

# **Beyond the lab: The DIY science revolution**

English



Science is done by scientists. Or is it? This exhibition explores seven remarkable stories of people who are opening up scientific research to everyone, taking it out of professional labs and into homes, workshops and back yards.

From people who build their own medical devices to manage their diabetes, to community groups measuring pollution, a growing number of 'do-it-yourself scientists' around the world are busy hacking, experimenting and inventing.

Equipped with low-cost sensors, smartphone apps and the ability to share information with communities online, these DIY science pioneers are challenging our ideas of who a scientist is and what science will look like in the future.



# Citizen Science: The power of the crowd

An increasing number of scientists are turning to the general public for help with their research. Easy access to smartphones and social networks means that citizens can work with scientists to collect information on everything from invasive mosquitoes to air pollution.

In return for dedicating their time and brain power to 'citizen science', participants are able to make a direct contribution to cutting-edge scientific research. With some projects, participants are trained so they can run their own experiments and gather evidence to use for political and social change.

## **Shazia Ali–Webber: The campaigner for clean air**

London's streets have some of the most polluted air in Europe. Shazia is a passionate campaigner for clean air in the city and one of thousands of people around the world who are using air monitoring devices to measure pollution in their homes and neighbourhoods.

Often working in collaboration with professional researchers, citizen scientists such as Shazia are using scientific evidence to gain a better understanding of their local environment and to campaign for change.

**1**  
**'Everyone should have access to clean air'**

**2**  
**I Like Clean Air**

Shazia has taken her message across the capital with other parents as part of the campaign group I Like Clean Air. Young children are particularly vulnerable to the effects of air pollution and they have joined Shazia's campaign by showing off slogan T-shirts, drawings and even performing a clean air song.

**3**  
**Shazia produced these campaign T-shirts for an event outside Hackney town hall in east London.**

**4**  
**Drawings produced by primary school children as part of an I Like Clean Air pollution awareness day in 2016.**

**5**  
**Pollution map of Hackney**

Shazia and members of I Like Clean Air climb ladders to fix diffusion tubes to lampposts around east London. In October 2014 they found that on some local streets the annual limit for nitrogen dioxide pollution was exceeded in just four weeks.

**6**  
**'We measure the air pollution where are kids walk to school'**

# Shazia Ali–Webber

7

## BuggyAir

Shazia monitors air quality on the go by strapping a BuggyAir sensor to the back of her son's pushchair. Developed by design company Superflux, BuggyAir combines air quality sensors and satellite positioning to map ground-level pollution across the city, which is then visualised using an app.

8

## Air Quality Egg

People all around the world have installed Air Quality Eggs in their homes and gardens, suspending them from roofs and buildings. Available as a do-it-yourself kit, the eggs measure harmful air pollution and share this data in real time via an online map.

9

## NO2 diffusion tubes

Perched atop lampposts, these tiny tubes collect samples of London air. Working with social enterprise Mapping for Change, Shazia has placed dozens of diffusion tubes around her neighbourhood to monitor levels of nitrogen dioxide (NO<sub>2</sub>). This invisible gas is present in vehicle emissions and is especially harmful to children's health.

10

## Air monitoring with Shazia

Shazia uses a range of different sensors to measure air pollution in the area of east London where she lives. Her I Love Clean Air campaign uses the data she gathers to raise awareness of the health impacts of air pollution and to call for action from government and industry.

Film duration:

2 minutes 4 seconds



## **Doreen Walther: The mosquito mapper**

Doreen is a scientist and a mosquito expert, but the people helping her are not. In 2012 she set up the Mosquito Atlas project to create a nationwide network of amateur mosquito catchers, who mail thousands of mosquitoes to her every year from all across Germany.

Mosquitoes can carry dangerous viruses, so Doreen's work – and the network of citizen scientists who support it – provides a vital monitoring service that helps the German government predict and plan for potential disease outbreaks.

# Doreen Walther

**1**  
**'I work with the public to monitor dangerous mosquitoes'**

**2**  
**Mosquito catching kit**  
Squashing mosquitoes might seem like the easiest way to catch them, but Doreen can only identify the insects if their tiny bodies are intact. Participants are encouraged to use this kit to catch mosquitoes alive and then put them in the freezer.

**3**  
**Mosquitoes in the mail**  
When a parcel arrives at Doreen's office her team examine the contents. Each sender gets a personal letter from her describing exactly what they have caught. Doreen believes this exchange of letters is a major factor in the project's success.

