Universität Zürich[UZH]

# APPLICATION INTERNATIONAL SCIENCE ALUMNI UZH SCOLARSHIP

## IGEM TEAM 2022

"Research is to see what everybody else has seen, and to think what nobody else has thought"

Albert Szent-Gyorgyi

iGEM UZH

## Motivation

We are a team of 13 motivated biology, biomedicine and biochemistry students at the University of Zurich. We are passionate about science and would like to make our contribution to solve a challenge faced by our society. In particular, we want to implement the tools synthetic biology has given us on the development of a novel, specific treatment option for inflammatory bowel disease (IBD), a chronic inflammatory condition found in the gastro-intestinal tract (GIT). We firmly believe that synthetic biology has the power to provide us with revolutionary solutions. Moreover, we are committed to bring science and research closer to the general public by making it accessible and understandable. In addition, participation in this competition allows us to develop and improve our scientific and communication skills to become better researchers in the future and conduct meaningful research with the skills to communicate and address the expectations of the community on the conducted research. We are motivated to make our contribution and help IBD patients in their disease management and thus improving their quality of life. We are committed to integrate our scientific passion, endurance, and innovative approach to tackle the local and international lack of tailored treatment possibilities.

## Project overview

IBD includes conditions like Crohn's disease and Ulcerative Colitis which are pathologies of the GIT characterized by inflammation of the intestinal mucosa. Since the disease is chronic, the patients' overall quality of life is reduced because of the presence of symptoms like diarrhea, abdominal cramps, pain and bloody stools. In Switzerland, the annual incidence for developing IBD is 1:250 and the costs carried by the public health system for the treatment and surveillance of these patients are increasing. Current treatment options are systemic and lack specificity that can lead to the development of severe side effects. To act against the lacking specificity and missing tailored delivery of anti-inflammatory compounds that dampen chronic inflammation in the GIT, we want to harness the power of the gut microbiota and use it as a vector for in-vivo drug delivery. The goal is to use a probiotic bacterium as our chassis and equip it with the needed BioBricks to make it able to sense the inflammation through the locally increased nitric oxide levels. This will trigger the production and secretion of an inhibitory humanised single domain antibody (nanobody) against the proinflammatory cytokine tumour necrosis factor (TNF). The binding of the nanobody will antagonise the TNF induced aberrant proinflammatory response observed in IBD patients and ameliorate the conditions in their intestine. To avoid the spreading of the engineered bacteria, we are aiming to engineer a kill switch mechanism that will kill the bacteria upon leaving the GIT by sensing the changed environmental conditions and thus triggering their death. Finally, our goal is the stable integration of the engineered blocks into the genome of the probiotic bacteria to avoid the in-vivo introduction of plasmids carrying antibiotic resistances and the phenomenon of bacterial conjugation. By the local induction of secretion, our project will only block TNF at the site of inflammation, without affecting immune function and TNF signalling throughout the body. Furthermore, the beauty of our system is the rapid adaptability to any other target by generating an affine nanobody sequence in little time whereas the working principle remains unchanged.

**The international genetically engineered machine (iGEM) competition**

The international genetically engineered machine competition (iGEM) is a contest in which student-led teams tackle current issues by engineering novel biological systems in the realm of synthetic biology. 2022 will mark the University of Zurich's fourth consecutive year of participation in the iGEM competition, with previous teams finding success in their projects. The aim of the 2022 team is to continue the trend of inspirational, innovative and effective projects that have been brought forth by the University of Zurich teams since participation began in 2019. While research and experimental data are an important composite of a successful iGEM project, judging goes beyond the lab bench and includes criteria such as collaboration with other teams, human practices, education and outreach related to synthetic biology. We as a team are committed to integrate all the different facets in our project to have an impact on the local community as well as to achieve meaningful research results. Thanks to the iGEM competition, we are provided with a framework that allows us to make our vision become reality.

**Overview of the iGEM year – our timeline**

For new iGEM teams, the competition starts in February. The first phase of the competition includes the team registration and project design and ends with the submission deadline on April 29th, 2022. The second phase is shaped by the laboratory work that takes place during the summer months (July-September) and additionally includes dry lab work such as modeling and data analysis, building of a team wiki page as well as education and outreach to the community. The last phase culminates with the Giant Jamboree at the end of October. This event is a huge international get together where the project is presented to a judging committee and teams have the chance to interact with each other. In the previous years this event has taken place either in Boston, USA or due to Covid-19, online. This year it is set out to take place in Paris, France.

