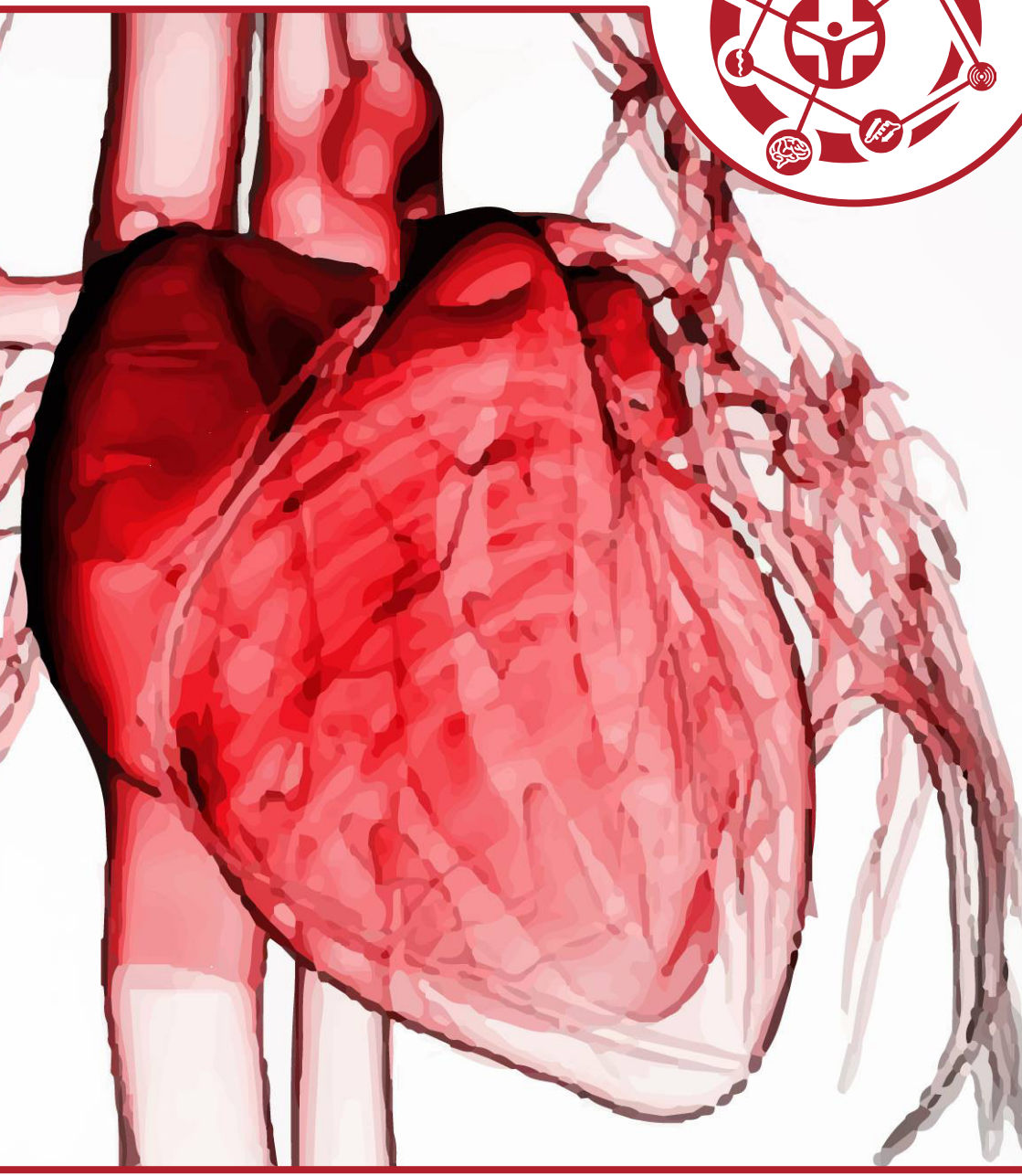
SensUs 2017



Program

8 & 9 September

Contents

Program

Friday September 8

12:30 - 13:00 Walk in

13:00 - 13:30 Opening speech in the big hall / forum

13:30 - 16:30 Testing rounds + Market + Pitches

16:30 - 17:30 Closing and Networking drink

Saturday September 9

13:00 - 13:10 Opening

13:10 - 13:30 One minute team pitches

13:30 - 15:30 Market + team pitches + activities/workshops

15:30 - 16:00 Zayna Khayat *'The Future of Health & How Sensors Will Help'*

16:00 - 16:30 Award ceremony

16:30 - 17:00 Drink

Prof. dr. Menno Prins
Founder of SensUs

Dear visitors and participants in the finals of SensUs 2017,

I welcome you to the finals of SensUs 2017!
We are going to admire 10 student teams from universities in Europe, Africa, and North America, that have developed biosensors for the detection of heart failure. This is an important global healthcare problem and there is a great need to provide doctors and patients with tools to better diagnose and monitor the disease.

