

HORIZON-MSCA-2021-DN-01



**Project No. 101072632**

**Breaking the barrier**

**An integrated multidisciplinary approach to kill Gram-negative bacteria through existing antibiotics by making their outer membrane permeable**

## **Deliverable 4.1**

### **Project website**

WP4 – Outreach

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Delivery date	31 March 2023
Dissemination level	Public
Type	Administrative

**Version 01**



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## Revision History

Author(s)	Description	Date
Wilbert Bitter (AUMC), Wei-Wei Lee (accelCH)	Draft version 1	21/02/2023
Marco Cavallaro (accelCH)	Revision draft version 1	22/02/2023
Pauline Leverrier (UCL)	Revision draft version 1	23/02/2023
Wilbert Bitter (AUMC), Wei-Wei Lee (accelCH)	Final version	22/03/2023

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## Partner short names

ABAC	ABAC Therapeutics SL
accelCH	accelopment Schweiz AG
AUMC	Stichting VUMC
CNRS-IBS	Centre National de la Recherche Scientifique
ICIQ	Fundació Privada Institut Català d'Investigació Química
Naicons	Naicons Srl
Roche	Hoffmann-La Roche AG
Symeres	Symeres Netherlands B.V.
Syn	Syngulon
UCLouvain	Université Catholique de Louvain
UL FFA	Univerza v Ljubljani
UNEW	University of Newcastle upon Tyne
UNIMI	Università degli Studi di Milano
UQ	The University of Queensland
URV	Universitat Rovira i Virgili
VU	Stichting VU

## Abbreviations

D	Deliverable
DC	Doctoral Candidate
GDPR	General Data Protection Regulation
M	Project month
PI	Principal Investigator
WP	Work Package

## Executive summary

### Background

As part of the Outreach work package (WP4), task 4.1, this deliverable presents the BREAKthrough project website, describing how it is set up and how it will be developed and maintained throughout the project's duration and following its completion.

### Objectives

The BREAKthrough website serves as a powerful tool to communicate, inform, and raise awareness on the project's objectives and progress, enabling the consortium to reach out to all its stakeholders. The website provides up-to-date, consistent, and comprehensive information about the project.

With the help of this deliverable and the project website, the BREAKthrough consortium aims to:

- Increase awareness of the BREAKthrough project
- Document and inform about the project's progress and results
- Inform about relevant activities and upcoming events

### Methodology and implementation

The BREAKthrough website was created using WordPress and the website builder plugin Elementor. As it is securely hosted on accelCH's web server, GDPR compliance is ensured. The website's appearance was customised according to BREAKthrough's visual identity as defined by accelCH.

### Outcomes

The outcome of deliverable 4.1 is the project website, available at [www.breakthrough-project.eu](http://www.breakthrough-project.eu) since January 9, 2023 (M1).

### Impact

As one of the main communication channels of the BREAKthrough project, the development and maintenance of the website is essential to maximising the project's impact. It is one of the most accessible and flexible platforms through which the consortium can communicate about the project and showcase its disseminated results to a broad audience.

### Next steps

Further areas will be created to give detailed information on research, training, outreach material, and project results as they become available. The next steps also include regularly posting project-related news and announcing relevant events. The website URL will be included on all BREAKthrough communication, dissemination, and exploitation material.

## 1 Key facts

The BREAKthrough website has the main purpose of raising awareness of the project's endeavours and progress. It also functions as a central platform to disseminate project results to the scientific community and to communicate its outcomes to the medical community, the patient community, and the general public.

- The BREAKthrough website address is [www.breakthrough-project.eu](http://www.breakthrough-project.eu).
- The website was first launched on January 9, 2023.
- accelCH created and currently maintains the website using WordPress.
- The project website is securely hosted on accelCH's web server.
- The website links to the project's social media channels (Twitter and LinkedIn).

## 2 Objectives

Designed to be easily accessible and user-friendly, the project website serves as a wide-reaching means of communication and engagement with all BREAKthrough stakeholder groups. By developing and maintaining the BREAKthrough website, we aim to:

- Increase awareness of the BREAKthrough project and its network
- Document the project's progress
- Inform about planned project-related activities
- Encourage networking and two-way communication between external stakeholders and the partners and DCs
- Share the project's results and outcomes
- Increase the project's impact

The specific objectives are not only to provide a source of information but also to create an interactive platform for exchange with the various stakeholder groups including the scientific community, the biotech and pharma industries, policymakers, and the general public as well as within the project's network. This is achieved by including engaging audio-visual material that clearly and effectively communicates the project vision, endeavours, and results to a wide audience and by providing educational material, regular news, and continuously updated content.

## 3 Strategy

The website functions as a focal point for all BREAKthrough stakeholder groups to find information on the project. This includes information on the partners involved, the background and motivation for the research, the training programme, the project's progress and key events.

At the initial stage, the website also serves as an important platform for the advertisement of open DC positions. During the first project months, i.e. the DC recruiting period, the key aim of the project website is to attract potential candidates interested in joining the BREAKthrough doctoral network as a DC. The focus of the current content is therefore to provide potential candidates with key information on the project, introduce the supervisors and project partners, and inform them about the individual research projects and requirements to apply for a position.

After its initial setup, the BREAKthrough website will be adapted regularly over the course of the project to ensure that the content continues to meet the stakeholders' needs and keeps all stakeholder groups interested and involved. This will be achieved by prompt communication of the project's newest results, regular and timely updates on news and events, and the enhancement of engagement opportunities through event registration

functions, when appropriate. The content of the web pages will be expanded and some parts of the website will be specifically tailored to different BREAKthrough target groups, including the scientific community, the biotech and pharma industries, policymakers, and the general public.

The current website content was developed in close collaboration with BREAKthrough’s coordinator, UCLouvain. Their feedback has been very valuable in the process. We will incorporate future feedback and ideas from the consortium to continue to shape and improve the website content and structure. The involvement of the consortium will be a helpful means to guide project communication strategies and the project itself towards achieving maximum impact among all its stakeholders.

## 4 Technical implementation

The BREAKthrough website, created with WordPress, is implemented in a way that allows easy maintenance and provides an appealing experience to its users. As it is securely hosted on accelCH’s web server, GDPR compliance is ensured.







### 4.1 WordPress

The website was created using the content management system WordPress and a website builder plugin called Elementor. WordPress offers flexible and professional layouts, a user-friendly interface for ease of editing and numerous additional plugins to integrate interactive features and adjust the website to the project’s needs. Thanks to the tool’s flexibility, the design and functionality of the website can evolve throughout the project and continuously adapt with ease. As a default feature, WordPress offers responsive designs. This means that the BREAKthrough website has a layout that adapts to different screen sizes depending on the device used, guaranteeing convenient access to the website from mobile devices and desktops.

