

NCCR AntiResist

A new paradigm in antibiotic research

The **National Center of Competence in Research (NCCR) AntiResist** is a Swiss research consortium funded by the Swiss National Science Foundation (SNSF), which **aims to tackle the urgent global imperative of antimicrobial resistance (AMR)**, one of the **top ten threats to global health**.

AntiResist is a **diverse panel of experts** in the fields of clinical research, infection biology, and engineering, which aims at **transforming the research and development of new antibiotics and antimicrobial strategies** by building **human tissue-based infection models** to screen and discover new antibiotics.

Based at the University of Basel's Biozentrum, **NCCR AntiResist oversees more than 30 research groups** across Switzerland and abroad, and is developing close **collaborations with the private sector** involved in antibiotic R&D.

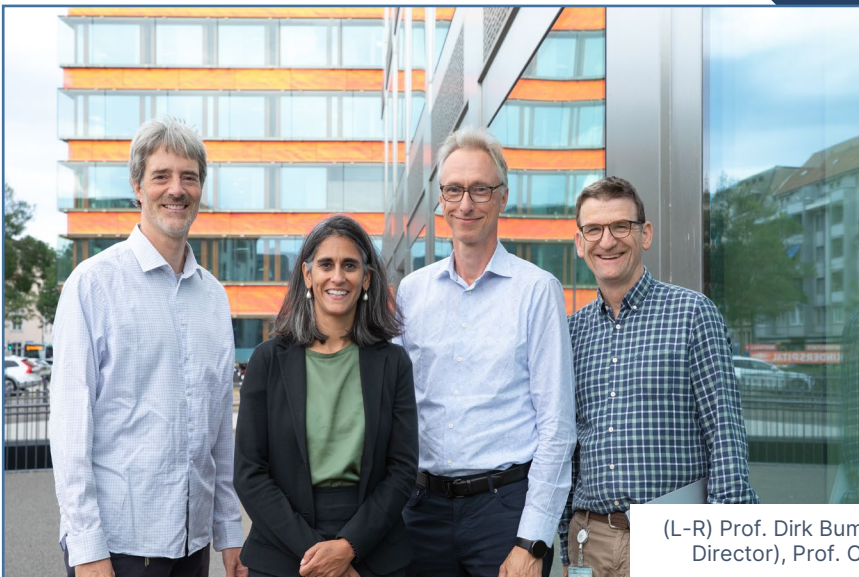
NCCR AntiResist aims to match the rapid evolutionary pace of antimicrobial resistance (AMR) with a new paradigm in antibiotic discovery targeting *in vivo* pathogen behaviour.

Antimicrobial resistance (AMR), the evolved ability of bacteria and other microbes to evade antibiotic treatment, is now a global threat to humanity, with the bacteria resistant to one or more antibiotics increasing rapidly.

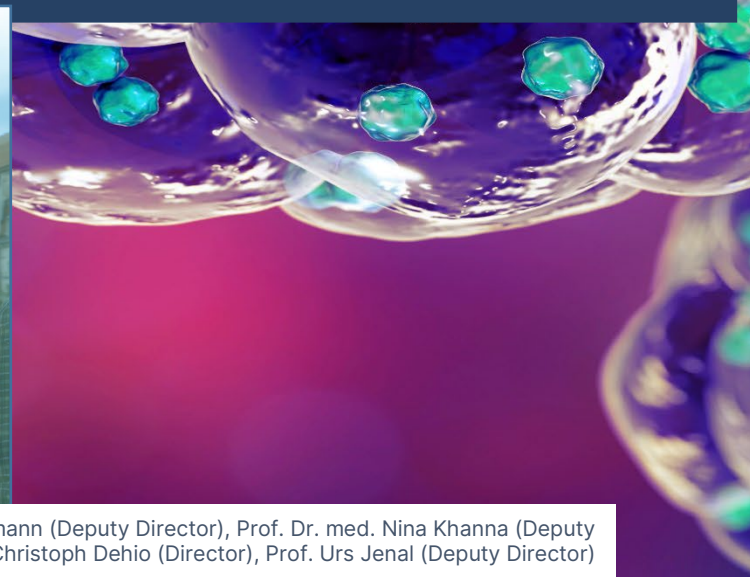
After thirty years of stagnation in the development of new antibiotics, we are faced with the very near prospect of a post-antibiotic era with common infections again becoming life-threatening.