Innovation happens when people have a vision, when they are knowledgeable and courageous, and when they collaborate and communicate. That is what the students learn and what they are going to show to us. Alongside the students also university professors, companies, patients and patient organizations, healthcare professionals, and you and me as global citizens play a role in SensUs. SensUs brings us all together in order to learn about innovation and to innovate ourselves.

Thank you for being here and I wish you two lively and inspiring SensUs days!

Anne de Dreu
Chair of the SensUs Organization

SensUs is a competition organized for students, by students. Therefore I would like to welcome you on behalf of the students of Eindhoven University who organize the SensUs competition. Organizing a large international competition is a demanding and innovative process in itself. Over a whole year we have worked to make this competition possible and I am very excited and proud to now see you all at these final contest days.

The SensUs Organization

From left to right and from top to bottom:

Willem Brekelmans - Eliene Rutten - Marliek Raadsheer - Joyce Kimenai - Aniek Wouters - Lieke van Dommelen - Nikki Valckx - Irma Vermeijlen - Alissa Buskermolen - Danny van der Haven - Hannah Brouwer - Anne de Dreu - Kim de Blezer - Tamar van Asch - Yi Hé Zhu - Menno Prins

Developing a biosensor requires creativity and multidisciplinary collaboration. The 10 teams have worked with dedication and strong motivation in their own universities, and now they are here to show their prototypes and the perspectives that they foresee for the future.

You can see, admire and enjoy their accomplishments by visiting the pitches and demos by the teams. Hopefully you will enjoy this innovative and creative event as much as I will. To me, seeing the work that the participating teams have put in, the enthusiasm of the organizing students and the interest shown by the many visitors and partners, has already made this year's competition a big success!

I wish you an innovative and inspiring SensUs event!

What is SensUs?

Vision

An important aim in healthcare is to let people live high-quality lifes in their own environments. Miniaturized and easy to use biochemical sensing devices will become increasingly important, for the monitoring, treatment and coaching of patients. As a consequence, over the coming decades biochemical sensing technologies are needed which will be small, sensitive, accurate, easy to use, cost effective, and versatile.

Mission

The mission of SensUs is to stimulate education and innovation in molecular health sensing by organizing an international competition. In a friendly competitive manner, SensUs challenges multidisciplinary teams of students to conceive and build innovative molecular biosensors. The competition gives students a unique training in goal-oriented multidisciplinary teamwork, innovative technological design, and entrepreneurial thinking.

Objective

The disease focus and technical objective of the competition change annually, based on input from healthcare professionals, patients, companies, and universities. SensUs 2016 focussed on kidney disease with a metabolite (creatinine) as marker. SensUs 2017 focusses on heart failure with a hormone (NT-proBNP) as marker. Challenges in next editions of SensUs will relate to disease area, molecular marker, speed, miniaturization, entrepreneurial aspects, etc. You are welcome to give your input for the objective of SensUs in the coming years.

Participating Universities

THE UNIVERSITY of NORTH CAROLINA at CHAPEL HILL

THE AMERICAN UNIVERSITY IN CAIRO
الجامعة الأمريكية بالقاهرة

UPPSALA UNIVERSITET

KU LEUVEN

University of Glasgow

Hochschule Kaiserslautern
University of Applied Sciences

Imperial College London

Technical University of Denmark

ÉCOLE POLYTECHNIQUE FÉDÉRALE DE LAUSANNE

TU/e Technische Universiteit Eindhoven University of Technology

Heartfailure

Heart failure is a very important public health problem in both developed and developing countries with a prevalence of about 1% of the population. When a person suffers from heart failure, the heart is not able to pump around the amount of blood the body needs. The resulting symptoms can for example be excess fluid in body and lungs, shortness of breath and fatigue. There are two different types of heart failure; systolic heart failure and diastolic heart failure.

