

ANNUAL REVIEW 2020

The corona pandemic did not spare the HIRI; it affected all areas of the institute's daily life and suddenly presented us with innumerable new challenges. However, thanks to the rapid action of our scientists, we have been able to contribute to a better understanding of the infection process of SARS-CoV-2 within a very short time span. At the HIRI, we all pulled together to counter the pandemic and to establish new routines: A number of "RNA & Infection" PhD students joined us this year, the new HIRI building is underway and scientific operations were digitized as much as possible.

DEALING WITH THE PANDEMIC

No area at the HIRI was spared from the novel corona virus. During the first wave of infections in spring, it was unclear which areas of everyday life posed risk, especially since good nose and mouth covering masks were in short supply. Many employees worked from home for weeks, whilst scientists worked in the laboratories in shifts. The relaxation of restrictions in the summer months created an illusion of normality; however, the second wave of infections has been hard-hitting and has demanded an even greater commitment from all employees.



As the year winds to an end, the world has learnt the good news that several vaccines will soon be approved, including two based on mRNA. This new hope underlines the HIRI's mission to use RNA to combat infectious diseases.

PERSONNEL



Sushila Pisano joined the science administration team in autumn 2020. © HIRI / HZI

This year the HIRI has recruited a number of scientific, technical and administrative staff. Since September, Sushila Pisano (University of Aberdeen, UK) joined the scientific coordinators working in public relations.

By the end of the year, the Institute has grown to 80 employees from 18 different countries.

NEW BUILDING

The new HIRI building became official: In March 2020, the building site was entered into the land register of the city of Würzburg. In September, the new building was included in Bavaria's high-tech agenda, considerably increasing funds as a result. The demolition of the existing building and the groundbreaking ceremony will take place in 2021.



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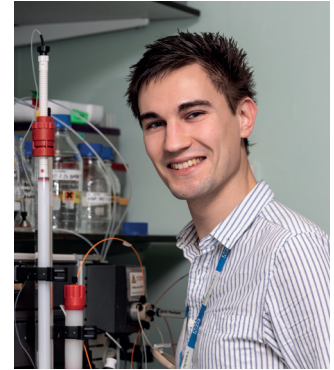
SEMINARS

Shortly before the pandemic hit in spring, Gunter Meister (University of Regensburg, Germany) and David Corey (University of Texas Southwestern Medical Center, USA) visited the HIRI to talk about their research in the RNA Seminar series. In September, Chris Hill (University of Cambridge, UK) visited the institute to share an insight into his work on the structural biology of viruses.

In order to promote scientific exchange even during the pandemic, the HIRI also participated in the RNA Collaborative Seminar Series: a joint project initiated by the RNA Society that organizes and broadcasts regular online seminars from international scientists in the field of RNA research.



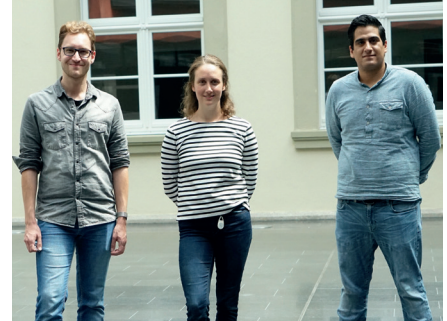
Meanwhile, the HIRI's RNA Salon entered its second phase as Neva Caliskan received confirmation from the RNA Society that the institute's RNA Seminar funding will be extended. Congratulations!



Chris Hill (Queen's College Cambridge, UK) visited the institute and presented the latest results of his work in September. © Brian Callingham, Queen's College Cambridge

PROMOTION OF YOUNG SCIENTISTS

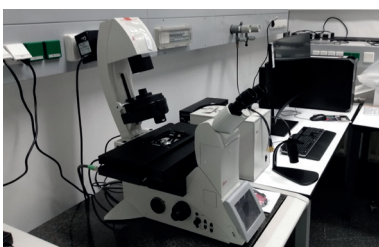
During the spring of 2020, the HIRI graduate program welcomed three newcomers, selected last autumn, in Würzburg: Elise Bornet (École Supérieure de Biotechnologie de Strasbourg, France), Marco Olguín (Universidad Nacional Autónoma de México) and Sebastian Zielinski (Technische Universität München, Germany) began their doctoral projects in the research group of their choice after completing three laboratory rotations. The call for applications in spring 2020 resulted in the addition of two more international candidates: Adini Arifa (Wageningen University, Netherlands) and Xiangyi Wang (Imperial College London, UK) who joined the HIRI at the end of the year. In the autumn call, Taís Franco de Carvalho (Universidade Federal do Paraná, Brazil) and Hoda Kooshapur (Ludwig-Maximilians-Universität Munich, Germany) were selected for the HIRI graduate program. They will start next February.



