

BRAIN Biotech AG

Pioneering Bio-based Products

Investor Call

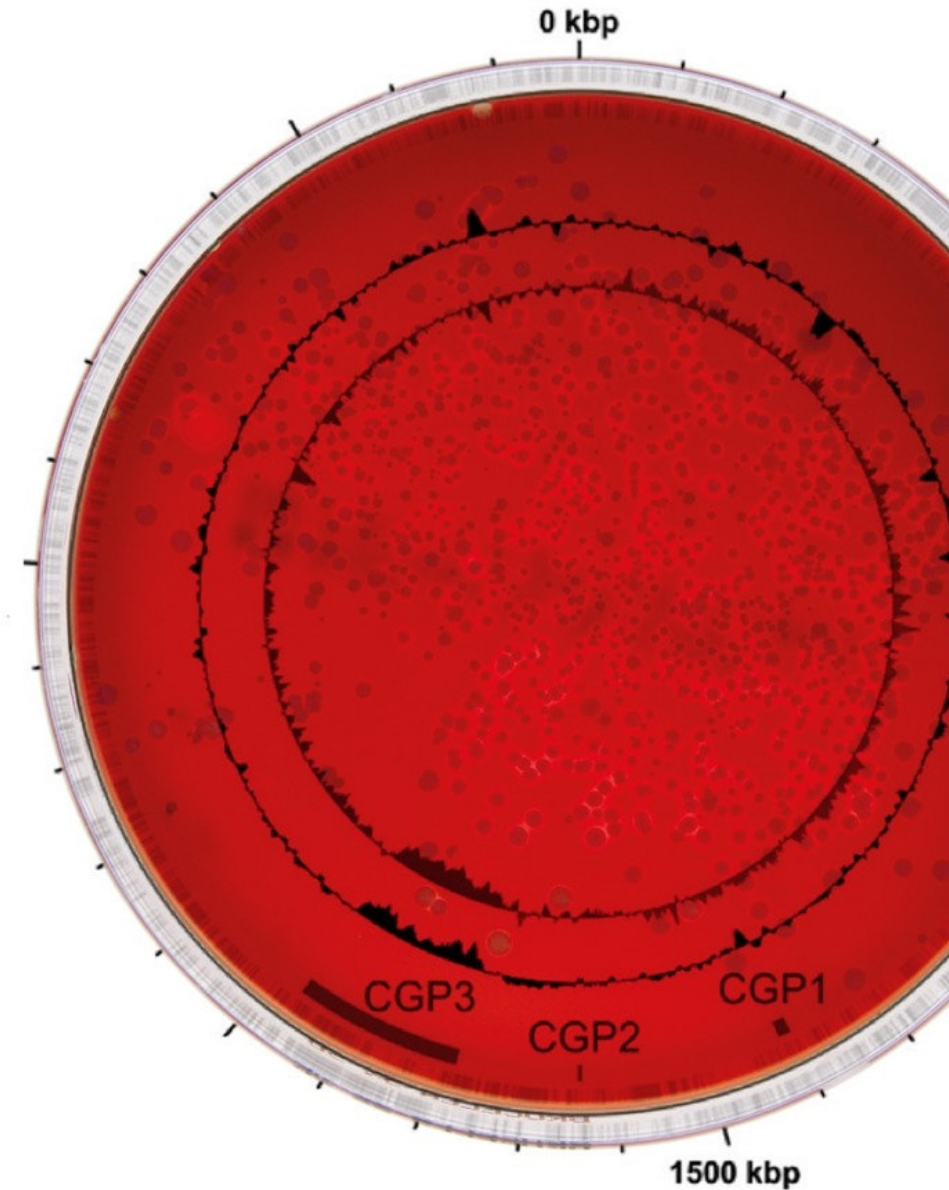
Genome Editing Tool developed by BRAIN

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Zwingenberg, May 7th, 2021



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Genome Editing – developed by BRAIN

Simple Introduction to CRISPR-Cas Technology

Genome Editing: directed and precise change or use of a chromosomal target in a given organism

CRISPR = clustered regularly interspaced short palindromic repeats

CAS = CRISPR associated sequence

CRISPR-Cas systems have enabled genome editing in multiple species and provided genetic tools with speed as well as simplicity that were previously unavailable

Editing requires only two components (1. Cas nuclease 2. programmable guide RNA), and can be multiplexed for simultaneous modification of multiple sites in a single transformation event

CRISPR-Cas systems can be used to edit a genome through gene **knockouts** or homology-mediated **knockins** to control transcription of exogenous or endogenous genes

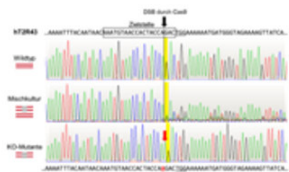
Industrial Biotechnology Significance: CRISPR-Cas-mediated engineering can increase the number of chemicals and products that are accessible through fermentation and broaden the diversity of strains suitable for industrial production