Systolic heart failure happens when the heart lacks the power to provide the body with enough blood. Normally the heart is able to eject about 70% of the blood inside the heart, while in a persons suffering from systolic heart failure this ejection goes down to less than 40%.

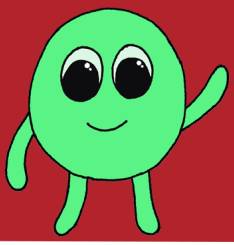
Diastolic heart failure refers to the condition in which the heart is still able to contract powerfully, but is not able to relax fully. An increased pressure remains, causing a less effective heart function and other consequences such as pulmonary edema.

NT-proBNP

Brain natriuretic peptide (BNP) is a polypeptide that is secreted by the heart ventricles in response to excessive strain on heart muscle cells. The release of BNP is modulated by calcium ions. The molecular pathway starts with preproBNP that is processed to proBNP and after afterwards cleaved into two different parts, the N-terminal 76 amino acid long peptide pro BNP, normally called NT-proBNP and the biologically active C-terminal amino acid peptide proBNP, normally called BNP.

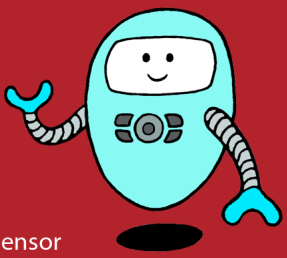
NT-proBNP is a suitable biomarker to exclude acute heart failure, because it can be found in low concentrations in the blood of healthy people and is present at much higher concentrations in ill individuals.

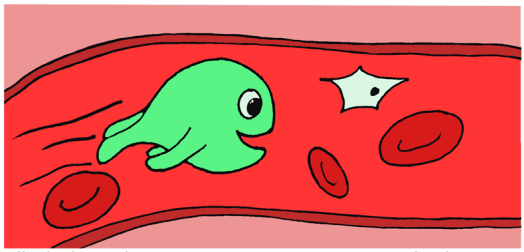
How does a biosensor work?



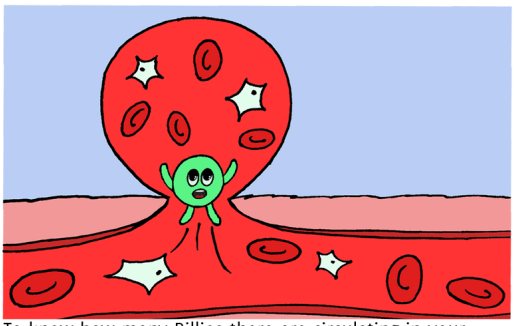
This is Billy, the biomarker

and this is Sensi, the biosensor

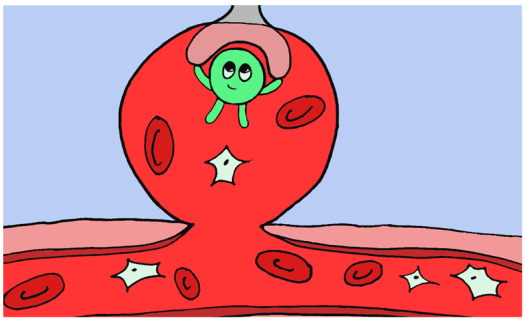




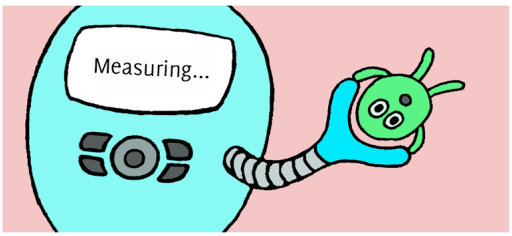
Billy the biomarker, in SensUs 2017 an NT-proBNP molecule, is circulating in you blood and can tell you something about your body. If you have too many Billies, you could have heart failure.



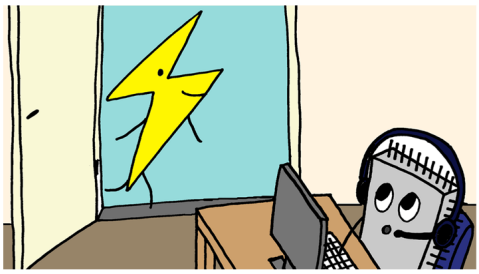
To know how many Billies there are circulating in your blood, you get a little prick in your finger so some blood comes out.