### 4.2 Theme

The website’s theme has been customised by accelCH according to the project’s visual identity. The font used for all (sub)headers is Source Sans Pro, while the font Urbanist is used for body text and buttons. Headers, links, buttons, and other visual elements make use of the BREAKthrough colours, as displayed in Table 1.

Table 1 Corporate colours of BREAKthrough

1		CMYK 18,100,91,8 RGB 190,31,45 HEX #BE1F2D	4		CMYK 11,80,97,2 RGB 213,87,43 HEX #D5572B
2		CMYK 1,51,99,0 RGB 245,145,31 HEX #F5911F	5		CMYK 88,47,16,1 RGB 0,119,168 HEX #0077A8
3		CMYK 68,61,59,46 RGB 64,64,65 HEX #404041	6		CMYK 31,100,100,44 RGB 115,7,16 HEX #730710

### 4.3 Images and graphics

To increase the visual appeal of the website and help illustrate information, images and graphics are used. This includes:

- adapted stock photos (e.g. in the header image slides on the homepage, on the [Research](#) page, as featured images of news items)
- icons adapted to the BREAKthrough project identity (e.g. on the homepage, representing 'Research', 'Training', and 'Network')
- event photos
- logos, of the project itself and of partner organisations (as seen on the [Network](#) page)
- profile photos of the principal investigators (PIs)

Partner logos and profile photos were provided by the respective partners, while other graphics were modified or created explicitly to be used within the BREAKthrough project. More visuals will be created and added throughout the project.

## 5 Structure

The website is currently structured as described in the following sub-sections, in line with the strategy, aims and objectives described above. However, this structure and the individual web pages are subject to evolve over time and will be adapted as the project develops. The present section follows the structure of the website's main navigation menu, starting with the homepage, followed by the other pages, and concluding with the footer.

The main navigation menu allows the viewer to easily reach the key pages of the website, currently including 'Home', 'Research', 'People', 'Open positions', 'Training', 'Network', and 'News'. As the project progresses, new pages will be added to the menu to accommodate further relevant content, such as research highlights, publications, and other project material.

The funding acknowledgement is displayed in the footer throughout the website, which also includes the copyright and links to the privacy and cookie policies, social media channels and the contact page.

### 5.1 Homepage

The Homepage is the landing page of the website where users arrive when directly navigating to the URL ([www.breakthrough-project.eu](http://www.breakthrough-project.eu)), searching for the project in a search engine, or being redirected through a different website (e.g. partner websites). The homepage enables the viewer to immediately gather an overview of the project, through an eye-catching, animated image of bacteria and the project's descriptive title (Figure 1). Directly below this, there is a short opening paragraph summarising the global challenge addressed by BREAKthrough and the solution the project aims to offer. Due to the website's current focus on advertising the open DC positions, a call for action is prominently placed next to this paragraph, which hyperlinks to the [Open Positions](#) page.

The main image banner on the homepage contains three moving slides. Besides the first one displayed in Figure 1, there is a slide that redirects to the open positions and another one linked to the [People](#) page, which currently presents all PhD supervisors in the project (Figure 2). While the slides move to the next one automatically, this is paused whenever the website user hovers over the image, ensuring that content that interests the user remains easily accessible.

