



The exciting science of genome editing was the topic of the inaugural Bayer Foundation-Bayer Science Fellows Boundary-Breaking Science Symposium in Monheim am Rhein, Germany, on 26th October 2022. Leading academic and industry speakers from across the globe presented stimulating scientific lectures to an audience of external guests and Bayer scientists. In keeping with our vision of **“Health for All, Hunger for None”**, the topics spanned human therapeutics and agriculture.

The symposium was opened by **Dr. Kimberley Sampson**, head of the Bayer Science Fellow Program, who introduced Bayer Foundation and the Bayer Science Fellows program prior to the scientific content.

Scientific Summary

The opening presentation was by Bayer Science Fellow **Dr. Florian Richter** from Bayer’s Pharmaceutical division, who gave an excellent overview of the basic science of CRISPR gene editing and how Bayer is applying the technology in its Pharmaceutical and Crop Science divisions.

YouTube Recording: [Introduction to gene editing and applications in human health and crop science - Florian Richter](#)

The program then shifted to a series of presentations by external academic and scientific speakers, starting with a focus on human therapeutics.

Dr. Lucas Harrington from Mammoth Biosciences in California, **“*Harnessing the diversity of CRISPR for therapeutic genome editing and diagnostics*”**, focused on the discovery and development of efficient, “ultra-compact” Cas nucleases that can be used for human therapeutic applications that use viral delivery. Dr. Harrington then described innovative ways in which CRISPR systems can be used as highly sensitive detection method for diseases, including COVID-19.

YouTube Recording: [Harnessing the diversity of CRISPR for therapeutic genome editing and diagnostics - Lucas Harrington](#)



Dr. Paula Rio at CIBERER in Madrid Spain, “*Gene Therapy in Fanconi Anemia: Looking for efficient and safe gene editing approaches*”, highlighted the application of editing technologies for the Fanconi Anemia disease in humans. Dr. Rio described several novel approaches to obtain the precision and safety needed, including careful positioning of small deletions as well as the use of recently developed base editors and Prime Editors that don’t rely on the production of DNA double-strand breaks.

YouTube Recording: [Gene therapy in Fanconi anemia: Looking for efficient and safe gene editing approaches - Paula Rio](#)

The next part of the program focused on the application of genome editing in agriculture.

Dr. Dirk Inze from the VIB-Ghent in Belgium, “*Crop improvement through incorporation of multiplex genome editing in breeding programs*”, highlighted groundbreaking examples of the use of genome editing technology in maize as a breeding approach, which he called BREEDIT. This approach leverages novel editing tools for multiplexed edits, and then creating combinations of up to forty-eight independent edits, resulting in plants with modified quantitative traits, such as leaf size. It was an exciting glimpse into how gene editing technology can be a tool for plant breeders in the future.

YouTube Recording: [Crop improvement through incorporation of multiplex genome editing in breeding programs - Dirk Inze](#)

Dr. Cathie Martin from the John Innes Center in England with a talk called “*Editing tomato to increase levels of Vitamin D*”. encouraged the audience to think of food as healthcare and described two examples of using genetic engineering to improve the health benefits of tomato. First, she highlighted a genetically engineered tomato with increased levels of anthocyanin and demonstrated the health benefits for the reduction of cancer risk in mice. The second part of her talk focused on gene edited tomato plants that produce elevated levels of Vitamin D.

YouTube Recording: [Editing tomato to increase levels of Vitamin D - Cathie Martin](#)

The program shifted to presentations on the genome editing tools and methods themselves, including the topic of genome *writing*.

Dr. Jacob Corn from ETH-Zurich Switzerland presented a talk called “*Better genome editing by listening to the cells*”. He showed data to demonstrate that different cell types and tissue types may have different editing outcomes, due to the presence of different repair pathways and different cell cycle states, so tissue and cell type must be considered when designing editing experiments. Next, he described a novel editing method called recursive editing, which is designed to allow several attempts to edit a given target, increasing the overall efficiency. Finally, Dr. Corn presented novel uses of adenosine base editors in a collaboration with Dr. Paula Rio.

YouTube Recording: [Better genome editing by listening to the cells - Jacob Corn](#)

Dr. Patrick Cai from Manchester University, England, gave a talk titled “*Synthetic Genomics: From Genetic Parts to Synthetic Genomes*”, which shifted the topic from genome editing to genome writing and synthetic biology. Dr. Cai described his team’s work on the Sc2.0 project, an ambitious project to ‘write’ the entire yeast genome from oligonucleotides, with carefully chosen design principles, most of which are only feasible if a writing approach is taken. He highlighted the processes that were used to synthesize sequences *de novo* and then assemble them into higher orders of assembly, ultimately creating entire chromosomes. Design features such as lox sites between every gene allow experimenters unprecedented screens of genome-wide rearrangements, enabling induced population evolution of novel properties. tRNA genes were repositioned, and one of three stop codons was changed genome wide to free up the sequence for future purposes. Finally, Dr. Cai described the development of innovative automation for liquid handling of volumes as low as 2.5 nanoliters.

YouTube Recording: [Synthetic Genomics: From genetic parts to synthetic genomes - Patrick Cai](#)

Last, but not least, **Prof. Anne Muigai**, from the National Defense University - Kenya, concluded the symposium with a talk on “*Bioethical Considerations of Human Genome Editing*”. She presented a synopsis of key bioethical issues that need to be considered in the context of human genome editing: e.g., human safety, informed consent, cost of treatments and the question of access, in particular, in low- and middle-income countries. Next, she outlined thoughts on mitigation measures on especially controversial topics such as human germline editing, enhancement of human traits, and health tourism. Finally, Prof. Muigai stated the importance for scientists to engage with the public, the role of governance systems and respective regulations to define international and regional standards, as well as the need for whistleblowing mechanisms.

YouTube Recording: [Bioethical considerations of gene editing & gene writing - Anne Muigai](#)

In addition to the outstanding series of scientific presentations, the symposium also included an announcement regarding the opening of a [new Bayer LifeHub in Monheim am Rhein](#). **Axel Trautwein**, the head of Bayer Crop Science Regulatory Science, and **Raphael Dumain**, from Bayer’s Open Innovation and Strategic Partnerships team, told the symposium attendees about the LifeHub concept and how Bayer uses LifeHub to connect with innovators in regions all over the world.

The symposium was organized by the Bayer Science Fellows in collaboration with Bayer Foundation. Additional support came through the Bayer Life Sciences Collaboration program, and the Bayer LifeHub.

Summary by Dr. Larry Gilbertson with support from Dr. Laura Hoffmeister, Bayer