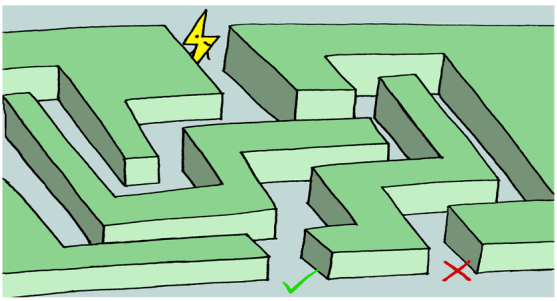
Sensi the biosensor can detect molecules like Billy in the drop of blood with its special hand.



This hand is called a receptor, and Billy fits perfectly in it. Other substances in the blood do not fit in the hand.



Sensi contains a small, very smart computer.
Here Senzorro enters. This is the signal that will be sent from the computer to Sensi.



Senzorro has to go through a maze to get to the correct exit. Sensi can then tell you if your body is healthy or not.

Jury Process & Awards

Jury process

The jury process consists of two parts. Professors of the universities, the University Representatives (UR), will assess the teams on the technical parts of each award and provide their information and results to the Core Jury (CJ). This is an interdisciplinary team that assesses technical as well as user perspective and commercial aspects of the results of the teams. With all inputs, including the votes of the public, the CJ determines the winner and runner-up of all awards.

Awards

During the event the teams compete for the following awards:

The **Analytical Performance** award is awarded to the team with the biosensor that functions best. Amongst others the sample volume needed and the accuracy and speed of the sensor are judged.

The **Creativity** award relates to the technological novelty of the biosensors and to the way how the teams have worked during their development process.

Translation Potential is about the plans of the teams to bring their biosensor from a prototype to a product that can be used in society. Will the product meet the needs of doctors and patients, and will it be suited for industrial production?

The **Public Inspiration** award gives recognition to the teams that best inspire the public. The award is based on the votes from the public, who see the presentations, pitches and demos of the teams.

Core Jury

dr. Rogier Hopstaken
general practicioner
Saltro

dr. Robert Verbunt
cardiologist
Máxima Medical Center

dr. Jeroen Nieuwenhuis
Philips

David Boss
clinical chemist
Saltro

Jesper Kristensen MSc
Medtronic

Bram Jongepier
Dutch Heart Foundation

Simone van Beek
cardiology nurse
Máxima Medical Center

University

Jeroen Lammertyn
Katholieke Universiteit Leuven

Winnie Svendsen
Danmarks Tekniske Universitet

Tony Cass
Imperial College London

Masood Kamali
Uppsala Universitet

Leo van IJzendoorn
Technische Universiteit Eindhoven

Representatives

Julien Reboud
University of Glasgow

Hassan Azzazy
The American University
in Cairo

Philippe Renaud
École Politechnique
Fédérale de Lausanne

Sven Ingebrandt
Hochschule Kaiserslautern
University of Applied Sciences

Michael Daniele
The University of North Carolina
at Chapel Hill

Teams

Carediobit

Carediobit is KU Leuven's team of highly motivated students from different countries, with different academic backgrounds and different interests but with one shared goal: to create an outstanding biosensor! The team will tackle the SensUs challenge of developing an innovative biosensor by exploring the state of the art, learning from experts in the biosensor field and combining the talents of all members.
The team is ready for you, but are you ready for the team?

UppSense

Team UppSense is representing Uppsala University Sweden in this year's SensUs competition. The team consists of nine students from various academic and geographical backgrounds. UppSense is looking forward to participate in the challenge of developing a biosensor for heart failure.
Vi hoppas att vi ses!

DeTectUs

DeTectUs is a multidisciplinary team from the DTU. Their motivation for joining the competition is that SensUs makes students face what happens in real life: cooperation between different background engineers and scientists that combining and sharing their knowledge get to create a final product. Their ultimate goal is to build a functional user-friendly sensor that can help to prevent heart failure and eventually saves lives.

T.E.S.T.

TU/e SensUs Team, T.E.S.T., is a multidisciplinary team which consists of eleven students from different faculties of Eindhoven University of Technology. Winning the prizes during the event is not our only goal. What we are really dreaming of is to create an actual point-of-care biosensor that is both accurate and innovative, helping to save lives.

