




A risk-based argument for distinguishing between SDN-1/2 and GMOs

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science & innovation
Department:
Science and Innovation
REPUBLIC OF SOUTH AFRICA



technology innovation
A G E N C Y

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Complex environment

(and the details are important)

Plant Breeding Innovation (PBI)

Genome Editing (GE)

New Genomic Techniques (NGT)

CRISPR-Cas

Gene drives

Gene therapy

Cisgenesis

New Breeding Techniques (NBTs)

Precision Bred Organisms (PBOs)

Genetic Modification (GM)

Site-directed Nuclease (SDN)

Conventional Breeding

Genetic engineering (GE)

Synthetic Biology

Mutation

etc, etc...



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Asilomar conference on rDNA (February 1975)



Risk management principles

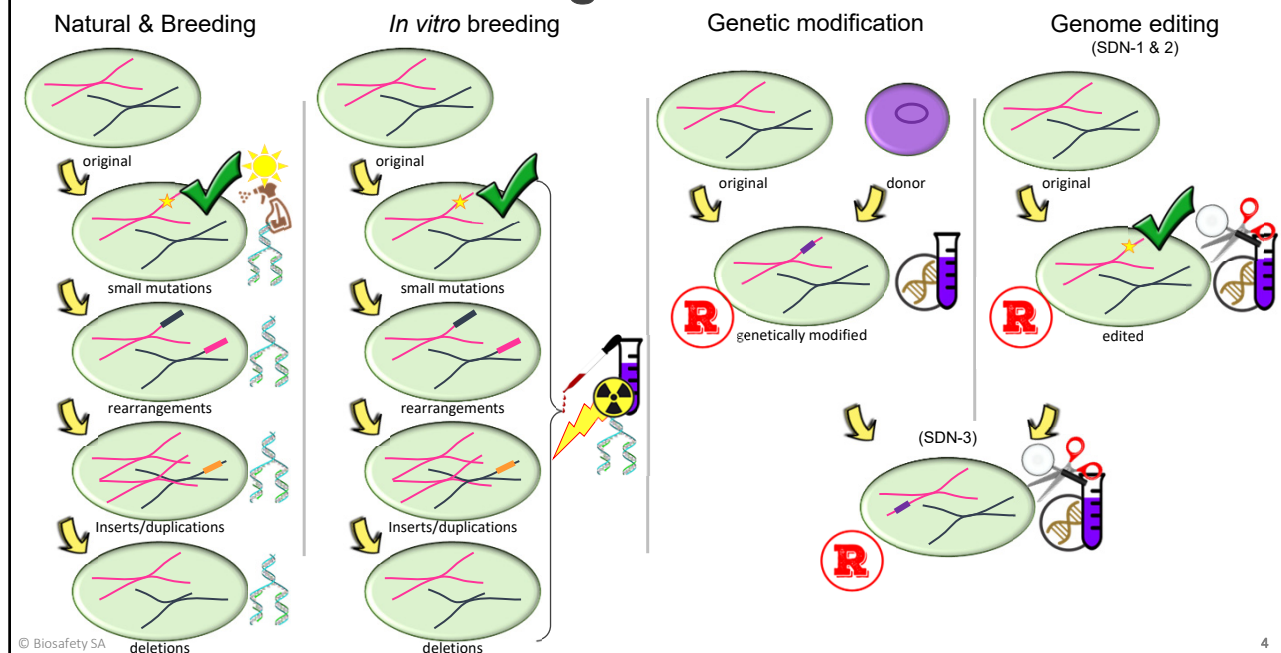
- Containment as primary risk mitigation strategy (based on 4 biotypes)
- Risk mitigation measures proportionate to estimated risk (fit-for-purpose)

Other contributions

- New era in science & public discussion on science policy
- Precedent on how to engage on changes in scientific knowledge

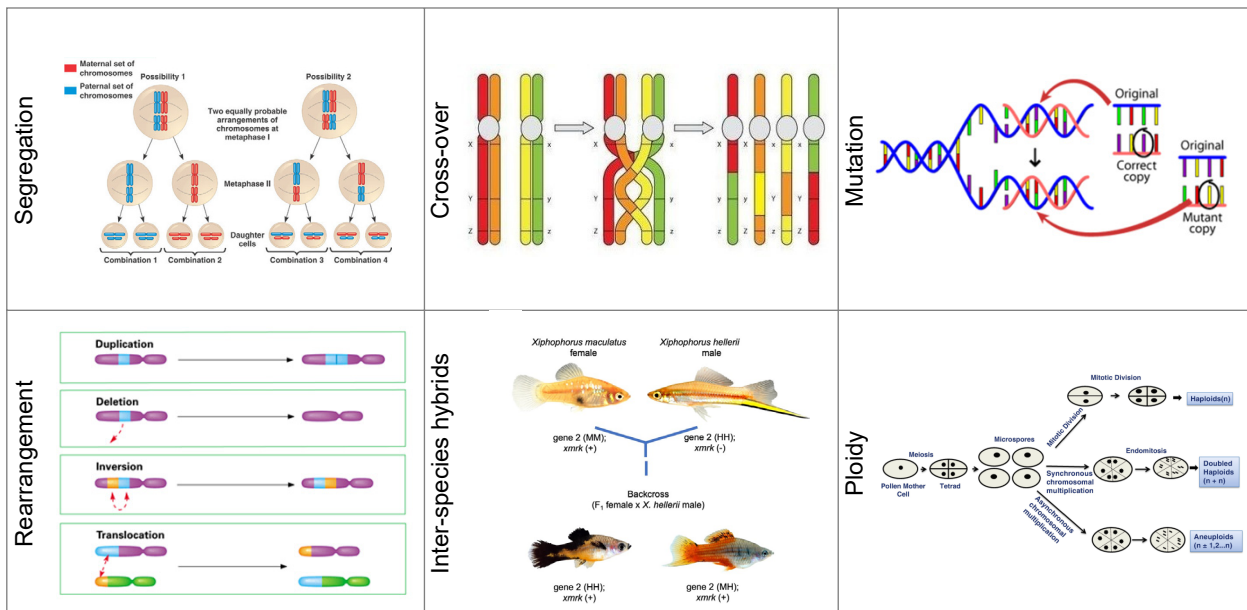
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Nature of genetic variation