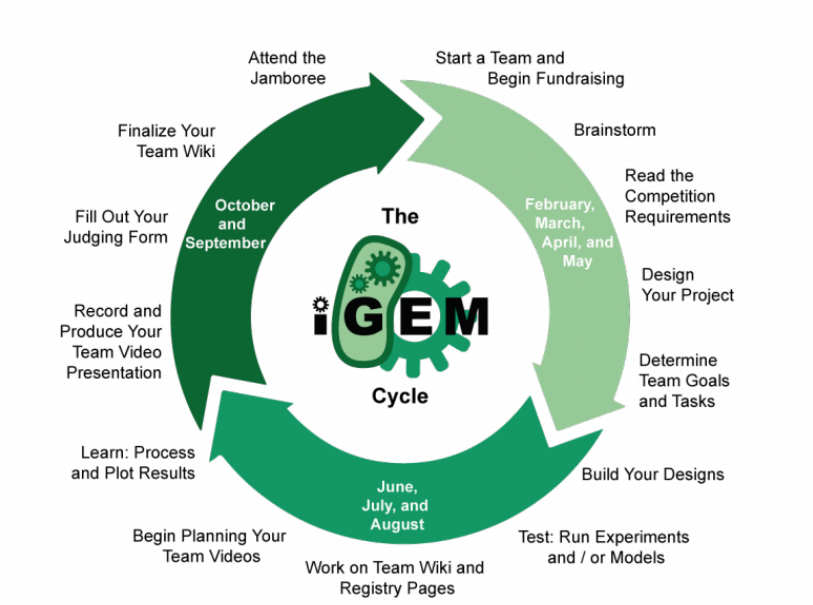


**Figure 1:** Overview over the iGEM year

**Budget plan and current sponsors**

| | |
|---|---|
| **Participation** | |
| Registration Fee | 5'150 CHF (5'500 USD) |
| Giant Jamboree | 8'900 CHF (9'500 USD) |
| Travel to Paris | 1'040 CHF (80 CHF per person) |
| Food & Accommodation | 6'240 CHF |
| **Lab Work** | |
| Labware | 5'500 CHF |
| Chemicals | 2'000 CHF |
| Sequencing | 2'000 CHF |
| Enzymes | 2'000 CHF |
| Kits & Laboratory Techniques | 4'000 CHF |
| **Other** | |
| Merchandise for Team Identity | 2'000 CHF |
| European Meetup | 500 CHF |
| Minor Expenses | 1'000 CHF |
| **Total** | **40'330 CHF** |

**Current confirmed sponsors:**

- Science Faculty of the University of Zurich (6'200 CHF)
- Medical Faculty of the University of Zurich (1'000 CHF)
- President's Services of the University of Zurich (2'500 CHF)
- Pierre Fabre Pharma AG (1'200 CHF)
- Microsynth AG (700 CHF)
- Swiss Academy of Sciences (1'500 CHF)
- SnapGene – Users licenses valid through November

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Zurich, 9 May 2022

**Support letter for UZH iGEM team 2022**

I write this letter in strong support of the UZH iGEM team 2022, which will represent the University of Zurich at this year's iGEM competition. iGEM has emerged as an important international competition in Synthetic Biology, providing undergraduate students a unique chance to plan and execute interdisciplinary research projects and to meet up with like-minded colleagues from across the world. Although iGEM does not have a long tradition at UZH, the previous teams were highly successful and have secured several awards and prices.

This year's team consists of 13 highly motivated students under the lead of Mrs Martina Curcio. The team aims to engineer a non-pathogenic Escherichia coli strain to secrete small antibodies – called nanobodies – in the gut of patients suffering from gut inflammation. Two PhD students of my lab will support the team in the aspects of nanobody secretion, because my lab happens to work extensively on nanobodies and bacterial transport (and secretion) systems.

The iGEM team deserves to be financially supported for three main reasons:

i) I find it fantastic that students dedicate hundreds of hours of their free-time to come together and plan their own project. The UZH needs dedicated people like them.

ii) The students learn highly important skills, such as collaboration, scientific discussions, reaching out to experts, explaining science in simple words for the general public, presenting a project and its results and finally planning and executing experiments in the lab.

iii) The iGEM team represents the UZH at a prestigious international competition: it is very important for UZH's reputation that our iGEM team is successful and hopefully wins some prices.

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**Institute of Medical Microbiology**

I was recently in contact with Martina Curcio and additional members of the team, who will perform experiments in our lab. I was deeply impressed by the very high level of motivation of the students and how well the entire project is managed and taken care of.

Therefore, I wholeheartedly support this year's UZH iGEM team and wish them best of luck (and most importantly a lot of fun!) for the competition.

Best regards,

University of Zurich
Institute of Medical Microbiology

Prof. Dr. Markus Seeger

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May 17, 2022

To Whom It May Concern,

We are pleased to confirm the registration of Team UZurich, consisting of students and faculty from University of Zurich in Zurich, Switzerland, in the International Genetically Engineered Machine (iGEM) competition 2022 season.

The iGEM competition is an annually organized competition for collegiate students in Synthetic Biology. The competition is organized by iGEM Headquarters in Cambridge, Massachusetts, USA (http://igem.org). This year, approximately 400 student teams from around the world will present their work performed during the summer in their University. The accomplishments of these student teams are impressive and may lead to important advances in medicine, energy, and the environment. An international scientific jury will review the work of all these teams at the Grand Jamboree.

All iGEM competitors are invited to attend the Grand Jamboree. The Grand Jamboree will take place from October 26 to October 28, 2022 at Paris Expo – Porte de Versailles in Paris, France. For more information about this event, please visit igem.org and 2022.igem.org.

Teams are responsible for the payment of the team registration fees, conference reservation fees, travel, and accommodations for participation in the Jamboree event. iGEM participants do not receive any salary or other compensation from iGEM Headquarters or the Jamboree organizers.

Please do not hesitate to contact me if there are any questions.

Sincerely,

Meagan Lizarazo
Executive Vice President,
iGEM Foundation