Swissense

Swissense a motivated team of 9 students from EPFL. They participated in this competition to solve real world problems and to create devices that have meaning and purpose. They hope to create an original device that is small in size and simple in use and yet capable of fast detection as required by the competition standards.

AUC Imhoteps

Much like Imhotep, the ancient Egyptian polymath who was an architect, engineer and a physician, this team harbors several different disciplines and backgrounds. They all love a good competition as well as working in challenging environments, and think that by joining SensUs they can push our own envelope and bring themselves to solve a real-life clinical problem.

SenseNC

SenseNC is a diverse group of fifteen students from the engineering and science programs at North Carolina State University and the University of North Carolina at Chapel Hill in the United States of America. By uniting their unique skills and training under the mentorship of their Team Guide, Dr. Michael Daniele, SenseNC is primed to disrupt the current state of healthcare and medical technologies.

Glasgo

Team Glasgo is a diverse team, both in terms of nationality and degree subjects. The team consists of 14 students who are focussed and ready to create! They range from medics, to biomedical engineers, to mathematicians and everything in between – including their 'wild card', a law student!

Desire to gain knowledge and practical experience, as well as a wish to advance a field which can have an incredibly positive impact on people's lives are amongst their key motivations.

SensAble

SensUs-Team SensAble of the University of Applied Sciences Kaiserslautern is a team that includes nine students from different fields of study such as Nano Systems and Micro Technologies and Applied Life Sciences. The goal of this team is to develop a fully functional and innovative sensor that is able to detect not only the BNP biomarker but also diverse biomarkers in human blood.

IC SensUs

IC SensUs is a team consisting of ten students from Imperial College London.

Master of Ceremonies

Dr. Barry Fitzgerald is a postdoctoral researcher based in the Process & Energy department of the 3mE faculty at TU Delft and previously a postdoctoral researcher at the ICMS here at the TU/e. He has written and self-published a book entitled “Secrets of Superhero Science”. In his book Barry describes some current scientific research that could, in the future, lead to the emergence of superpowers in the real world. Besides publishing his book, he established a brand new open access journal – “Superhero Science and Technology”.
As a skilled speaker, scientist, singer and guitar player he is an excellent communicator of science and we are happy to have him as this year’s MC.

Keynote Speaker

Dr. Zayna Khayat will give a keynote presentation on the Saturday of this SensUs event. Dr. Khayat completed a PhD in biochemistry from the University of Toronto and thereafter specialized in consultancy for healthcare innovation. She is currently on secondment from Toronto (Canada) to the REshape Health Innovation Centre at Radboud University Medical Centre in Nijmegen. Dr. Zayna will be giving an inspiring presentation on the exciting developments in the field of sensors for health!

Partners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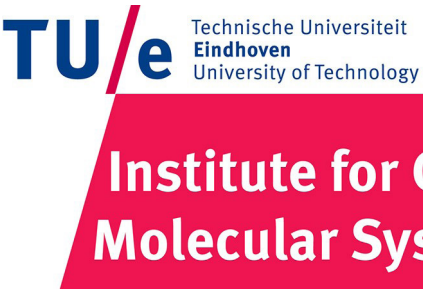
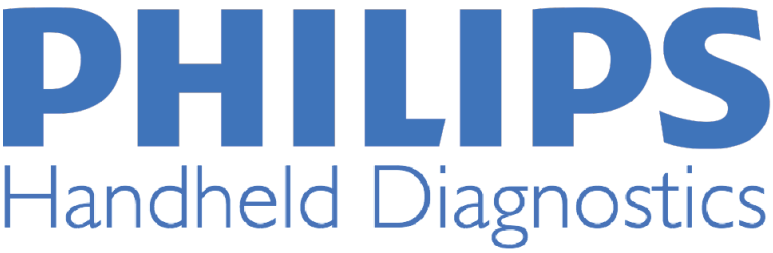
Health


TU/e
Technische Universiteit
Eindhoven
University of Technology
Institute for Complex
Molecular Systems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Further, Together


future
diagnostics

ASML

AXXICON

HyTest Ltd

scienion
ENABLING LIFE SCIENCE

TU/e Honors Academy

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Affiliates

Hartstichting

NIERSTICHTING
Leven gaat voor.

