEN shares its expertise through countless publications and training courses, so that this pool of exceptional competence can be maintained.

**More information:** [www.sckcen.be](http://www.sckcen.be)

## QbD Group

The QbD Group supports life science companies worldwide throughout the product life cycle – from idea to patient. Since 2011, the QbD Group has been offering product development and production solutions. QbD's team provides the skills and expertise to solve complex project problems in quality assurance, validation & qualification, regulatory affairs, clinical, quality control, software solutions & services and business & communications for companies operating in the biotech, small molecule, digital health, medical devices & IVD industries. QbD Group is headquartered in Belgium and has +500 consultants worldwide in the Netherlands, Spain, France, the United Kingdom, Switzerland, Austria, Mexico, Colombia and the US.

**More information:** [qbdgroup.com](http://qbdgroup.com)

## BIO INX

BIO INX is a spin-off from Ghent University and the Vrije Universiteit Brussel working on the development and commercialisation of materials for 3D bioprinting. It is currently one of the market leaders in terms of materials for high-resolution laser-based 3D bioprint technologies. Their mission is to develop innovative materials and solutions that allow researchers and clinicians to 3D-print advanced biomedical 'living' structures. To that end, BIO INX offers a whole portfolio of bio-inks for different bioprinting technologies, such as extrusion-based printing, digital light projection and 2-photon polymerisation. By offering a unique material portfolio with diverse material properties suitable for many cell types, the applications for 3D bioprinting become almost endless. These applications range from regenerative medicine to medicine development and reducing animal testing.

**More information:** [www.bioinx.com](http://www.bioinx.com)

## Antleron

Antleron is an innovative Leuven R&D start-up that develops tailored bioprocess solutions for various life science applications, with a focus on advanced therapies (cell & gene) and personalised therapies. The unique Antleron technology, combined with the multidisciplinary team of specialists, allows Antleron to conceive, test and develop both biomanufacturing solutions and infrastructure platforms for bringing innovative therapies faster and closer to patients in a sustainable way. The Antleron technology combines digital twins and medical 3D printing with the potential of cell biology to make the factory-of-the-future vision for biomanufacturing 4.0 in Flanders a reality through co-creation.

**More information:** [www.antleron.com](http://www.antleron.com)

## VLAIO

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Flanders could be a bit more ambitious when it comes to entrepreneurship. We need more starters, more stayers and more growers. That is why VLAIO wants to set up projects that encourage, support or guide entrepreneurs in doing business. With

our partners, we combine our strengths and resources. Astrocardia is part of a network of initiatives you can make use of. Discover them all at [www.vlaio.be/sterkondernemen](http://www.vlaio.be/sterkondernemen). #sterkondernemen