We are rising to meet that challenge.

While new antibiotics may provide a temporary reprieve, AntiResist plays a pivotal role in addressing this innovation gap for good. With a fundamental shift towards *in vivo* antibiotic research, we are providing the standard for continual novel antibiotic discovery to keep pace with AMR evolution for generations to come.



(L-R) Prof. Dirk Bumann (Deputy Director), Prof. Dr. med. Nina Khanna (Deputy Director), Prof. Christoph Dehio (Director), Prof. Urs Jenal (Deputy Director)





The origins of NCCR AntiResist

Antimicrobial resistance (AMR) is taking a significant toll on world health. Currently, AMR is directly attributable to over **one million deaths every year**, a figure estimated to rise to **10 million by 2050**. The pipeline for new classes of antimicrobials has run dry for several decades, and urgently needs to be filled.

In the light of this situation, Professors Christoph Dehio, Urs Jenal, and Dirk Bumann, **three internationally renowned infection biologists**, decided to **change how research into antibiotic-resistant pathogens was being done**. With their work leading to **fundamental insights into host-pathogen interaction and bacterial pathogen physiology**, they were ideally positioned to transform antimicrobial research and discover new ways to address AMR.

Their vision was clear. They wanted to **target bacterial vulnerabilities** revealed *in vivo* in the human body, which have never successfully been systematically investigated by drug development programs using traditional laboratory conditions.

Their ambitious plan included uniting a **multi-disciplinary team across Switzerland** to channel expertise across **clinical and biological research and engineering**, and to translate the *in vivo* data from human patients into human tissue-based targeted solutions for **accelerating discoveries of innovative antimicrobials**, such as novel antibiotic drug classes or phage therapy.

They compiled this plan for a **new paradigm in antibiotic research** into a proposal submitted to the Swiss National Science Foundation, and in 2020, Phase 1 of the National Centre of Competence in Research AntiResist, began.

Since then, NCCR AntiResist has gone from strength to strength. With Prof. Dr. med. Nina Khanna joining the trio as Deputy Director in 2022, and now with over 30 research groups across Switzerland and abroad, the collaborative science is starting to pay off. The consortium is now in Phase 2, which will take the results from human tissue-based infection studies to build screening platforms for new antimicrobials.

Strong relationships are being forged with industry in anticipation of the results, which have the potential to transform antimicrobial research and development and lead the way in ending AMR.

We work from bedside to bench and back

Antimicrobial research has been impeded by artificial research environments which do not reflect the *in-vivo* state of the infected human body. Our approach studies the complex interactions between pathogenic microorganisms and the human host *in vivo* to guide the development of human tissue-based *in vitro* models, which identify novel bacterial vulnerabilities to target for drug development. Based on the analysis of infected tissue from patients, we develop solutions in our labs to deliver back to those most affected by AMR.

We target the microbes posing the greatest threat to human health

Escherichia coli, *Pseudomonas aeruginosa* and *Staphylococcus aureus* are among the deadliest bacterial pathogens threatening global health. Our research is guided by a deep understanding of the mechanisms by which these pathogens evade current treatments and our mission is to identify vulnerabilities in their biology and exploit them to develop novel therapies. We use the latest technologies and multi-disciplinary approaches to gain insights into the complex dynamics of host-pathogen interactions and to design targeted interventions that will be effective in the long-term.

We bridge clinical, biology, and engineering disciplines

At NCCR AntiResist, our team includes Swiss experts in microbiology, biochemistry, human biology, pharmacology, bioengineering science, and clinical medicine across multiple institutions, who work collaboratively to identify new antibiotics and antimicrobial strategies. This diversity of perspectives allows us to ensure that we are finding previously neglected possibilities and examining them from all angles. By focusing these expert collaborations on specific pathogens, we can confidently innovate to identify the targets, methods and technologies necessary to discover how to break down conventional approaches and develop a new generation of antimicrobial strategies.