H.S.A.
Confluente

Acknowledgements

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Bloemisterij Tuincentrum C.J. Brekelmans

TU/e Technische Universiteit Eindhoven University of Technology
Where innovation starts

Interview

Floris Italianer - CEO Dutch Heart Foundation

For our first edition of SensUs interviews for SensUs 2017, we spoke with Floris Italianer, the CEO of the Dutch Heart Foundation. We spoke with Floris Italianer about the benefits of future biosensors for patients and about research supported by the Dutch Heart Foundation.

Can you tell something about yourself, and about your role as director of the Heart Foundation?

Before joining the Dutch Heart Foundation, three years ago, I have been working in the healthcare industry for ten years. Originally, as a CEO of a private eye laser clinic, later on in advising and financing roles for smaller Dutch hospitals and finally, as CEO of a public foundation that was responsible for the financing system for hospitals in The Netherlands. Those experiences in private and public healthcare, combined with my background in private industry, help me tremendously in my work for the Dutch Heart Foundation. Within the Dutch Heart Foundation we combine marketing, science and advocacy. Consequently, a background in these areas helps a lot.

How are you involved with TU Eindhoven?
I have been asked to join the Advisory Board of the Strategic Area Health of TU/e. For me it is important to stay in touch with the academic world and to stay involved in the plans and activities of universities such as the TU/e. It is very inspiring to be among people with different backgrounds, such as from the insurance world and from Philips and to discuss how academic work translates in applications and solutions in healthcare.

Might patients benefit from biosensing in the future?
Technology opens new roads to monitoring and curing patients and should be explored as much as possible. Equally important is to innovate in how different healthcare providers cooperate and exchange patient information for the benefit of the patient and for scientists to exchange scientific data. For these developments, smart and experienced people need to sit and work together. The center point should be the patient, for which reason we are involved in many of these discussions.

The teams of SensUs 2017 will build biosensor prototypes that can detect NT-proBNP in blood. Can you explain how heart patients can benefit from these biosensors?
NT-proBNP is a marker for damage of the heart muscle. In combination with other tests, it is used for the diagnosis of heart failure. It is also used to monitor disease progression and effect of therapy. There are about 142.000 patients with heart failure in the Netherlands. Cardiologists, GPs and specialised nurses are working together in the care for these patients. A validated NT-proBNP point-of-care biosensor that would make the testing of this marker faster, more efficient, more accurate, less complicated or require less blood could improve care for heart failure patients. It would for example mean that they would have to go to hospital less often, that they don't have to wait long for the results of the test and that their treatment could be adjusted more precisely. Overall, it would make the burden of the disease a little less and it would allow patients to better live the life they want. And this is what the Hartstichting and the Hart&Vaatgroep are working for.

Personal Stories

Paula - heart failure patient

I am Paula, 51 years old. If you looked at me a few years ago, you would have seen a strong and fit middle-aged woman who had one passion: mountaineering.
If you look at me now, outsiders still see the same Paula. A middle-aged woman with two children and a husband, who still looks quite fit. However, I am not the same anymore. Inside I have an invisible disability that affects me and numerous other people: heart failure.

The change

In October 2014 a sudden heart infarction happened. I had a open heart surgery, and remained in a critical condition for three days long. In total I spent a week in a coma. When I woke up, I could not remember anything. I did not realize the gravity of the situation I was in. The first thing I asked was: “When can I start climbing again?”. They told me I should leave that to the next generation. I did not believe them and I convinced myself I would get better and healthy again. It turned out, however, that I would never be able to recover completely. I had lost two-thirds of my heart function.

My new life

There are a lot of restrictions in my new life. Firstly, I need to very carefully plan which activities I will spend my energy on, as I get tired very quickly. Doing an activity can mean I have to rest for a few days afterwards. I also have to maintain a very disciplined lifestyle since I need to follow a strict diet. Finally, the loss of some cognitive capabilities make the heart failure difficult to accept, especially because outsiders often do not understand or see the loss I suffer from. This invisibility of heart failure has many consequences. I am for instance very insecure during travelling with public transport. I simply do not dare to ask for a seat when a bus or train is full, because many people think I am a healthy woman. Will they take me seriously while I look healthy?

Looking to the future

It is very hard to accept that my future is not so bright. I always used to say that I would live past a hundred, but I am now left to hope that I will reach the age of eighty. My future lies in me accepting this, and dealing with it in the most positive way I possibly can. There is unfortunately no hope for full recovery. My strict discipline and self-management only prevent my condition from getting worse. The hard truth is that the only certainty I have is that my heart and health will eventually decline.