**4**  
**Insect storage box**  
Doreen and her colleagues pin every mosquito they receive with a detailed description of when and where it was found. The mosquitoes are then stored in wooden boxes and data on the species name, location and date of capture is plotted on an online map.

**5**  
**'People send me mosquitoes from all over Germany'**

## 6

### Mosquito map

From schoolchildren and teachers to fishermen and families, people from all across Germany have captured mosquitoes and sent them to Doreen. The project has gathered more than 30,000 mosquitoes and discovered populations of Asian bush mosquitoes and Asian tiger mosquitoes, both of which are invasive species that can carry dangerous viruses.

#### ***Culex pipiens***

(Common house mosquito)

Kiel, July 2015

#### ***Aedes cataphylla***

Schwerin area, July 2014

#### ***Culex pipiens***

Bremen area, August 2015

#### ***Aedes cinereus***

Wolfsburg area, September 2013

#### ***Aedes cataphylla***

Frankfurt an der Oder, October 2015

#### ***Aedes japonicus***

'Asian bush mosquitoes are clearly frost resistant as this one was caught in December'

#### ***Aedes rusticus***

'A retired engineer in Berlin has sent me more than 200 mosquitoes'

#### ***Anopheles plumbeus***

'This was one of 20 mosquitoes sent by a family during their summer holidays in 2014'

# Doreen Walther

## ***Leptoglossus occidentalis***

'This bug is an invasive species but it's no mosquito – we get sent quite a few of these!'

(Common house mosquito)  
Bayreuth, May 2015

## ***Aedes geniculatus***

'There's a fisherman near Dresden who sends us mosquitoes every year from the river Elbe'

## ***Aedes albopictus***

(Asian tiger mosquito)  
Wuerzburg, August 2015

## ***Aedes albopictus***

'This one was caught by a woman in her garden after it bit her on the arm'

## ***Aedes albopictus***

'A professor caught this striped female on his allotment near Heidelberg'

## ***Aedes japonicus***

'The first Asian bush mosquito sent to us from north-west Germany was caught near Bonn'

## ***Culex pipiens***

(Common house mosquito)  
Saarbruecken area, June 2013

## ***Culex pipiens***

'A group of schoolchildren near Frankfurt sent me more than 75 mosquitoes in one go'

## ***Aedes cantans***

Regensburg, September 2015

## ***Aedes japonicus***

(Asian bush mosquito)  
Koblenz area, August 2012

## ***Aedes japonicus***

'I've been sent loads of Asian bush mosquitoes from around Stuttgart'

## ***Culiseta annulata***

Fulda area, December 2015

## ***Aedes albopictus***

'We were sent our first ever adult tiger mosquito in 2014 by a police officer in Freiberg'

## ***Culex pipiens***

## ***Culex pipiens***

(Common house mosquito)  
Munich area, August 2012

**7**

## **Mosquito Alert**

Doreen's project is not alone. Founded in Spain in 2013, Mosquito Alert asks people to photograph invasive mosquitoes using their smart-phones. The project app also invites people to help identify mosquito species by reviewing photos online. The data can then be used to produce risk maps for potential disease outbreaks.

**8**

Above and left

**Using the Mosquito Alert app, participants have identified thousands of invasive Asian tiger mosquitoes.**

**Smartphone images of mosquitoes and mosquito breeding sites submitted to Mosquito Alert.**



# Health hacking: Patients doing it for themselves

Healthcare is being 'hacked' today like never before, opening up a new era of patient-driven innovation. The availability of technology such as 3D printing, together with new apps and devices for collecting data about the body, means that patients are increasingly able to take health into their own hands.

From people experimenting on their bodies, to those inventing medical devices from scratch, patients are discovering radical new methods to manage their health and improve their lives.

## Tim Omer: The diabetes hacker

Tim is part of a global community of type 1 diabetics who are hacking and building their own medical devices and apps. Their mission is to bring down the cost of diabetes care and build tools that improve on what is currently available from healthcare providers.

Doctors and medical charities warn of the risks of do-it-yourself patient solutions, but diabetes hackers such as Tim argue they know what is best for their bodies and say they are frustrated that research and innovation are not delivering results fast enough.



