

Working together for better health

Innovation @ Boehringer Ingelheim



Boehringer Ingelheim Beyond Borders: Science, Collaboration, Geography

New ideas and new science. These are the key ingredients that our Research Beyond Borders (RBB) team is looking for as it seeks to discover the next generation of breakthrough medicines.

As the Company's 'radar' for the next big wave of innovation, the RBB team is tasked with exploring emerging science and technologies. They take an agnostic approach to therapeutic area and modality, which allows them to explore new and disruptive ideas and technologies across the entire research spectrum. But where are the new frontiers in science and how is the team meeting the challenge?



At the frontiers of science

RBB's current portfolio has a wide, opportunistic horizon: from heart failure to tropical infectious disease and from cystic fibrosis to Duchenne muscular dystrophy. The team is particularly interested in advancing drug discovery in areas of high unmet medical need, or where existing therapies are limited in efficacy, acceptability or applicability. Areas of specific interest include gene therapy, regenerative medicine and the role of the microbiome in human health and disease.

Collaboration is key

The notion of 'beyond borders' also extends to how the practice of science is executed. Collaboration with the external scientific community is key. This blend of external innovation and internal expertise allows us to effectively incubate the most creative scientific ideas and build a cradle for innovation. Already involved in key research projects in gene therapy for eye and lung diseases, as well as regenerative medicine, our team has established more than 30 partnerships with world-leading universities and academic research institutions in the USA, Europe and Asia.

Harnessing scientific excellence in Asia to meet global healthcare challenges

Asia is a particular focus for the RBB team, driven by the continent's significant investment in life-science innovation as well as Asia's own increasing 'beyond borders' approach to research – encouraging exciting scientific talent back to Asia and looking outwards to forge partnerships. China and Japan are ranked second and fifth respectively in the Nature Index 2017,¹ indicating a high level of quality research outputs from these two Asian scientific powerhouses. Working together with the innovation community and leading research institutions in Asia, enhances our capacity to explore cutting-edge science and meet the global healthcare challenges of the future.

In May 2017, we established a strategic alliance with Peking University. This long-term collaboration with one of the world's leading life-science research institutions focuses primarily on regenerative medicine, incorporating ground-breaking projects such as cell regeneration of the heart and pancreas. The joint research agenda also covers topics such as cancer and diabetes research as well as gene therapy.



Other collaborations are ongoing in China, based on the outstanding science across major innovation hubs, including Beijing, Shanghai, Nanjing, Hangzhou and Guangzhou.



Henri Doods, Global Head, Research Beyond Borders, Boehringer Ingelheim.

"We are excited about the opportunity to forge innovative collaborations with our partners in China and other Asian centers of excellence. Their world-class academic institutions are leading the way in key areas of science such as regenerative medicine and immune infection and we are pleased to be connecting our scientists with leading experts in these and other emerging areas of research through our Research Beyond Borders activities. We look forward to further expanding our community of innovation partners in Asia to create new journeys of discovery that will lead to the development of new and advanced medicines to help patients around the world."

New Joint Venture with Tsinghua University, China, Aims to Explore Immune Modulation Principles for the Treatment of Infectious Diseases

Collaboration establishes immune-infection as a new area of focus for Research Beyond Borders

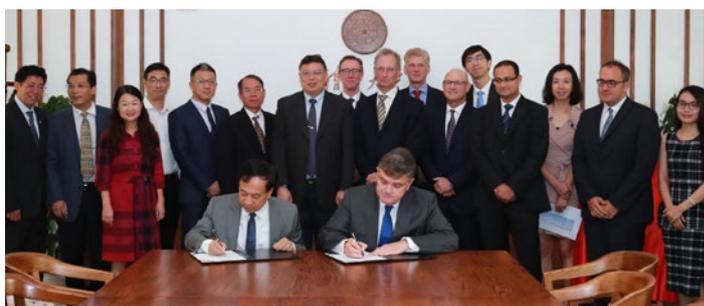
Boehringer Ingelheim has further expanded its research and development partnership footprint in Asia by forging an innovative collaboration with **Tsinghua University**, one of the region's leading centers for infectious disease research.

One of the greatest challenges facing medical research today is the global burden of infectious diseases. Although anti-microbial treatments and vaccinations have greatly reduced the impact of communicable diseases, factors such as increasing levels of antimicrobial resistance threaten the therapeutic effectiveness of currently available treatments. With no new antibiotic classes developed over the last 30 years, and many treatments failing to achieve cure, large numbers of patients are at risk due to long-term persistent infections.

Like cancer, many pathogens can inhibit or modulate their host's immune system thereby circumventing their immune defence system. Therapies which activate the immune system, which have provided a major therapeutic breakthrough in cancer, may offer similar opportunities for infectious disease treatment. This joint research and development project aims to translate these principles into an effective treatment approach for infectious diseases based on molecular similarities.