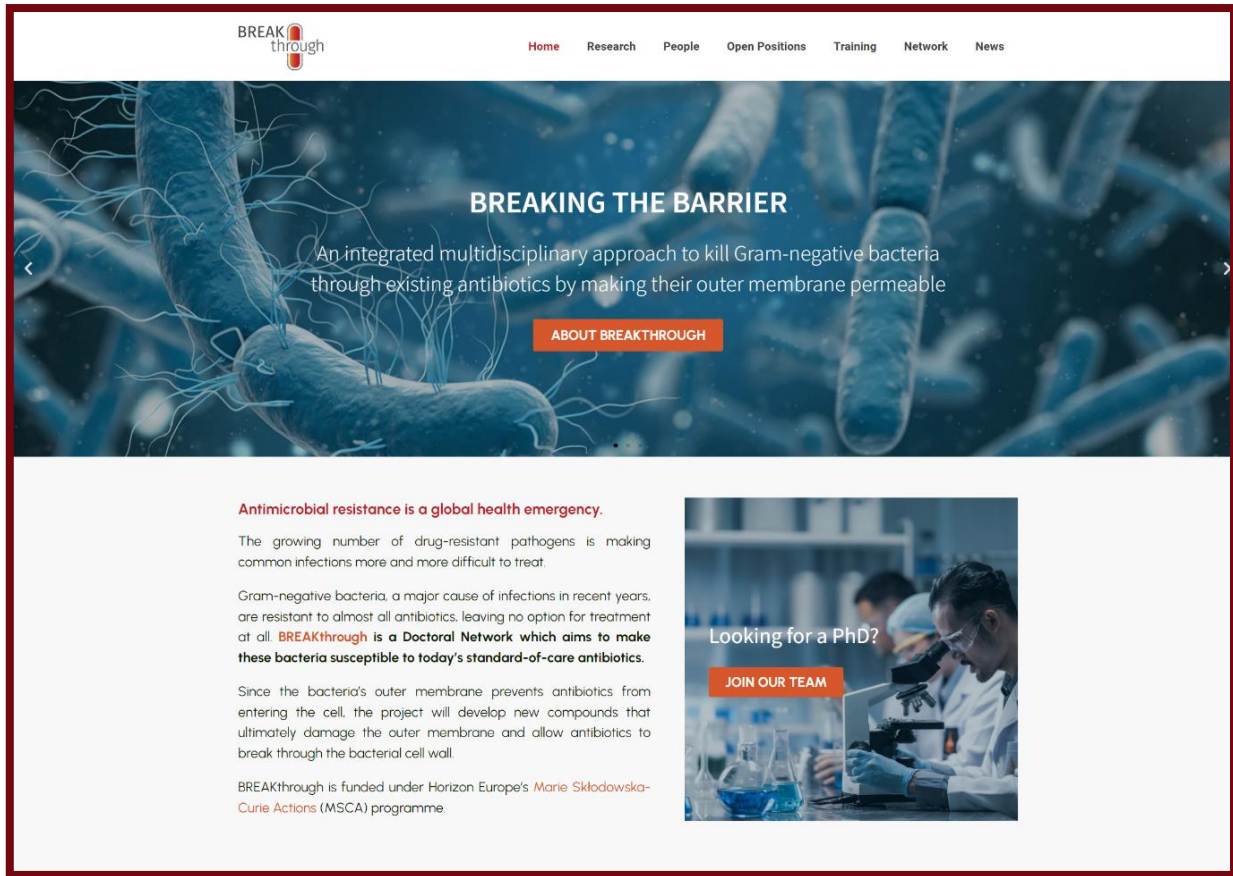


Figure 1 Upper section of the BREAKthrough website homepage

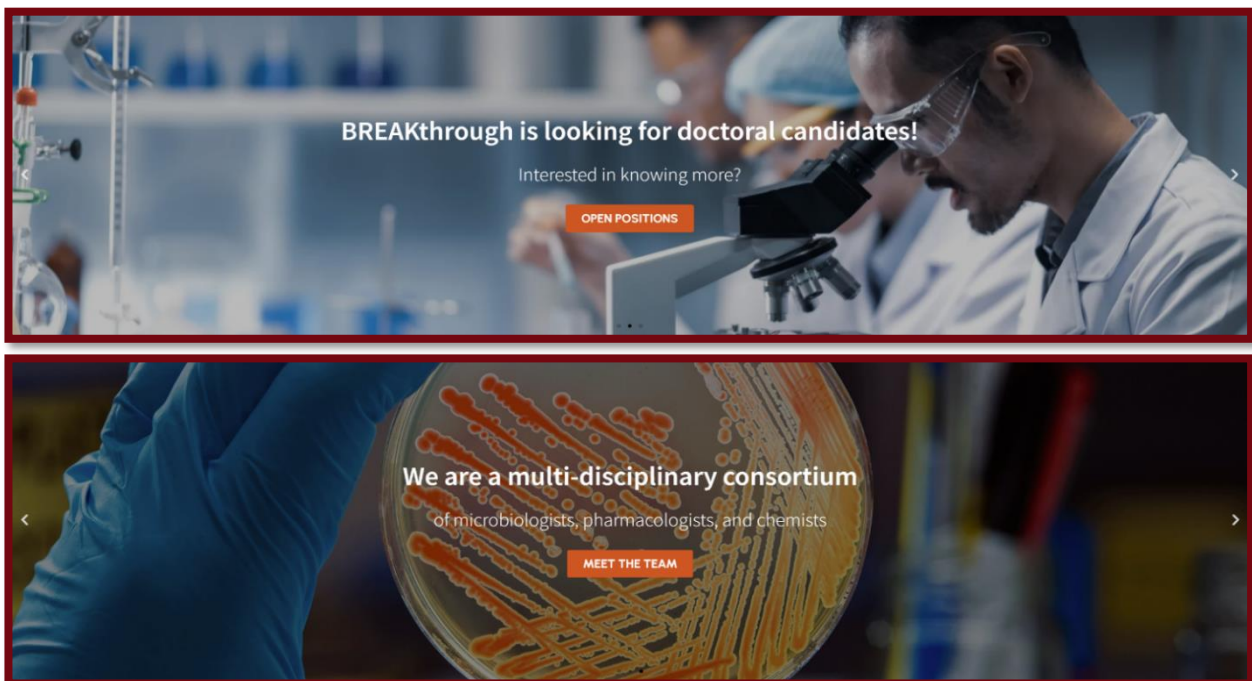


Figure 2 Main header images displayed on the homepage

In the lower part of the homepage (Figure 3), three boxes briefly introduce the research and training BREAKthrough is involved in, the two main components of the doctoral network, as well as the consortium, each of the three linking to the relevant web pages. Below the boxes, there is a 'Project news' section showing the news items posted on the website and the BREAKthrough Twitter feed.

