Introduction
Workshop: Genetic Engineering

Angelika Hilbeck, ENSSER Board and Founding Member

Mid 70s:
Lederberg and Stanley Cohen, duly emphasized the "promise" of the new gene-splicing techniques for medicine, industry, and agriculture. The techniques could "revolutionize" the pharmaceutical industry, according to the San Francisco Chronicle. The new methods will "meet some of the most fundamental needs of both medicine and agriculture, such as supplies of now scarce hormones and nitrogen-fixing microorganisms," according to the New York Times.
Assumption:

- **reductionistic concept**: Organisms are the sum of it’s ‘coded’ parts.

[Link to ISAAA.org information resources on biotech crops: The Golden Rice Technology](https://www.isaaa.org/kc/inforesources/biotechcrops/The_Golden_Rice_Technology.htm)
The step into the real world remains vastly underestimated.

‘NEW’ Genetic Engineering Methods
Wie CRISPR arbeitet

Guides ‘scissors’ to specific locations on genome

‘Delete’ known sequences on genome

Adding new traits much more difficult and less efficient


HOW TO MAKE GOLDEN RICE

any GMO

A process in 2 steps!

New genetic engineering methods

The Promises: 1970 - 2010
Sweeping safety claims – total disregard for risks

Prominent example:

Robert May (Chief Scientific Advisor to UK Government), 2000:

"On the one hand so-called GM techniques which in the precise and targeted way bring in a couple of genes that you know what they do and you know where they are is vastly safer, vast, vastly more controlled than this so-called conventional breeding that reshuffles about a tenth of the genome."

"... den genetischen Code quasi zu redigieren oder besser:
die Erzählung der Natur zu verschönern."

The Contributions of Plant Biotechnology to Agriculture in the Coming Decades, R. T. Fraley

Figure 2: Plant Biotechnology Promises to Deliver Many New Products in Coming Decades
Ending World Hunger. The Promise of Biotechnology ... 

Norman E. Borlaug  
Nobel Prize Laureate for Peace, 1970 

Versprechen der neuen Gentechnik 

GM crops help fight hunger 

In the light of new European legislation, Sterling Crew, Head of Technical at Kelak Snack Foods, reviews the essential role of GM crops in safeguarding the security of our food supply, protecting the environment and improving our quality of life.

The security of food supply is in danger unless negative attitudes to GM crops are ...
Re-newed efforts of semantic engineering:

Not calling it what it is: genetic engineering

Gene/genome EDITING, CODING, WRITING, SPELLING,...
New BREEDING techniques (although the aim is to overcome ‘breeding’) etc.

One example: “So what is gene editing? Scientists liken it to the find and replace feature used to correct misspelling in documents written on a computer. Instead of fixing words, gene editing rewrites DNA, the biological code that makes up the instruction manuals of living organisms.”

Ian Sample, the Guardian, 2018
“The end product is what matters”
Detlef Weigel, Director at the Max Planck Institute for Developmental Biology, explains why genome editing offers a targeted way of breeding better crops

... together with colleagues from the USA and China, is asking for genome-edited plant varieties of this kind not to be classified as genetically modified plants.

• no regulation, no safety testing (sweeping claims)
• no oversight
• no responsibility
• no knowledge outside of insider developer circles

https://www.mpg.de/10444274/genome-editing-breeding-better-crops

Persisting CONTRADICTION:
‘Product’ only matters regarding safety and regulations

It is all about ‘process’ when it comes to profiting from patents and property rights!

THE BATTLE FOR OWNERSHIP

“Whoever owns the commercial or IP rights to CRISPR-Cas9 has the potential to generate huge financial returns and to decide who gets to use it.”

Sweeping, unsupported, arbitrary safety claims

PREVAILING ‘DOGMA’:

Control over DNA = Precision = Safety = predicted outcomes
Ruling: “… the Court of Justice takes the view, first of all, that organisms obtained by mutagenesis are GMOs within the meaning of the GMO Directive, in so far as the techniques and methods of mutagenesis alter the genetic material of an organism in a way that does not occur naturally. It follows that those organisms come, in principle, within the scope of the GMO Directive and are subject to the obligations laid down by that directive.”
“… the Court considers that the **risks** linked to the use of these new mutagenesis techniques **might prove** to be similar to those that result from the production and release of a GMO through **transgenesis**, since the direct modification of the genetic material of an organism through mutagenesis makes it possible to obtain the same effects as the introduction of a foreign gene into the organism (transgenesis) and those new **techniques** make it possible to produce genetically modified varieties **at a rate out of all proportion to those resulting from the application of conventional methods** of mutagenesis.”