We build long-lasting partnerships with the private sector

We remain open at all times to ideas, discussions, and collaborations to open the pipeline for the development of new antimicrobials. Basel houses many pharmaceutical headquarters and is therefore a prime location for making progress against AMR. We have current collaborations with Roche, Spexis, BioVersys and Basilea with plans to build more of these relationships and establish a strong foundation for drug development using our research. We invite and encourage pharmaceutical companies to talk to us about potential collaborative work.

We train future generations of infection research scientists

A crucial part of our work is to support our students and postdoctoral scientists to use the most effective research solutions for humanity's long-term gain. Our Principal Investigators teach and mentor students at Masters and PhD levels to perfect and exploit state-of-the-art techniques and methodologies. Our PhD Fellowship is designed to allow PhD students access to multi-disciplinary knowledge for their first year, and we encourage and facilitate internships in the private sector, to enable a future generation to see beyond the bench and expand our antimicrobial research into the future. Reaching beyond universities is also vital. We are developing a school outreach programme and campaigns to inform public perception of AMR, guide people towards reduced infection risk and antibiotic use, and talk about our work, to ensure that the next generations grow up informed and ready to take on AMR.

AMR is a global problem. We therefore embrace the principles of open science and collaboration, and are proud to publish our data, so that scientists around the world can see, expand and build on our work.



Collaboration

Openness

Equity

The AMR crisis will not be solved by science alone. To achieve our aim to transform antibiotic research, we recognise and strongly endorse collaboration, open science, and equity, within and outside our walls. We are committed to excellence and ethical conduct in all aspects of our work and we support inclusive, diverse, and equitable conduct of research.

Our multidisciplinary approach emphasises the importance of diverse perspectives, expertise, and backgrounds in tackling complex challenges related to antimicrobial resistance.

Collaboration is the cornerstone of our research and of our culture, and we strive to build a working environment in which that is both possible and desirable.

Practicing open science strengthens and accelerates the impact, transparency and reproducibility of scientific research. We are committed to publishing all of our data and to giving free access to our research publications.

We are committed to promoting a culture of equity and inclusion, where everyone is valued and treated with respect and dignity, and where diversity is recognised as a strength. Our research outcomes have the potential to affect every living person, and we strive to remember that in all that we do.

By embracing these values, we aim to make a positive and lasting impact on human health, and contribute to building a healthier and more equitable world.

ANTIRESIST VALUES



Prof. Dr. Christoph Dehio
Director of NCCR AntiResist

Professor of Molecular Microbiology at Biozentrum, University of Basel. From 2016-2019 he was president of the National Research Project "Antimicrobial Resistance" (NRP72), and has been Director of the National Centre of Competence in Research (NCCR) AntiResist since 2020, where he leads the *Brucella melitensis* research group working on the discovery of more efficacious treatments for Brucellosis.

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Prof. Dr. Urs Jenal
Deputy Director of NCCR AntiResist

Prof. Jenal is Professor of Molecular Microbiology at Biozentrum, University of Basel and Deputy Director of NCCR AntiResist where he leads the *Pseudomonas aeruginosa* research group. The group is developing in-vitro models that approximate the physiological state of *P. aeruginosa* in the human lung.

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Prof. Dr. Dirk Bumann
Deputy Director of NCCR AntiResist

Professor of Infection Biology at the Biozentrum, University of Basel and Deputy Director of NCCR AntiResist, where he leads the *Staphylococcus aureus* research group. The group is unravelling mechanisms enabling *S. aureus* tolerance to antibiotics, and developing patient-mimicking in-vitro models to identify more effective eradication strategies.

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Prof. Dr. med. Nina Khanna
Deputy Director of NCCR AntiResist

Prof. Dr. med. Nina Khanna is Associate Professor of Infectious Diseases at the University of Basel, Senior Physician at the Clinic for Infectious Diseases and Hospital Hygiene at the University Hospital Basel, and Deputy Director of NCCR AntiResist. She leads *Clinical Studies*, deriving guidance and benchmarks for development of patient-like in-vitro models.

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FURTHER INFORMATION

In this pack, you can find

- ⇒ Images of our leadership team
- ⇒ Image of the NCCR AntiResist members
- ⇒ Logos

For further information, please visit our website www.nccr-antiresist.ch or contact us through the channels below.

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