I, however, refuse to just wait and do nothing. I still have my willpower and I want to stay completely self sufficient. I will continue pushing myself to the limit, to experience what I am and am not capable of.

Role of biosensors

The major difficulty of heart failure is that you cannot see any symptoms. Therefore, if you do not feel well, you often cannot explain it. A biosensor would give me and other patients that extra information, in order to explain and maybe prevent further decline of the heart or hospitalization.

SensUs is, in my opinion, a great initiative and I am a fierce supporter of science. Because if it weren't for science, I would not be here anymore. It makes devices like biosensors a reality. I am always open for new technologies and if there will be a working biosensor at the end of the competition, I want to be the first one to try it!

Personal Stories

Cindy - cardiology nurse practitioner

My name is Cindy Verstappen and I have been a nurse in in the field of cardiology since 1999. In 2003 I became a nurse practitioner, which means that I integrate tasks typically performed by a cardiologist with those of a nurse. I map case histories, do physical examinations, treat and guide patients at the heart failure clinic. I also educate cardiology nurses and nurse practitioners. I work closely with cardiologists, other nurse practitioners, general practitioners, the dietitian, the physiotherapist, personal carers in private homes, and heart patients and their families.

Contact with heart failure every day

I see heart failure patients on a daily basis. Their other caretakers and I try to keep the patients' quality of life as high as possible, so they can stay at home, in their own environment, for as long as possible. Yet despite our best efforts, many patients with heart failure need to be rehospitalized multiple times.

Struggles every day

Living with heart failure comes with a lot of everyday struggles. Heart patients have

to weigh themselves every day, meaning that they are confronted with their disease on a daily basis. Furthermore, heart patients need to keep a very strict diet takes a lot of discipline and determination, as does following the numerous edicts relating to the correct use and dosage of their medication. Finally, all these difficulties are compounded by frequent interruptions in the lives of these patients by visits to the hospital and the GP's office to monitor drug use, heart rate, blood pressure and several molecular parameters.
There are also the societal issues to take into consideration. Heart patients usually get tired very easily and have other physical restrictions that make it hard for them to find a job. This sometimes gives rise to financial problems. Furthermore, because heart failure is invisible from the outside, people don't usually notice the condition of the patient. It is very visible if you break your arm, but when you have heart disease people cannot see the problem. This causes a lot of struggles in social interactions.

NT-proBNP

One of the molecular parameters we monitor is NT-proBNP, the target biomarker of SensUs 2017. (NT-pro)BNP maintains the blood pressure. We currently use this to test if there is an increase of heart failure in a patient. When we want to test for the amount of NT-proBNP, we draw blood and it takes at least a day before we have the results. It is currently impossible to have the result within an hour, which would be useful when I need them as supporting information to an examination.
A device for point-of-care testing would, for use in both the clinic and patients' homes, be a great help. A biosensor for the monitoring of NT-proBNP could really prevent rehospitalization. It would also be a great help if these devices were synched with the electronic record of the patient. That way I could monitor patients from a distance and only have to help them if their blood values or other parameters were off. Furthermore, a biosensor could also give the patient more control over his or her own health. This is beneficial for the mental health state of the patient and will contribute greatly to their quality of life.

The SensUs competition

I believe the SensUs competition is a great initiative. I think the fact that the competition has so much contact with different stakeholders from hospitals and healthcare environments is amazing. This can provide a lot of useful information, since these people are going to be the ones that use the sensors once they become available.

Closing SensUs 2018

The SensUs organization would like to thank you for visiting this event. We hope you had an inspiring and innovative time and enjoyed the creations of our teams.

Next year we will again expand our global network, growing from ten to thirteen teams, from four different continents!

The universities participating in SensUs 2018 are:

	Country	University
	Belgium	KU Leuven
	Sweden	Uppsala University
	United Kingdom	Imperial College London
	Denmark	Technical University of Denmark
	The Netherlands	Eindhoven University of Technology
	Switzerland	École Polytechnique Fédérale de Lausanne
	Egypt	The American University in Cairo
	United States of America	North Carolina State Univ. & UNC at Chapel Hill
	United Kingdom	University of Glasgow
	Germany	Univ. of Applied Sciences Kaiserslautern
	Spain	BarcelonaTech
	China	Zhejiang University
	Canada	Université de Montréal

We hope to see you again at the SensUs event of 2018!

Notes

Competing for quality of life