The three new HIRI graduate students in early summer 2020. Image: Hilde Merkert, © HIRI / HZI

In parallel, the HIRI Research Career Development Fellowships were created to support exceptional postdoctoral candidates in the structured development of their individual research identity. This new funding scheme is particularly aimed at supporting young female scientists in a transitional phase such as starting a family, thus enabling them to pursue a career as research group leaders.

INFRASTRUCTURE



HIRI can call the Leica Thunder 3D microscope its own. Image: Hilde Merkert, © HIRI / HZI

In 2020, the HIRI added new state-of-the-art equipment to its inventory. At the beginning of the year, for example, the Leica Thunder microscope was purchased. This imaging system enables the acquisition of sharp images of three-dimensional specimens – in real time. In order to get started with SARS-CoV-2 research, the S3 laboratory was substantially upgraded in April. The HIRI also acquired a NovoCyte Quanteon (Agilent Technologies), a highly advanced and precise flow cytometer. A new anaerobic workbench increased the capacity for working with organisms under oxygen-deficient or oxygen-free conditions.



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In November, the cell dispenser b.sight from Cytena also arrived at the HIRI labs. It is capable of separating individual bacterial cells and is therefore unique on the market. A further special feature, high-resolution photo documentation, can be used to subsequently verify whether the cells have indeed been separated. The I-DOT combined with the b.sight dispenser doses liquids contact-free in the nanoliter range. It is used to further process the cells separated by the b.sight. Thus, the HIRI further optimized its workflow in the field of single-cell analysis.

At the end of the year, the 10x Chromium Controller complemented the equipment in the S3 laboratory. With its help, single-cell analysis has made its way to biosafety level 3 at the HIRI.

RESEARCH FUNDING

Neva Caliskan received a Starting Grant from the European Research Council (ERC) in September. The ERC Starting Grants are specifically designed to enable young scientists to advance their careers as top independent researchers. The prestigious grant is endowed with 1.5 million euros over a period of five years. With her project “T-FRAME”, she is investigating the question of how so-called frame shifting is regulated in eukaryotic cells during viral infections.



HIRI Junior Professor Neva Caliskan received an ERC Starting Grant. Image: Hilde Merkert, © HIRI / HZI

HIRI group leader Chase Beisel was doubly successful this year: His idea to use the CRISPR/Cas genetic scissors for a groundbreaking diagnostic platform has earned him initial funding from the BMBF's GO-Bio program as well as the Bavarian Medical Valley Award. The funding is enabling him to perform proof of concept work in the laboratory. In addition, market and patent analyses were commissioned to actively promote the first HIRI spin-off.

Furthermore, the joint project Rbiotics of Lars Barquist and Jörg Vogel, together with Franziska Faber (Institute for Molecular Infection Biology, JMU), to develop new strategies against multi-resistant pathogens using digital networking is underway. This project is being funded with a total of 1.4 million euros within the Bavarian research network bayresq.net, of the Bavarian State Ministry of Science and the Arts (STMWK).

AWARDS AND POSITIONS



EMBO Young Investigator and HIRI group leader Antoine-Emmanuel Saliba. Image: Mario Schmitt, ©HIRI / HZI

Emmanuel Saliba was selected as EMBO Young Investigator in December, making him one of 30 to be included in the Excellence Program this year. EMBO Young Investigators receive financial support of 45,000 euros over four years. In addition, as a member of the program, he has access to a wide range of mentoring and networking schemes to support him in this phase of his career.



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CONFERENCES

Emmanuel Saliba organized the virtual workshop “Temporal Single Cell Analysis” on September 15th as part of the Single Cell Omics Germany (SCOG) initiative.