---

**Prof Nick Talbot, Deputy Vice Chancellor, and Professor of Molecular Genetics, University of Exeter, said:**

“This ruling by the CJEU is a mis-guided and retrograde step that is not based on any scientific evidence. **Mutation occurs all the time in all organisms.**”

**Dr Nicola Patron, Head of Synthetic Biology, Earlham Institute, said:**

“This is not an approach based on scientific evidence. Mutagenesis is a natural phenomenon responsible for the genetic diversity that can been seen in all living organisms. Humans have used different technologies to induce mutations in plants to increase genetic diversity and improve the agronomic qualities of crops for almost a century; the same outcomes can now be achieved using **faster, more efficient and precise** mutagenesis methods.”

Now it’s safe – now it’s not!

https://www.youtube.com/watch?v=th0vnOmFltc
“This kind of gene editing [Crispr/Cas9] ... is still experimental and DNA changes can pass to future generations, potentially with unforeseen side-effects. ... Many mainstream scientists think it is too unsafe to try...”

Julian Savulescu, a professor of practical ethics at the University of Oxford. “... Gene editing itself is experimental and is still associated with off-target mutations, capable of causing genetic problems early and later in life, ....”
I want to help humans genetically modify themselves

Former NASA biochemist Joshua Zayner became an online sensation by conducting DIY gene therapy on himself. He explains why he did it.

Joshua Zayner with his gene-editing kit. Photograph: Courtesy Joshua Zayner / The New York Times

Joshua Zayner, 36, recently made headlines by becoming the first person to use the revolutionary gene-editing tool CRISPR to try to change their own genes. Part way through a talk on genetic engineering, Zayner pulled out a syringe apparently containing DNA and other chemicals designed to trigger a genetic change in his cells associated with dramatically increased muscle mass. He injected the DIY gene therapy into his left arm, live-streaming the procedure on the internet.

The former NASA biochemist, based in California, has become a leading figure in the growing “biohacker” movement, which involves loose collectives of scientists, engineers, artists, designers, and activists experimenting with biotechnology outside of conventional institutions and laboratories.

A Biohacker Regrets Publicly Injecting Himself With CRISPR

“There’s no doubt in my mind that somebody is going to end up hurt eventually.”

NASA ZAYNER FEB 26, 2018

https://www.youtube.com/watch?v=a6A9bb0166o
Another leading CRISPR scientist, who asked not to be named because of involvement with genome-editing companies, called the new data “pretty striking,” and raised concerns that a potential fatal flaw in some uses of CRISPR had “been missed.”

CRISPR—a weapon of mass destruction?
By Kelly Servick  |  Feb. 11, 2016, 4:45 PM

Which of these threats to our existence is not like the others: North Korean nukes, Russian cruise missiles, and... the gene-editing technology CRISPR. A global threat assessment released this week by U.S. director of national intelligence James Clapper placed "genome editing" among six threats listed in the section on weapons of mass destruction. The inclusion of CRISPR and related techniques in the gallery of rogues came as a surprise to some bioweapons experts, MIT

Cyberterrorism and Biotechnology
When ISIS Meets CRISPR
By Amrit P. Aharya and Aniruddha Aharya
"75 research institutions demand new gene technology law"


CONCLUSIONS:

The field is riddled with scientific contradictions and logical misfits (safe in plants/animals, unsafe in humans)

- ‘Product’ for regulation but ‘process’ of property rights
- ‘Natural’ to avoid regulation but ‘non-natural human invention’ for IP rights
- Hyping promises to maintain massive (public) cash flow into (privatized) underdelivering on promised science-fiction techno-fixes
- Science falls by the wayside to maintain/rescue the DNA-centered world view that forms the root of power structure
Thank you!