**1**

**‘The technology is out there so why shouldn’t I use it?’**

**2**

### **Tim’s artificial pancreas**

As a type 1 diabetic, Tim’s body cannot produce insulin. This essential hormone is released by the pancreas and helps cells take up glucose from the blood. Tim’s artificial pancreas is a DIY system that aims to detect changes in blood sugar and automatically inject him with the right amount of insulin.

**3**

### **Continuous glucose monitor and hacked transmitter**

A small sensor inserted under the skin on Tim’s arm monitors his blood sugar. The readings are then sent via a transmitter to a receiver device. Tim’s first hack was to replace the expensive batteries in the transmitter, meaning he no longer has to buy a new device every six months.

**4**

### **Homemade data receiver – xDrip**

Housed inside a Tic Tac box and made using off-the-shelf electronics, Tim’s receiver allows him to intercept data from the transmitter and send it to his smartphone. The design is based on plans created and shared online by the diabetes hacking community.

**5**

### **Smartphone app – HAPP**

Tim monitors his blood glucose level using his smartphone and a smart- watch. An app on his phone analyses the data from his glucose monitor and recommends how much insulin his body needs.

# Tim Omer

**6**

## **Insulin pump**

Worn on Tim's hip, this pump injects insulin into his body. Tim is working with other diabetes hackers to link the pump to his smartphone app so it can automatically inject him with insulin.

**7**

**'I want access to data about my body—on my terms'**

**8**

## **Nightscout**

Tim's work builds on the efforts of a global community of diabetes hackers using the hashtag #WeAreNotWaiting. One of their best-known hacks is Nightscout, a system that allows remote access to blood glucose readings using the internet. To use Nightscout, a smartphone and a data receiver are connected together. This 3D-printed case holds them in place, ensuring a secure connection.

**9**

## **Using Nightscout**

Film duration:

2 minutes 41 seconds

## **Pedro Oliveira and Helena Canhão: The online innovation hub**

One in twelve people living with a chronic disease come up with a novel idea for managing their condition. This inspired Pedro Oliveira and Helena Canhão to set up Patient Innovation, an organisation that works to share home-grown medical solutions with a world-wide audience.

Founded in 2014, Patient Innovation has gathered more than 600 medically reviewed innovations on its website. The organisation publishes in multiple languages and supports patients and carers to launch businesses based on their ideas.

# Pedro Oliveira and Helena Canhão

**1**  
**'We find amazing inventions and share them with the world'**

## **2** **Thermal pockets**

Diogo Lopes has a neurological condition with many symptoms, including persistently cold feet and hands. Pedro and Helena's team at Patient Innovation put Diogo in touch with a group of university students in Lisbon to develop this do-it-yourself hand-warming device.

## **3** **ViEx**

Sarah Betts was diagnosed with rheumatoid arthritis when she was 10 years old. As a violinist she noticed that her left hand, which she uses to press down on the strings of her instrument, was much less swollen than her right. She created ViEx, a device based on her violin that other people with arthritis can now use to exercise their hands.

## **4** **Shower Shirt**

Lisa F Crites invented the Shower Shirt following a mastectomy in 2009. Like other women who have undergone the procedure, she was told not to shower unprotected because of the infection risk from unsterilised water. Lisa developed a waterproof shirt that women around the world now use following surgery. She was awarded the first Patient Innovation Award by Pedro and Helena in 2015.

**5**

**‘Patients are incredible innovators—we help them realise their ideas’**

**6**

**3D-printed prosthetic hand**

In 2015 the Patient Innovation team created this 3D-printed prosthetic hand for 7-year-old Nuno. The team worked with Ivan Owen, a professional puppeteer and 3D printing specialist. Ivan designs 3D-printed prostheses for both children and adults, and shares the designs online free of charge, meaning people around the world can produce their own low-cost prostheses.

**7**

**Patient Innovation**

Pedro and Helena have gathered hundreds of ideas on the Patient Innovation website. The selection on display here showcases the huge diversity of amateur innovations created by patients themselves, as well as ideas from friends, families and professional inventors.

**8**

**ExoVasc**

Tal Golesworthy has lived for decades with a serious genetic defect to his aorta, the main artery connected to the heart. Instead of accepting the treatments available, he drew on his experience as an engineer to develop an alternative. The ExoVasc is a supportive fabric mesh that is produced using a 3D-printed mould. It fits over the aorta, providing an exact fit for every patient.