This important partnership has two main dimensions: Boehringer Ingelheim and Tsinghua University scientists will investigate

Boehringer Ingelheim immune oncology compounds in a range of model diseases. In addition, scientists from Tsinghua University will research novel targets for immune modulatory intervention and beyond in infectious diseases.



"The joint scientific hub gives our scientists the opportunity to work hand-in-hand with the outstanding scientists at Tsinghua University to discover novel treatment approaches in the fields of immunology and infectious diseases. This partnership has the potential to open new approaches for currently untreatable infectious diseases." **Dr. Clive R. Wood, Head of Discovery Research at Boehringer Ingelheim.**



For more information about **Research Beyond Borders** in China contact weiyi.zhang@boehringer-ingelheim.com

Championing Innovation and Collaboration in Japan



Supporting Grass Roots Innovation in Japan

- Workshops for life-science innovators
- Inaugural Japan Innovation Prize
- Networking Reception
- Opportunities for collaboration

Boehringer Ingelheim is excited to be extending its successful program of 'Grass Roots' initiatives to Asia with a series of workshops across the country, culminating in the award of our inaugural Japan Innovation Prize on January 24th, 2019. This award recognizes the challenge and dedication it takes to develop new science by supporting the innovation process and celebrating life-science entrepreneurs. It is also hoped that this initiative will reveal new opportunities for research collaboration with the RBB team.

Universities, start-up companies and other life-science innovators are being invited to submit proposals profiling their projects which will be assessed by an expert panel. The contributors of the most promising projects will be invited to present their ideas at one of four workshops taking place across the country. The best ideas from each of the workshops will then be invited for a poster presentation at the Innovation Prize event. The winner will be announced at a Networking Reception, following the poster presentation. Cash prizes will be awarded to the top three ideas along with the potential opportunity for collaboration.



For more information please contact amelia.viana@boehringer-ingelheim.com
<https://www.boehringer-ingelheim.jp/bi-academy>

Boehringer Ingelheim Builds Momentum on Open Innovation Initiatives

A leader in open innovation and a champion of open science approaches, Boehringer Ingelheim has long-held a progressive approach to the concept of 'sharing to learn'. This started with the Company's involvement with the Structural Genomics Consortium (SGC) where it experienced the benefits of making chemical tools freely available to the wider scientific audience and which was a catalyst for Boehringer Ingelheim to establish its own open science initiative – [opnMe.com](http://www.opnMe.com).

Early success for opnMe

Since November 2017, scientists around the world have been able to access selected Boehringer Ingelheim research assets in the form of pre-clinical molecules through the [opnMe.com](http://www.opnMe.com) program. More than 20 high-quality, well-characterized molecules, designed by Boehringer Ingelheim scientists, are offered through the program. These are made freely available to the scientific community through *Molecules to Order* (M2O) for researchers to initiate their own non-clinical investigations, or as *Molecules for Collaboration* (M4C) which offer the opportunity for bilateral research collaborations with Boehringer Ingelheim scientists.

In the first nine months:

- >160 order requests for Molecules to Order via [opnMe.com](http://www.opnMe.com)
- >750 batches shipped
- Advancing research projects in **24 countries**
- Initiated **three research collaborations** in US, UK and Japan for two Molecules for Collaboration, more in discussion
- Added **six new Molecules to Order** since launch in Nov 2017

Dr K Chris Carter, Senior Lecturer, Strathclyde Institute of Pharmacy and Biomedical Sciences, Edinburgh, was one of the first customers. *"opnMe makes collaboration with industry simple. The portal, [opnMe.com](http://www.opnMe.com), is easy to use and gives access to high-quality, pre-clinical compounds at the push of a button. The compound is then posted, free of charge, so you can start investigating it within two or three weeks."*

Breaking barriers to collaboration

Building on its long-standing relationship with the **Structural Genomics Consortium**, Boehringer Ingelheim, along with eight other pharmaceutical companies, have entered into a pre-competitive collaboration to make freely available many innovative high-quality probes. The companies have donated about 40 high-quality, small molecule chemical modulators of protein function from their research pipelines in the first wave and plan to release another 30 compounds soon.¹ All probe and control compound-associated data and recommendations for use undergo a stringent independent scientific review procedure and are presented in a database, providing both a unique resource of chemical tools and target-related knowledge. These chemical probes, many of which were not previously accessible to the broader scientific community, are now available at <http://www.sgc-ffm.uni-frankfurt.de/>.