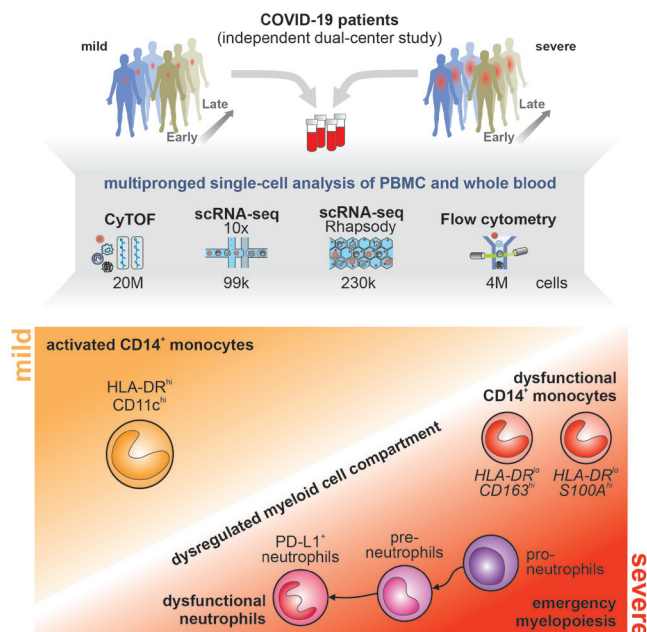
The joint conference of the French, German, Swedish and British academies of science “Microbiology 2020”, initially planned for 2020, was postponed until next year due to the pandemic, as are all other events planned for this year at the HIRI. Most symposia were cancelled or converted into digital formats. Nevertheless, HIRI group leaders presented their work and the institute at a total of 13 events, 11 of them as invited speakers.



PUBLICATIONS

The HIRI published 42 publications in 2020, 17 in high-impact journals.

In a joint publication in *Nature Microbiology*, Jörg Vogel and Emmanuel Saliba provided novel insights into the RNA world of individual bacteria. The newly developed method of bacterial single cell RNA-seq can measure gene activity in individual bacterial cells and thus contribute to our understanding of the development of antibiotic resistance.



Graphical abstract of the publication in *Cell*. Reprinted from: *Cell* 182 (6): 1419–1440, Schulte-Schrepping J, ..., Saliba AE, Sander LE, *Severe COVID-19 is marked by a dysregulated myeloid cell compartment*, © 2020 Elsevier Inc., with permission from Elsevier.

The Saliba lab also played a major role in a nationwide study on the course of disease in COVID-19 patients, which was published in *Cell* in September. With the help of single-cell RNA-seq and other techniques, it was discovered that neutrophils can contribute to a severe course of COVID-19.

In the July issue of *Nature Communications*, Lars Barquist, Alexander Westermann and Jörg Vogel delivered new insights into the biology and host-pathogen interactions of *Orientia tsutsugamushi*, the causative agent of Japanese river fever. They achieved this by combining dual RNA-seq, comparative genomics and proteomics with machine learning. This approach offers the possibility to characterize comprehensively those pathogens that had remained largely unstudied in the past.

Furthermore, Chase Beisel and his team published their work in *Science Advances*, which describes the detection of new PAM sequences that can be used to improve the precision of CRISPR genome editing technologies.



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OUTREACH & EVENTS



Lively crowd at the opening of *HIRI meets Alkymi Materialbar*. Image: Hilde Merkert, © HIRI / HZI

On February 18th, we organized the *HIRI meets Alkymi Materialbar* exhibition. The HIRI supported the information design students Anastasia Meid and Magdalena Skala (*Alkymi Materialbar*) of the University of Applied Sciences Würzburg Schweinfurt in the realization of their biodesign project. For this project, the designers aimed to combine environmentally friendly textile dyeing with a possible medical application.

This year we were delighted to welcome a series of guests from the world of politics, despite the pandemic. In February, Dr Robert Geiger and Dr Sabine Jarothe from the Bavarian State Ministry of Economic Affairs visited us. On April 29th, we hosted Bernd Sibler, the Bavarian State Minister of Science and Art (STMWK), to discuss the effects of the corona pandemic and how to best mitigate the impact of infectious diseases in the future. In summer, Dorothee

Bär, Minister of State for Digital Affairs at the Federal Chancellery, made a short visit to inquire about the progress of the new HIRI building. With Christian Schuchardt, Lord Mayor of Würzburg, and Barbara Stamm, former President of the Bavarian Parliament, we hosted two important HIRI sponsors in September. Last but not least, in November we had a rendezvous with the newly elected President of the Julius-Maximilians-Universität of Würzburg, Prof. Paul Pauli.



High visit at HIRI. Christian Schuchardt (OB Würzburg), Alice Hohn (HIRI head of administration), Barbara Stamm (former president of the Bavarian parliament) and Jörg Vogel (HIRI director). Image: Tim Schnyder, © HIRI / HZI



Dorothee Bär (center), Minister of State for Digital Affairs in the Federal Chancellery, also makes a short visit to the HIRI. Pictured here together with Jörg Vogel (left) and Alice Hohn (right). Image: Tim Schnyder, © HIRI / HZI

With the groundbreaking for the new HIRI building and the RNA-based SARS-CoV-2 vaccine approaching, we are looking forward to a promising 2021!