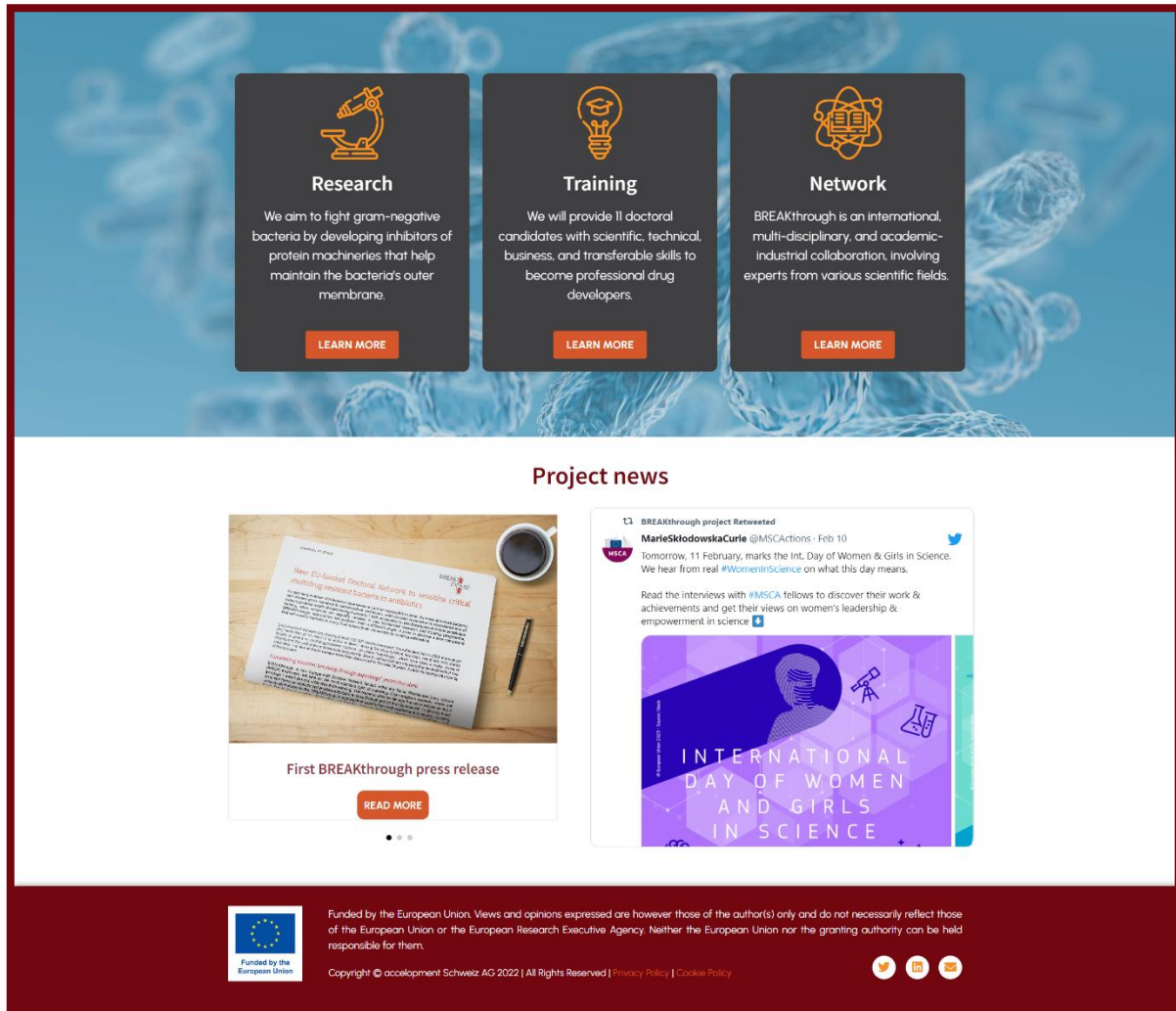


Figure 3 Lower section of the BREAKthrough website homepage

## 5.2 Research

The [Research](#) page explains why the BREAKthrough project is needed, the project's main objectives and its approach to reaching those objectives (Figure 4). This section will be expanded with more detailed information about the different work packages in BREAKthrough.



**RESEARCH**

**BREAKthrough is breaking the barrier**

An integrated multidisciplinary approach to kill Gram-negative bacteria through existing antibiotics by making their outer membrane permeable


No novel antibacterial drug classes have been discovered and developed for clinical use since 1987. This lack of innovation in antimicrobial research has resulted in limited new options to address multi-drug-resistant bacteria like Gram-negative (Gram-) bacteria. Infections by multi-drug-resistant Gram- bacteria are particularly hard to treat because the **impermeability of the outer membrane restricts access** by existing standard-of-care antibiotics. The goal of the BREAKthrough project is, therefore, to destabilise the outer membrane and make it permeable, **sensitising the Gram- bacteria to antibiotics**.

**BREAKthrough aims to sensitise bacteria towards new and existing drugs.**

Prof. Jean-François Collet  
UCLouvain, BREAKthrough coordinator

To make multi-drug-resistant Gram- bacteria vulnerable to standard-of-care antibiotics, their outer membrane, **their barrier to the outer world, needs to be broken**. For this purpose, the project will target three key protein systems that are essential to maintain the outer membrane. Defects in any of these three targets have been shown to increase the permeability of the outer membrane, allowing a large variety of drugs to enter the cell. BREAKthrough aims to **deliver molecules that inhibit these three protein machineries**.

**Three targeted protein systems:**

-  Bam complex
-  Lpt complex
-  L,D-Transpeptidases

**More specifically, the BREAKthrough project aims to achieve the following objectives:**

1. Develop and optimise **specific bacterial assays that report on defects in Bam and Lpt multicomponent machineries and in L,D-Transpeptidases**, as well as use and optimise recently developed **screening assays that report on OM stress and permeabilisation**. Existing and newly synthesised libraries provided by the industrial collaborators will be tested, and this may lead to the **repurposing of existing drugs**.
2. Develop an **in vivo screening assay for compounds that permeabilise the OM using a zebrafish infection model** that reports on sensitisation to large-scaffold antibiotics.
3. Construct an open-access **BREAKthrough data hub** that defines the physicochemical characteristics of compounds that can cross the OM of GNB based on an SPPR that is to be defined. The purpose of the database is to facilitate a rational drug design.
4. **Optimise lead compounds** in iterative synthesis/testing rounds based on SPPR findings.

Figure 4 Research page of the BREAKthrough website

### 5.3 People

On the [People](#) page, visitors can see all 10 PIs involved in BREAKthrough (Figure 5). Knowing who is involved in the project is interesting for all stakeholders, but during the recruitment period in particular, this is essential