Open access to accelerate research

The principles of open science are also a key component in RESOLUTE (Research empowerment on solute carriers) – a new 20-million-euro project supported by the Innovative Medicines Initiative. Boehringer Ingelheim is one of 13 academic and industry partners in this public-private partnership that aims to intensify worldwide research on solute carriers (SLCs) and potentially establish them as a novel target class for medicine research and development. The research output and techniques will be available openly to the scientific community. By combining an open-access approach with the highest-possible quality of research output, RESOLUTE expects to accelerate research in the field of SLCs to the global benefit of both basic academic research and applied research in biotech and pharmaceutical companies. For more information visit: <https://re-solute.eu/>



Multiple New Partnerships Maintain Momentum for Breakthrough Pipeline

2018 heralded a new wave of partnerships for Boehringer Ingelheim as we continue to strengthen our pipeline with projects from an increasing number of external innovation partners. With a promising pipeline of more than 80 clinical and pre-clinical projects, of which 65% have first-in-class and breakthrough potential, we are building for the future following our recent success of 14 regulatory approvals since 2014. With around 50% of our pipeline anchored in external innovation, we are excited that this new wave of collaborations is making an important and valued contribution to delivering the next generation of breakthrough medicines for patients.



Boehringer Ingelheim's Research Beyond Borders at the Forefront of Gene Therapy for Cystic Fibrosis

New four-way collaboration unites leaders in cystic fibrosis to develop first-in-class gene therapy

A ground-breaking partnership has been announced between Boehringer Ingelheim, the **UK Cystic Fibrosis Gene Therapy Consortium**, **Imperial Innovations** and **Oxford BioMedica** to develop the first gene therapy as long-term treatment for patients with cystic fibrosis.

Cystic fibrosis is a genetic disease, estimated to affect around 70,000 people worldwide, that causes persistent lung infections, often making it difficult for people to breathe. With no treatment for the underlying genetic defect which causes cystic fibrosis, the disease is associated with reduced life expectancy and quality of life and a high therapeutic burden. Gene therapy is the only therapeutic approach to date that can address all gene mutations associated with cystic fibrosis, thus potentially offering a universal treatment.

The collaboration will focus on a novel approach, using a replication-deficient lentiviral vector in an inhaled formulation, to introduce a healthy copy of the cystic fibrosis transmembrane conductance regulator (CFTR) gene into the cells of the lung. This method has demonstrated high gene transfer efficiency and offers the possibility of repeated administration to maintain the therapeutic effect.

Boehringer Ingelheim will collaborate with the UK Cystic Fibrosis Gene Therapy Consortium on research and development and has option and license agreements with Imperial Innovations and Oxford BioMedica on the viral vector as well as production technology. Oxford BioMedica will manufacture the viral vector and the UK Cystic Fibrosis Gene Therapy Consortium will lead the development and completion of the preclinical studies and bring together a package to support first-in-man clinical trials.

Expanding our 'Grass Roots' Innovation Footprint

Launched in 2015, our 'Grass Roots' innovation program was created to support the next generation of life-science innovators and entrepreneurs. Initially seeded in the Boston life-science 'super-cluster', the initiative is now also established in New York City and San Diego in the USA, and has expanded to include the innovation hubs of London, UK and Vienna, Austria. 2018 has seen this unique program of activities extend to Canada, Germany, France and Japan. But what are we doing to practically help young bio-entrepreneurs take their businesses and research to the next level?

Designed to address a knowledge and experience gap among young companies, our growing program of 'Grass Roots' events facilitates information sharing and establishes an open dialog through mentoring and knowledge-transfer workshop activities.

Since the program was established, more than 180 companies have participated in Office Hours and five companies have been recipients of the Innovation Prize. And in 2018, our Partnering events in London and Heidelberg have attracted around 150 companies wanting to learn more about partnering with Boehringer Ingelheim.

"What you can expect from our Partnering Day is an opportunity to really get to know the team here at Boehringer Ingelheim. Our business development team are all scientists who've spent a lot of time at the bench and understand deep science as well as business. So they bring a very comprehensive understanding of the business issue, as well as the scientific issues, and our Partnering Day is an opportunity to get access to that." Imran Nasrullah, Director, Strategic Partnering, Business Development and Licensing, Boehringer Ingelheim

"Boehringer Ingelheim is really enthusiastic about partnering with small companies early on. As a young biotech company, being able to get feedback, advice and mentorship through the Office Hours program has been incredibly valuable. Their expertise and input, from both a scientific and business perspective, have helped shape our R&D and business strategies." Rathi Srinvas, Co-Founder and Chief Scientific Officer, Novopyxis.

OFFICE HOURS:

a personalized mentoring program that provides access to expertise, a big pharma industry perspective and feedback to emerging life-science businesses

ACADEMY:

an informal networking environment providing content on current topics of interest in an interactive setting

INNOVATION PRIZE:

recognizes the challenge and dedication it takes to start a new company by supporting the innovation process and celebrating life-science entrepreneurs

PARTNERING DAYS:

an opportunity to meet our leadership teams and learn about our research and partnering interests

For the latest information on locations and dates, visit:

<https://www.boehringer-ingelheim.us/partnering/how-we-engage/supporting-grass-roots-innovators>

Programs are not necessarily available in all locations and locations are subject to change.