# Pedro Oliveira and Helena Canhão

**9**

## **Ostom-i**

Michael Seres was diagnosed with Crohn's disease aged 10. Following an operation to transplant a new intestine, he needed to use an ostomy bag to collect his bodily waste. With no easy way of checking when the bag was full, Michael used part of a Nintendo Wii glove to build himself a sensor that monitors the bag and communicates via an app on his mobile phone. What began as a do-it-yourself project is now available in hospitals around the world.

**10**

## **Upsee**

Debby Elnatan's son was diagnosed with cerebral palsy when he was 2 years old. After being told he would be a wheelchair user for life, Debby designed the Upsee to enable her to walk with him strapped to her waist and feet. She has now developed the design with company Firefly, so other children can benefit from her idea.

## **Sara Riggare: The expert patient**

Sara was diagnosed with Parkinson's disease in 2003. To stay fit and healthy, she has become an expert in her disease and shares her experiences with other patients online. She uses a range of wearable technologies to record her heart rate and sleeping patterns, track symptoms and even customise her treatments.

Sara is a passionate believer in the power of patients to take control of their own health-care. She encourages others to join online networks, embrace their role as expert patients and refuse to accept one-size-fits-all medical solutions.

# Sara Riggare

**1**  
**‘Collecting data helps keep me healthy’**

**2**  
**‘Self-tracking is my most powerful weapon against Parkinson’s’**

**3**  
**Living with Parkinson’s**  
Sara’s complex medication plan reduces her symptoms and lets her get on with daily life. She organises her daily dose of six different pills with the help of physical planners and has also worked on a smartphone app that sends a reminder when it’s time to take medication.

**4**  
**Self care**  
Sara spends only one hour a year with her neurologist, during which he evaluates her condition and prescribes medication. For the remaining 8765 hours Sara is in charge of managing the disease. She produced this info-graphic to encourage others to embrace their role as expert patients.

**5**  
**Sara the self-experimenter**  
To measure the effects of her medication, Sara helped to develop a smartphone app that counts the number of times she can tap her finger in 30 seconds. This ‘tap test’ revealed her medication was less effective in the late morning – a problem Sara has solved by changing the time she takes her daily pills.



## 6

### **Daily exercise**

To stay healthy Sara has to keep her hands and body moving. She does this by following a weekly activity plan, and attending a knitting group and boxing classes that are run especially for people with Parkinson's.

## 7

### **Sara's story**

Sara has been successfully managing Parkinson's disease every day since 2003. While boxing, knitting or simply walking to work, Sara uses wearable devices to monitor her body and keep track of her symptoms.

Film duration:  
2 minutes 8 seconds

## 8

### **Activity trackers**

Wristbands such as Jawbone and Misfit Shine track sleep, activity and food intake. These wearables are commercial products intended as keep-fit tools, but Sara uses them to run her own experiments.

## 9

### **Sleep and exercise data**

Many people with Parkinson's disease have trouble sleeping. Sara monitors her symptoms using self-tracking devices and has discovered that exercising in the morning helps her sleep the following night.



# DIY biology: Out of the lab and into the home

In kitchens, basements and garages all over the world, a new brand of science is being forged. Do-it-yourself biology is a growing grassroots movement that puts genetics and molecular biology into the hands of hackers and hobbyists.

Central to the DIY biology movement are new community labs where anyone can learn the basics of biology, run his or her own experiments and work alongside other amateur enthusiasts. Beyond these community-led spaces, DIY biologists are building new devices that bring the lab directly into people's homes.

# Philipp Boeing and Bethan Wolfenden: The lab in a box

When they met at university, Bethan Wolfenden and Philipp Boeing were frustrated that biology was out of reach for anyone without access to a professional lab. Their big idea was to compress a lab's worth of scientific instruments into a laptop-sized box.

What began as a jumble of equipment inside an old suitcase has become a fully functioning device: Bento Lab. Because it is compact, affordable and easy to use, Bethan and Philipp hope their creation will be used in homes and schools by people from all walks of life.

**1**

**'We want to reclaim biology for everyone'**

**2**

**User testing**

The Bento Lab on display is a prototype. In 2015 it was sent out to eager DIY biologists around the world for them to test. Their feedback has helped Bethan and Philipp develop the latest version of the device.