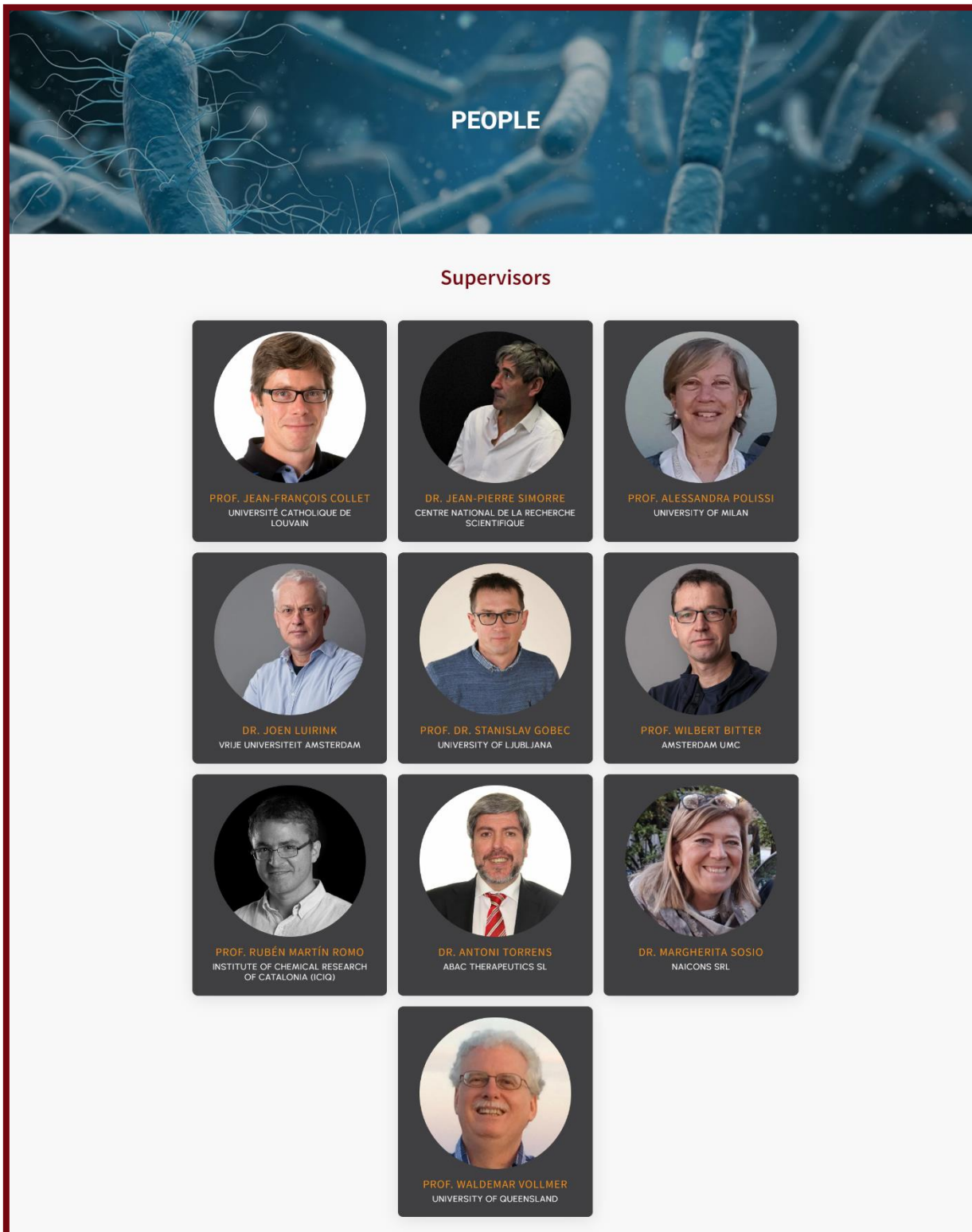
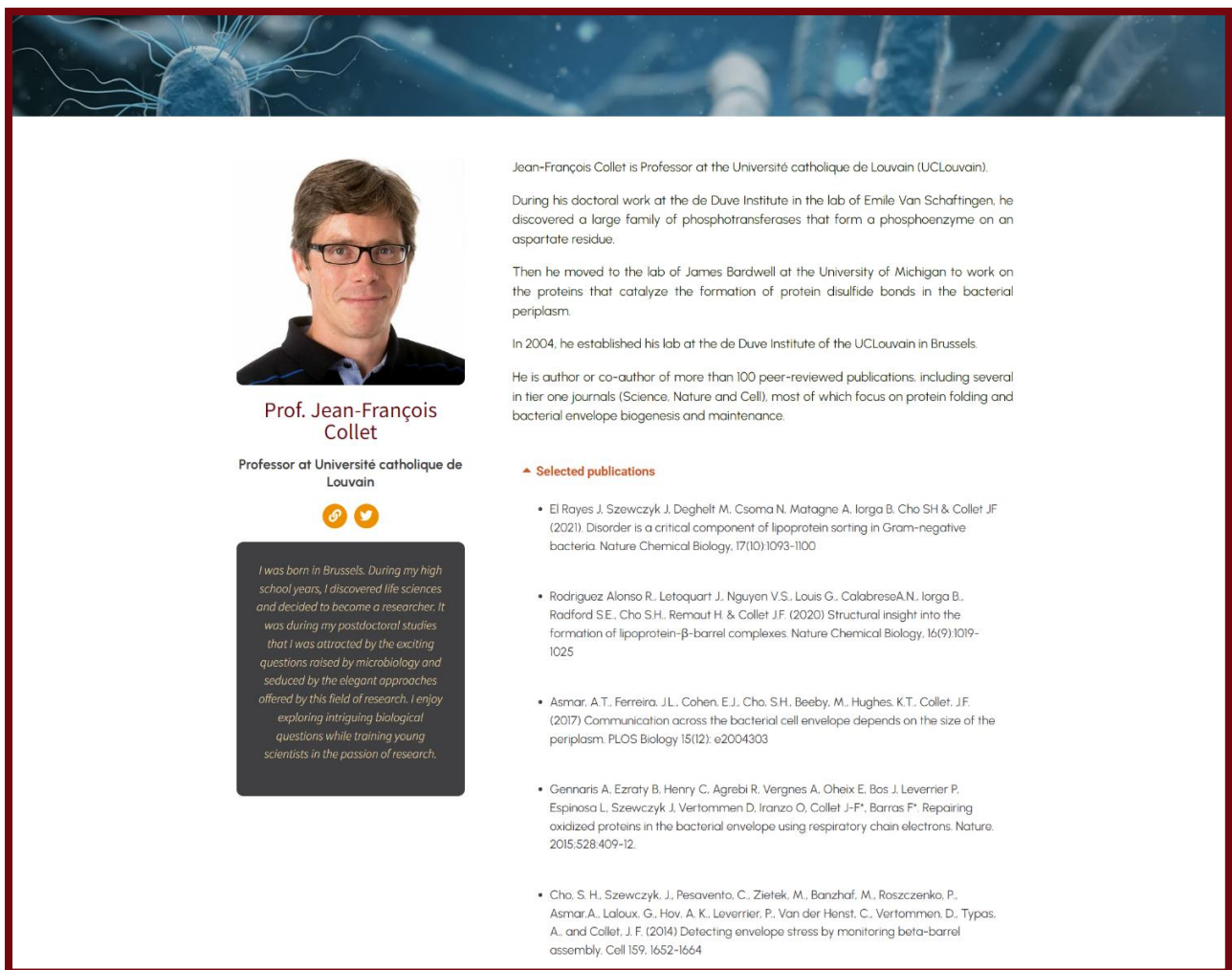


Figure 5 People page on BREAKthrough website

information for potential job applicants. Through this page, they can learn more about their potential future PhD supervisors. Clicking on their picture or name will send the visitor to the respective person's individual profile page. An example of a profile page is shown in Figure 6. The left column contains hyperlinks to the person's social media and/or Google Scholar pages and a short personal narrative about their background, personal interests, and/or how they became interested in their field of research. Their professional background is displayed in the wider right column, and by clicking on 'Selected publications', the interested visitor can open and view the list of publications.

As soon as DCs have been recruited, individual profile pages will be created for them, and they will likewise be added to the People page in a section dedicated to DCs.



Jean-François Collet is Professor at the Université catholique de Louvain (UCLouvain).

During his doctoral work at the de Duve Institute in the lab of Emile Van Schaftingen, he discovered a large family of phosphotransferases that form a phosphoenzyme on an aspartate residue.

Then he moved to the lab of James Bardwell at the University of Michigan to work on the proteins that catalyze the formation of protein disulfide bonds in the bacterial periplasm.

In 2004, he established his lab at the de Duve Institute of the UCLouvain in Brussels.

He is author or co-author of more than 100 peer-reviewed publications, including several in tier one journals (Science, Nature and Cell), most of which focus on protein folding and bacterial envelope biogenesis and maintenance.