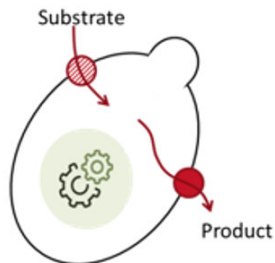
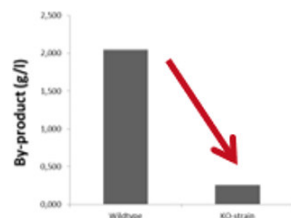
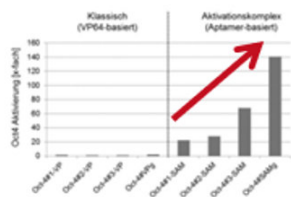
Genome Editing – developed by BRAIN

BRAIN's Novel CRISPR-Cas

modified genome



phenotype



- **Novel** CRISPR Cas system developed using metagenomics sequencing and protein engineering
- **Non-Cas9** type genome editing nuclease
- **Scarless gene modification** at the single nucleotide level
- **In-house designed** application tools and strategies
- Development of customized screening cells for **target identification / validation** or bioactive product development / identification
- State of the art technology for the development of high performance **producer strains**

BRAIN has extensive practical experience with Genome-Editing Technologies

Genome Editing – developed by BRAIN

BRAIN's CRISPR-Cas, Status Quo

Status Quo

- Today validated as a **genome editing tool** in selected bacteria, fungi and yeast
- Today **demonstrated DNA targeting activity** in selected bacteria, fungi and yeast
- Technology **already employed** in internal projects
- Activity in **plants** has been achieved but still needs to be validated
- Genome editing activity tests ongoing for additional applications incl. mammalian cell lines
- **First IP application** to protect the Brain developed CRISPR associated nuclease (BEC) sequence is already submitted
- Currently developing **system to work as a genome editing tool** in BRAIN related strains
- **International Partner** for plant cells involved since the beginning of the program (non disclosed)
- Could **open up application fields** where classical Cas proteins are not suitable
- **Explore multiplex** metabolic pathway engineering / redirection
- Off target analysis running & further mode of action studies are necessary

The CRISPR-CAS Market

A Very Exciting & High Growth Market

- The global CRISPR and CRISPR-Cas gene market size was valued at USD 1.42bln in 2019 and is expected to grow with a CAGR of 16.6% from 2020-27 (Grandview Research)
- Global genome editing market is witnessing high growth rate after the discovery of cutting-edge tool- CRISPR. Global CRISPR market is estimated to grow at a CAGR of 33.26% during the forecast period to reach a total market size of above US\$3.09bln by 2023 from US\$551.2 million in 2017 (Research & Markets)
- The global CRISPR and Cas genes market shows stellar future growth prospects, expanding at a CAGR of 21.2% during the forecast period 2020-2026 (FACT.MR)
- The worldwide market for CRISPR and CRISPR-Associated Genes is expected to grow at a CAGR of roughly 39.8% over the next five years and will reach 2640 million USD in 2024, from 350 million USD in 2019 (MarketWatch)



A simple guide to CRISPR, one of the biggest science stories of the decade

It could revolutionize everything from medicine to agriculture. Better read up now.

By Brad Plumer, Eliza Barclay, Julia Belluz, and Umair Irfan | Updated Dec 27, 2018, 2:45pm EST



Jun 25, 2018, 06:30am EDT

How CRISPR Gene Editing Is Revolutionizing Medicine And The Companies Who Invest In It



NEWS · 07 OCTOBER 2020

Pioneers of revolutionary CRISPR gene editing win chemistry Nobel

Emmanuelle Charpentier and Jennifer Doudna share the award for developing the precise genome-editing technology.



CRISPR-CAS 9 – The Current Standard

Advanced Tool Set but Very High Costs and Some Limitations

The high costs for a distributed license agreement make the leading CRISPR-CAS 9 uneconomical for many applications and smaller biotech players

- Upfront tech access fee
- Annual license fee
- Royalties on product sales
- Patent situation still unclear (Broad Institute, ERS Genomics)
- Diversity in the application is missing
- Diagnostic benefits from different mode of action
- Potential for synergetic additions is still a vision



Genome Editing – developed by BRAIN

Significant Economic Potential

Genome editing developed by BRAIN has significant economic potential

- Speed up own strain and product development
- Become a TMS partner of choice for genome editing, harvest additional TMS business
- Freedom to operate in genome editing
- Omit license fees for own development and TMS business
- Tech access and license potential for TMS business
- Significant license/x-license upside if technology can be validated for further plant and especially in mammalian cell lines
- All options open for commercialization model
- New legal entity for genome editing will be created: flexibility, focus and speed
- Management intends to keep as much upside potential for BRAIN shareholders as possible, future partnering and timing versus financing requirements need to be considered carefully

Will enter our incubator as a project with “Large” rNPV potential, if next development steps are successful could have very large potential

Genome Editing – developed by BRAIN

Q&A



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Thank you for your attention.

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