**3**

**'We want to use Bento Lab to diagnose dengue fever in developing countries. Bento is cheap and portable, so it's ideal for clinics in need of equipment.'**

Blaine Doyle and Yensi Flores,  
Ireland

**4**

**'I used Bento Lab to show people what's possible with molecular biology. I can't wait until my entire biology lab is the size of my laptop.'**

Kevin Chen, Canada

**5**

**'We love exploring Pembrokeshire's beautiful woods for fungi. We used Bento Lab to identify fungi from their DNA and investigate the spread of particular species.'**

David Harries, Wales

# Philipp Boeing and Bethan Wolfenden

## 6

### **Bento Lab**

Bethan and Philipp's sleek design contains three pieces of sophisticated kit that are essential for analysing DNA. The centrifuge, PCR (polymerase chain reaction) machine and electro-phoresis unit can be used to perform many experiments, from identifying horse meat in a hamburger to testing for specific genes in human DNA.

# Pieter van Boheemen: The DIY antibiotics hunters

In one of Amsterdam's oldest buildings is a room filled with home-made microscopes, Petri dishes and local people making and experimenting.

Pieter van Boheemen is at the heart of this hustle and bustle. Through hands-on workshops and events, Pieter is working to make biology accessible to all. His do-it-yourself antibiotics project invites people from around the world to search for a solution to one of today's biggest medical challenges: antibiotic resistance.

# Pieter van Boheemen

1

## 'I believe we can crowdsource a new antibiotic'

2

### Hunting for antibiotics

Pieter is concerned that growing antimicrobial resistance means our current drugs may soon stop working. His answer is to encourage people around the world to search for new sources of antibiotics in nature. These Petri dishes were made by Pieter's group in Amsterdam, and contain different species of bacteria and a variety of extracts from plants and soil.

3

#### 1. Gather

Take a plant and cut up its leaves or petals. Extract the juice, mix it into a solution and soak it up using a small paper disc.

#### 2. Grow

Prepare a Petri dish with milk powder, honey, Marmite, water and agar. Add bacteria and your paper disc and incubate overnight at 34°C.

#### 3. Test

Look for a clear area around the paper disc where bacteria have not been able to grow. These 'zones of exclusion' could mean you have found a plant extract with antimicrobial properties.

4

### Pieter's Open Wetlab

Pieter runs the Open Wetlab in Amsterdam, a community space that seeks to democratise biology and make cutting-edge science available to all. A huge range of experiments and activities take place in the Wetlab, including Pieter's project to discover new sources of antibiotics.

Film duration:

2 minutes 7 seconds



**5**

## **DIY biology labs of Europe**

Pieter's community lab is not alone. Across Europe, open spaces for DIY biology have sprung up everywhere from Prague to Paris.

**6**

## **DIY lab equipment**

Pieter and other DIY biologists buy and scavenge materials everywhere from hardware shops to eBay, building on one another's ideas and sharing tips online. This brings down costs dramatically, enabling people to build their own labs in shared workspaces and even at home.

**7**

## **Microscope**

Pieter uses his home-made microscope – crafted from laser-cut wood, DIY shop wires and disposable camera lenses – to monitor bacteria as they grow.

**8**

## **Spectrometer**

Spectrometers work by shining a light through different materials to determine what they are made of. Pieter uses this device to measure the impact of antibiotics on growing microbes.

**9**

## **Centrifuge**

Spinning at 10,000 revolutions per minute, this centrifuge is made using a motor from a toy drone. Pieter uses it to separate microbes, proteins and DNA.

**10**

## **Incubator**

A warm environment for growing microbes, this home-made incubator is an essential tool for microbiology. Using this design, virtually any box can be converted into a DIY incubator.

# Art and DIY science

The potential of DIY science is vast, but where will it lead in the future? Three artworks have been produced in collaboration with Ars Electronica Futurelab in Linz, Austria. Over several months, artists Lucy McRae, Jakob and Lea Illera, and Anouk Wipprecht worked with curators and scientists to develop new work that explores the future of science as it moves beyond the lab and into our lives.

**1**  
**Jakob Illera and Lea Illera**  
*BeBots*, 2016

Speculative design objects  
made from 3D-printed resin

Would you insert a robot inside your body if it improved your health? Artists Jakob and Lea Illera have created the BeBot, an imaginary 'nanobot' that manipulates the nervous systems to suppress our conscious and subconscious desires. Designed in response to the growth in diseases like diabetes and obesity, BeBots examines a future where everyone can use DIY medical solutions to manipulate their thoughts and feelings.