**Prof. Jean-François Collet**  
Professor at Université catholique de Louvain

*I was born in Brussels. During my high school years, I discovered life sciences and decided to become a researcher. It was during my postdoctoral studies that I was attracted by the exciting questions raised by microbiology and seduced by the elegant approaches offered by this field of research. I enjoy exploring intriguing biological questions while training young scientists in the passion of research.*

**Selected publications**

- El Rayes J, Szweczyk J, Deghelt M, Csoma N, Matagne A, Iorga B, Cho SH & Collet JF (2021) Disorder is a critical component of lipoprotein sorting in Gram-negative bacteria. *Nature Chemical Biology*, 17(10):1093-1100
- Rodriguez Alonso R, Letoquart J, Nguyen V.S., Louis G., Calabrese A.N., Iorga B., Radford S.E., Cho S.H., Remaut H. & Collet J.F. (2020) Structural insight into the formation of lipoprotein-β-barrel complexes. *Nature Chemical Biology*, 16(9):1019-1025
- Asmar, A.T., Ferreira, J.L., Cohen, E.J., Cho, S.H., Beeby, M., Hughes, K.T., Collet, J.F. (2017) Communication across the bacterial cell envelope depends on the size of the periplasm. *PLOS Biology* 15(12): e2004303
- Gennaris A, Ezraty B, Henry C, Agrebi R, Vergnes A, Oheix E, Bos J, Leverrier P, Espinosa L, Szweczyk J, Vertommen D, Iranzo O, Collet J-F, Barras F. Repairing oxidized proteins in the bacterial envelope using respiratory chain electrons. *Nature*. 2015;528:409-12.
- Cho, S. H., Szweczyk, J., Pesavento, C., Zietek, M., Banzhaf, M., Roszczenko, P., Asmar, A., Laloux, G., Hov, A. K., Leverrier, P., Van der Henst, C., Vertommen, D., Typas, A., and Collet, J. F. (2014) Detecting envelope stress by monitoring beta-barrel assembly. *Cell* 159, 1652-1664

Figure 6 Profile page of the BREAKthrough coordinator

## 5.4 Open Positions

The [Open Positions](#) page provides all relevant information about the DC positions within BREAKthrough. An additional menu on top of the page facilitates navigation on the page (Figure 7). Using the menu, visitors can jump to the section of interest directly. The sections are 'What we offer', describing the main benefits of being a DC in an MSCA doctoral network like BREAKthrough, 'Open positions' (Figure 8), displaying the individual job ads for the 11 positions, and 'Eligibility', listing the requirements one must fulfil to be eligible as a DC.

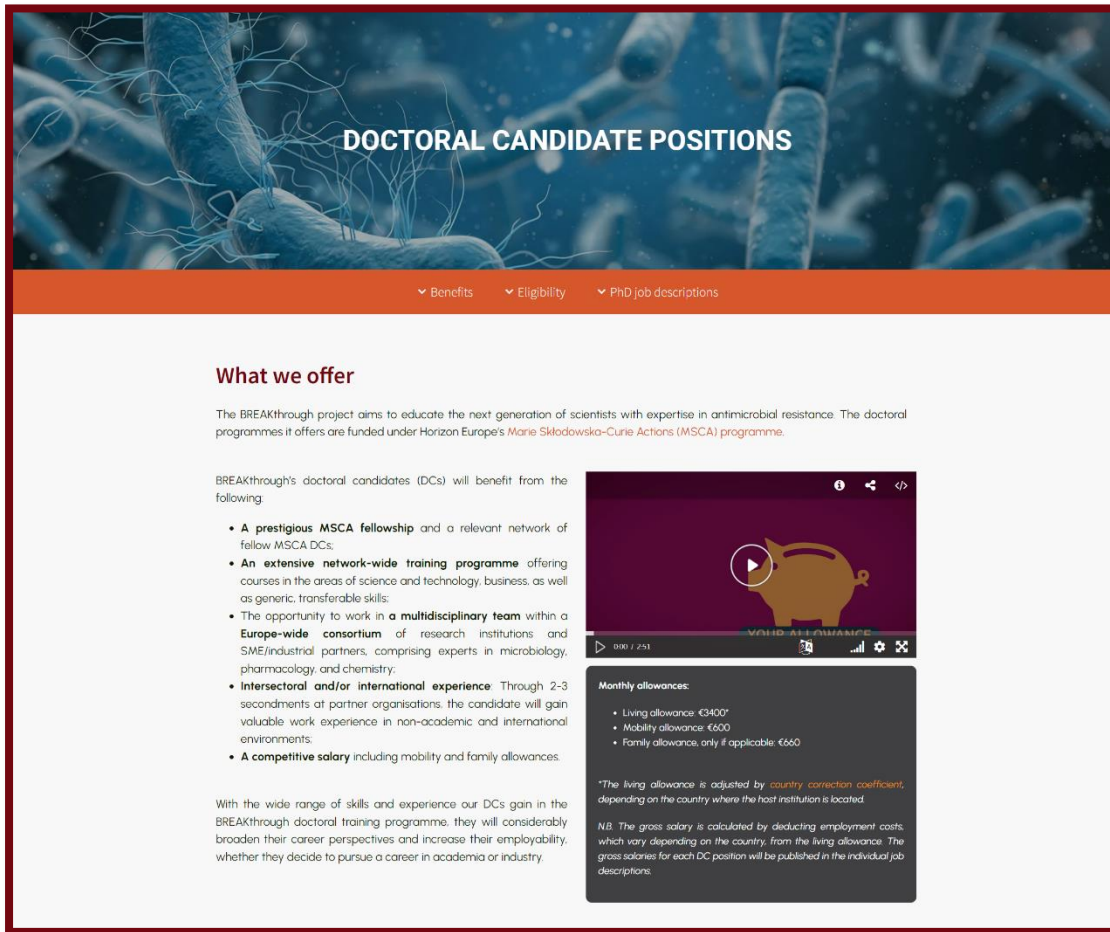


Figure 7 Upper section of the Open Positions page of the BREAKthrough website

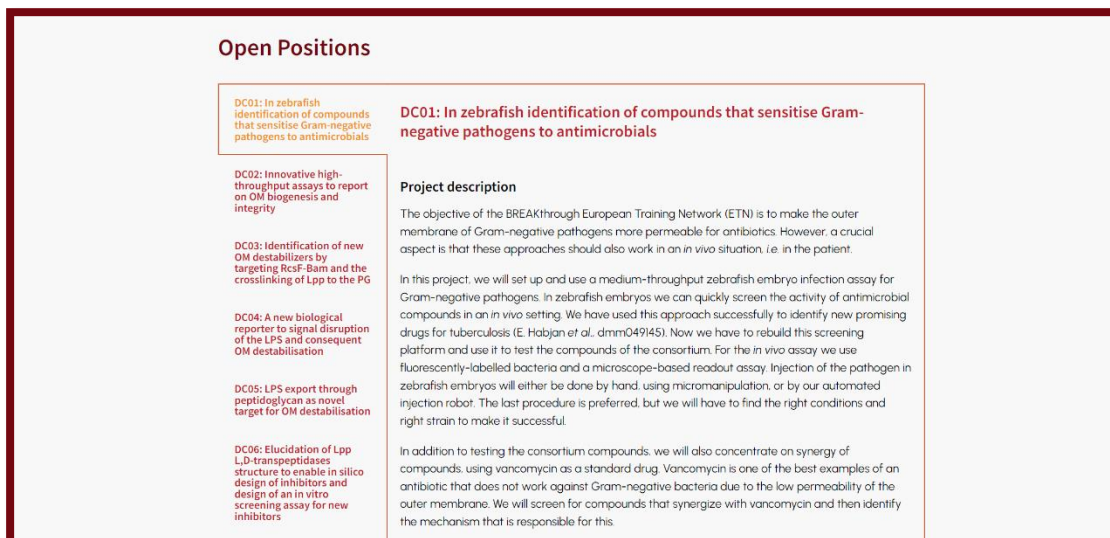


Figure 8 Job advertisements on the Open Positions page

## 5.5 Training

Since the training programme is a key component of the BREAKthrough doctoral network, a [Training](#) page was set up, providing information about the different types of training as well as the individual training modules the programme offers. Clicking on a training module expands the item, displaying a short description of the module's content and objectives.

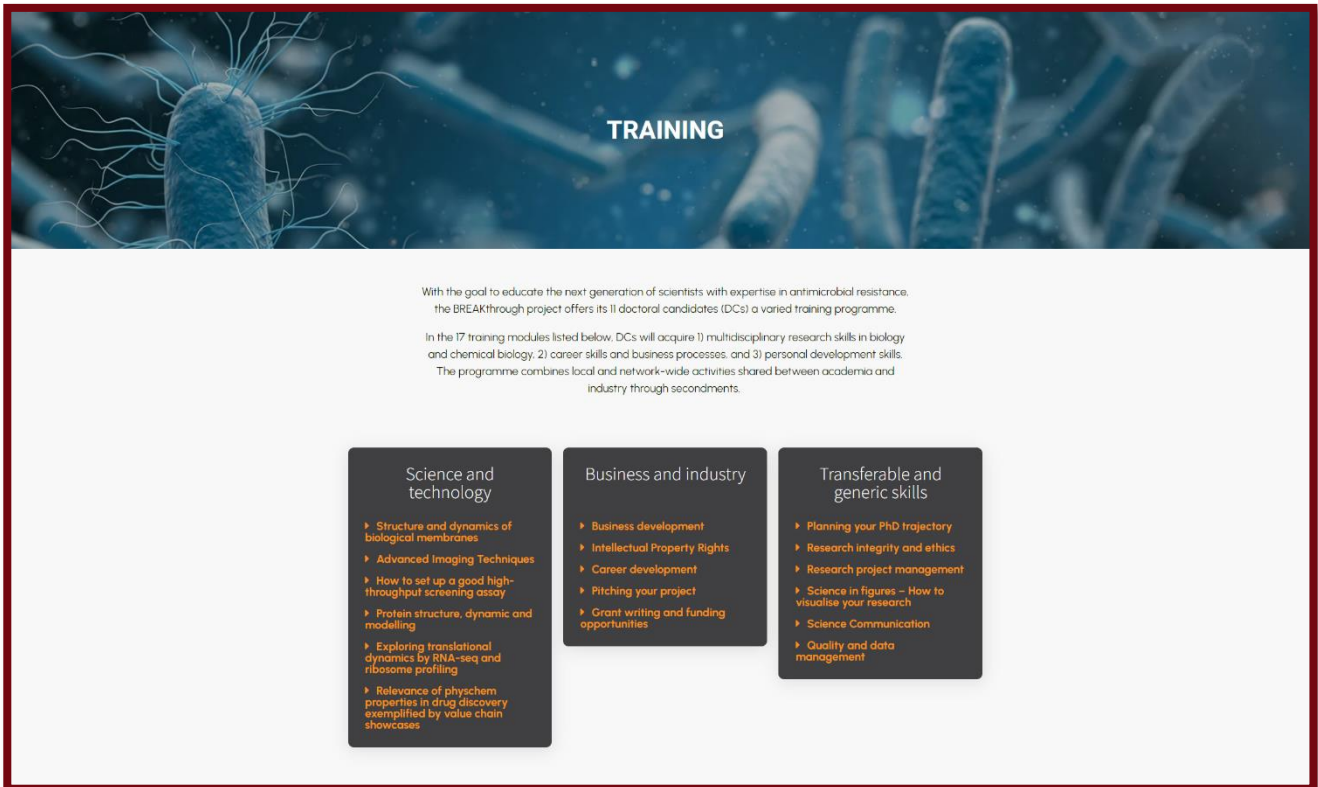


Figure 9 Training page of the BREAKthrough website

## 5.6 Network

On the [Network](#) page, website visitors can find information about the BREAKthrough consortium. It includes a map with all partners' locations and, below that, a carousel displaying all partners' logos, each linked to the respective organisation's website. More detailed information about the beneficiaries' roles within BREAKthrough will be added at a later stage.



Figure 10 Network page on the BREAKthrough website

## 5.7 News

The **News** page features short blog posts, which are published whenever there is a relevant update regarding the BREAKthrough project. This includes updates about the research, training, secondments, dissemination and outreach activities. A minimum of one blog post per month will be published. Once the number of news items starts to grow, these will be tagged based on their topic so that viewers can easily sort through them based on their interests. Each news post is linked to its own individual page, meaning that each post has an individual URL that can be shared.