**2**  
**3D-printed model BeBots.**  
A single BeBot is approximately 12 nanometres long.

**3**  
**Cell culture plates containing billions of BeBot nanobots, each made from folded strands of DNA.**

**4**  
**A BeBot inhaler designed for daily personal use.**

**5**  
**This info-graphic imagines how BeBots would work in our bodies.**

# Art and DIY science

6

## **Anouk Wipprecht** *Agent Unicorn, 2016*

Laser-sintered polyamide prototypes

How can design and new technology be used to improve mental health therapy? Anouk Wipprecht's 3D-printed headsets, which take the form of unicorn horns, are designed for children with ADHD (attention deficit hyperactivity disorder). Electrodes within the headsets measure activity in the brain, triggering a built-in camera that starts filming when the wearer's attention level spikes. This creates a visual record that children can watch to gain a better understanding of what interests and distracts them.

7

## **Lucy McRae with Lotje Sodderland** *The Institute of Isolation,* 2016

Film duration: 9 minutes 38 seconds

In this observational documentary, Lucy McRae tells the story of The Institute of Isolation, a fictional organisation that offers people the chance to optimise their bodies. Inspired by current developments in genetics and medical technology, McRae examines how the human brain and body might be shaped in the future through sensory deprivation and extreme isolation.

Right  
**Film props from *The Institute of Isolation.***

## **Film transcript:**

We can accurately measure the physiology of the body, but the psychological responses to prolonged isolation are largely unpredictable.

How does the brain respond in manipulated conditions below the threshold of hearing?

Does it mimic previous experiences in order to adapt?

The body is not designed to exist beyond the Earth's edge.

Fundamental aspects human of biology will need to change.

10% of people who spend winters in the Antarctic develop serious psychological problems.

It's difficult to predict who will not cope in extreme environments.

Reproductive technology is editing life, like computational code.

Is this becoming an adventure of control?

Does the body become a mixing board of switches, where we curate life decades after an egg and sperm has left the body.

We are in a different phase of evolution, no longer driven just by nature but human intent.

Technology is embalming the body, pulling death out of time.

Could the design of isolation augment the self, beyond genetic traits?

# To learn more

**Shazia Ali-Webber**

[www.ilikecleanair.org.uk/](http://www.ilikecleanair.org.uk/)

**Doreen Walther**

[www.zalf.de/en](http://www.zalf.de/en)

**Tim Omer**

<http://www.hypodiabetic.co.uk/>

**Pedro Oliveira and**

**Helena Canhão**

[patient-innovation.com/](http://patient-innovation.com/)

**Sara Riggare**

[www.riggare.se](http://www.riggare.se)

**Philipp Boeing and**

**Bethan Wolfenden**

[www.bento.bio/](http://www.bento.bio/)

**Pieter van Boheemen**

[waag.org/en/lab/open-wetlab](http://waag.org/en/lab/open-wetlab)

**Jakob Illera and Lea Illera**

[www.inseq.com/](http://www.inseq.com/)

**Anouk Wipprecht**

[www.anoukwipprecht.nl](http://www.anoukwipprecht.nl)

**Lucy McRae**

[www.lucymcrae.net/](http://www.lucymcrae.net/)

# Acknowledgements

This exhibition has been created as part of Sparks, a European project that explores new ways to involve people in scientific research and innovation. The exhibition will tour a total of 29 different museums, science centres and research institutions across Europe from 2016 to 2018.

**Exhibition curation and production:** Science Museum

**Artwork curation and production:** Ars Electronica

**Exhibition and graphic design:**  
Andres Ros Soto and  
Michael Montgomery

**Photography:** Angela Moore  
Film: Science Museum

**Exhibition build:** MER Services

**Cost consultancy:** Flemming  
Associates

**Exhibition tour:** Ecsite

**Sparks** is collaboration between 33 organisations from all EU Member States and Switzerland. The project aims to raise awareness of Responsible Research and Innovation (RRI) through exhibitions, events and publications, with a specific focus on technology shifts in healthcare and medicine. RRI is a European initiative to involve citizens and stakeholders in the research and innovation process and aims to ensure that science and technology reflect the needs, priorities and values of wider society. The Sparks project is coordinated by Ecsite, the European network of science centres and museums. Find out more at: [sparksproject.eu](http://sparksproject.eu)

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