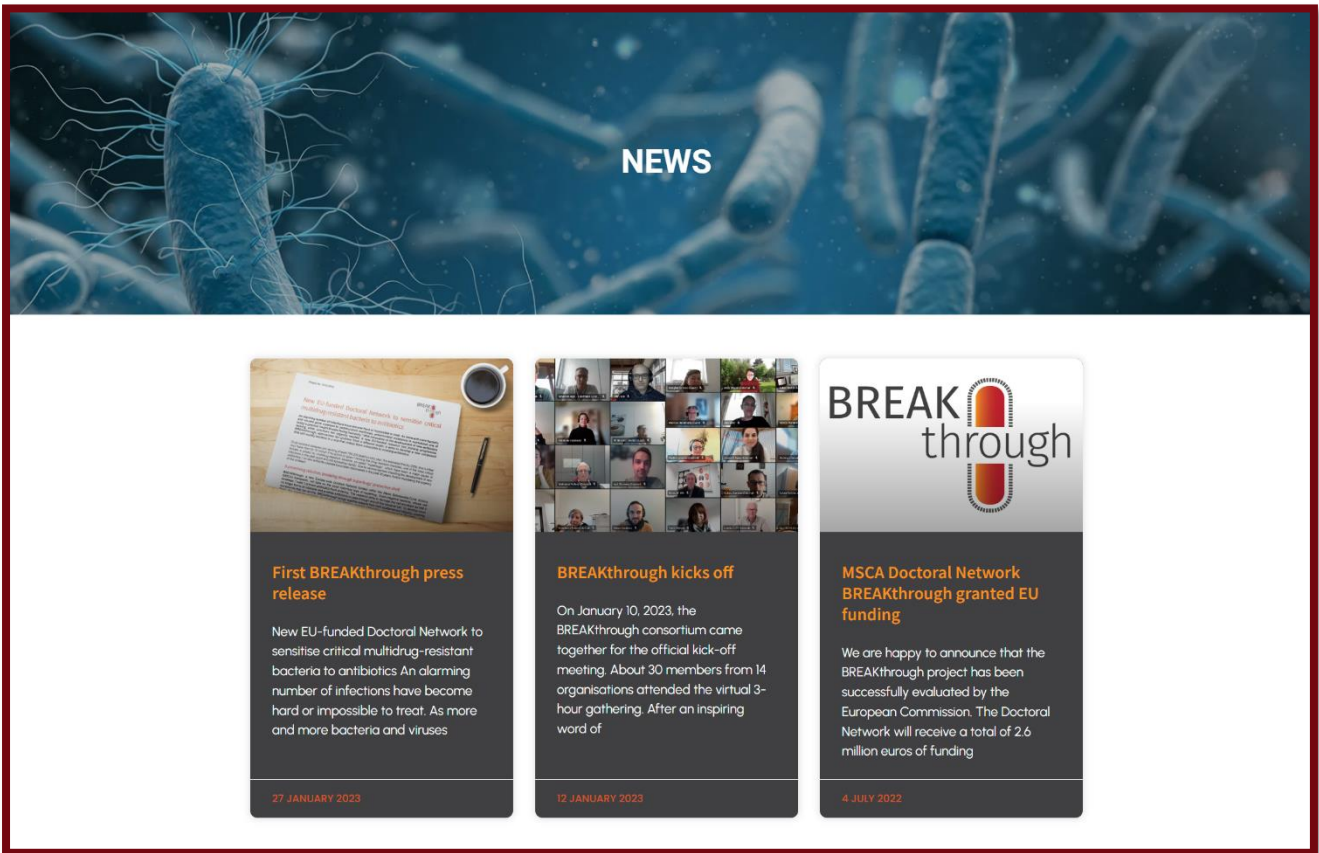


Figure 11 The latest posts on the BREAKthrough News page

## 5.8 Contact

The [Contact](#) page allows interested stakeholders to engage with project partners. Through the contact form, emails are sent to one representative of the project who distributes the enquiries to the relevant project partners.

The screenshot shows the 'CONTACT US' page of the BREAKthrough website. The background features a microscopic view of blue bacteria. The page includes a contact form with the following fields:

- Name
- Email Address
- Subject
- Message

Below the form is a red 'SEND' button. Above the form, there is a message: "If you have any questions or enquiries concerning BREAKthrough, please do not hesitate to get in touch using the contact form below. We look forward to hearing from you!"

Figure 12 Contact page of BREAKthrough website

## 5.9 Footer items

The footer area appears on every page of the BREAKthrough website (Figure 13). It includes the following items:

- Funding acknowledgement: EU emblem, funding statement, and disclaimer
- Links to Privacy Policy and Cookie Policy pages
- Links to the project’s Twitter and LinkedIn channels and the [Contact](#) page



Figure 13 The BREAKthrough website footer

To comply with the GDPR, the website includes a cookie banner with an opt-in option for the usage of cookies, which visitors are presented with on first access to the BREAKthrough website (Figure 14).

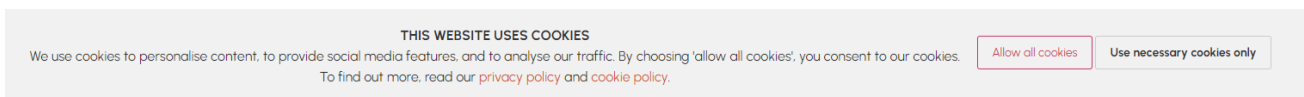


Figure 14 Cookie permission banner on first access of the BREAKthrough website

## 6 Development and evaluation

accelCH reviews and updates the website on a regular basis. At project meetings, BREAKthrough partners are reminded to share any ideas and/or suggestions they may have for the website. New results as well as project-related news and event updates will be added to the website as soon as they become available. All BREAKthrough partners can send information to accelCH to be published on the website. The project coordinator and accelCH decide on the publication of new input for the website since confidentiality issues might arise.

accelCH will measure the website’s impact with Google Analytics on a quarterly basis. The tool not only offers the possibility to track website traffic (e.g. page views, unique visitors) but can also detect the immediate impact of dissemination activities that lead to more page views. For instance, when a partner or DC presents their results at a conference, we expect to see an increase in new visitors. The outreach will be evaluated based on the quarterly reports to see if targets have been reached and, if necessary, to identify new outreach measures.

## 7 Outlook and sustainability

As the project progresses, the structure of the website will be adapted to include relevant information and new pages when needed. More specifically, in addition to the currently existing content, we plan to complement the website with the following sections and additions to existing sections:

- **Doctoral candidates:** Profiles of the DCs will be created and updated as soon as the first DCs are recruited and start in their positions. A DC section will then be added to the People page. Their profile pages are likely to evolve as they create new content such as videos presenting themselves and their work.
- **Research:** This section will be expanded with a description of the work packages. These will also be cross-linked with the future DCs' profiles to show who is working in which area.
- **Events:** We will promote the BREAKthrough Annual Meetings, training events (BREAKthrough Days), networking events for external audiences, as well as conferences and other events DCs plan to attend.
- **Outreach:** We will create a section for outreach and communication materials, to be developed by the DCs.
- **Training:** The training overview will be expanded with a timeline of training events. If open to the public, details on the agenda, speakers, and registration will also be published here.
- **Results:** Once the first project results are available, a results section will be created which includes links to conference presentations, publications, and the corresponding datasets.

The website will be complemented with embedded videos, event photos, slideshows or other multimedia features to create a visually appealing and dynamic platform for its visitors.

Towards the project's end, the website will be adapted to ensure the content included stays relevant after the project end. The focus of the website will be on the research and results achieved during the project, an overview of the training the DCs received and one or multiple points of contact for users who may have questions long after the project is finalised. These will not be to email addresses which may change after the project ends but to relevant social media channels which will remain up to date, such as LinkedIn. Further, the pages for news and upcoming events will be archived so that users do not expect further entries after the project has been finalised.