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Mechanisms underlying (natural) genetic variation



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Managing “natural genetic uncertainty”



“genetic uncertainty”

History of safe use
Phenotypic evaluation



Distinguishability
Uniformity
Stability
(Food safety other legislation)

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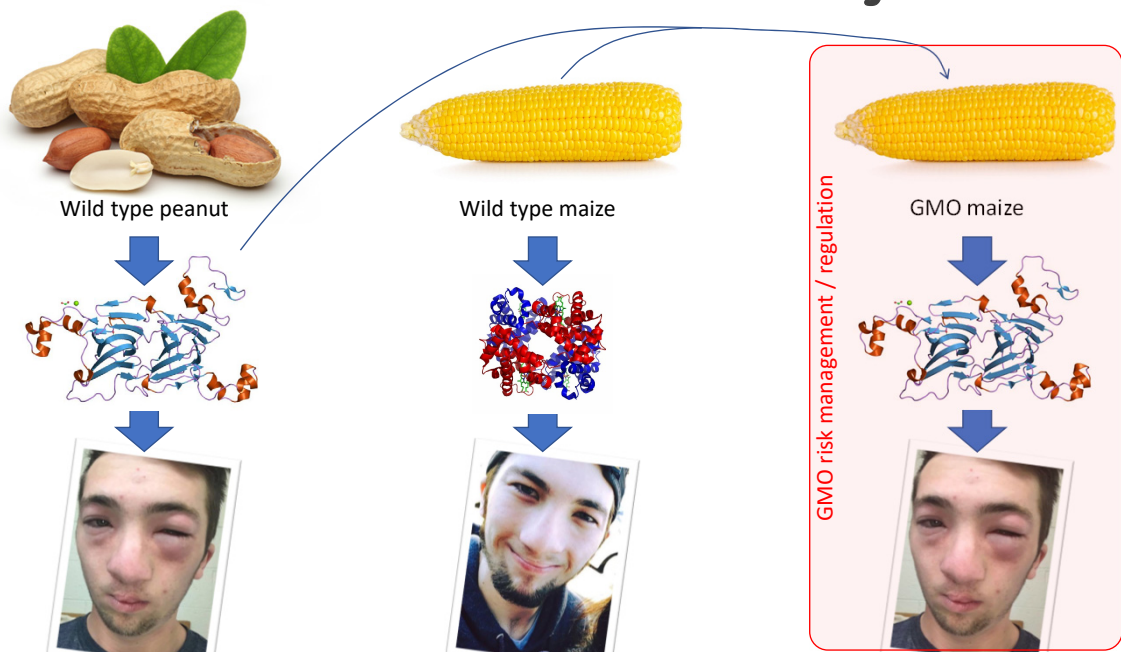
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WHY ARE GMOs SUBJECT TO ADDITIONAL REGULATION?

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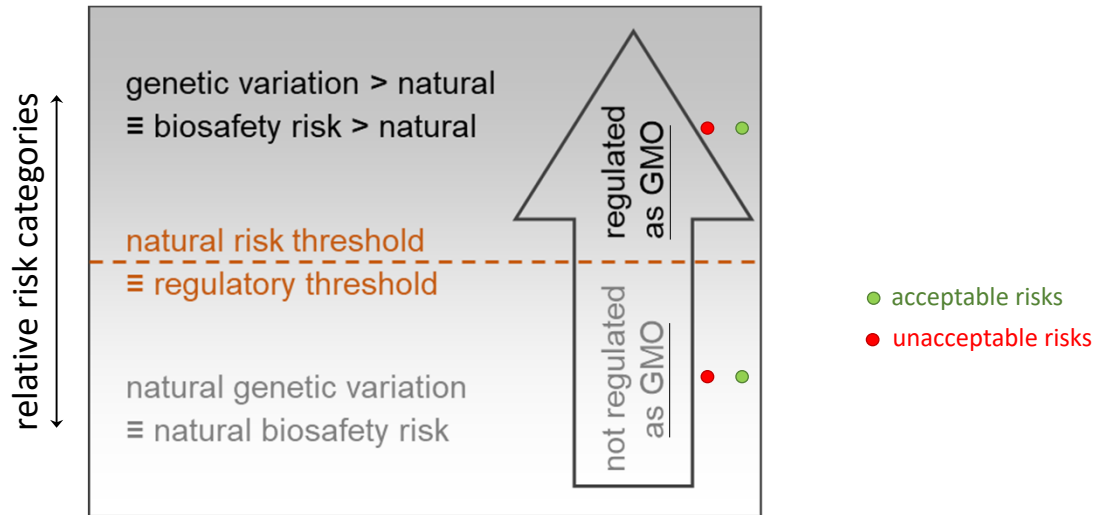
The novel risk context introduced by GMOs



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GM introduced a novel risk context

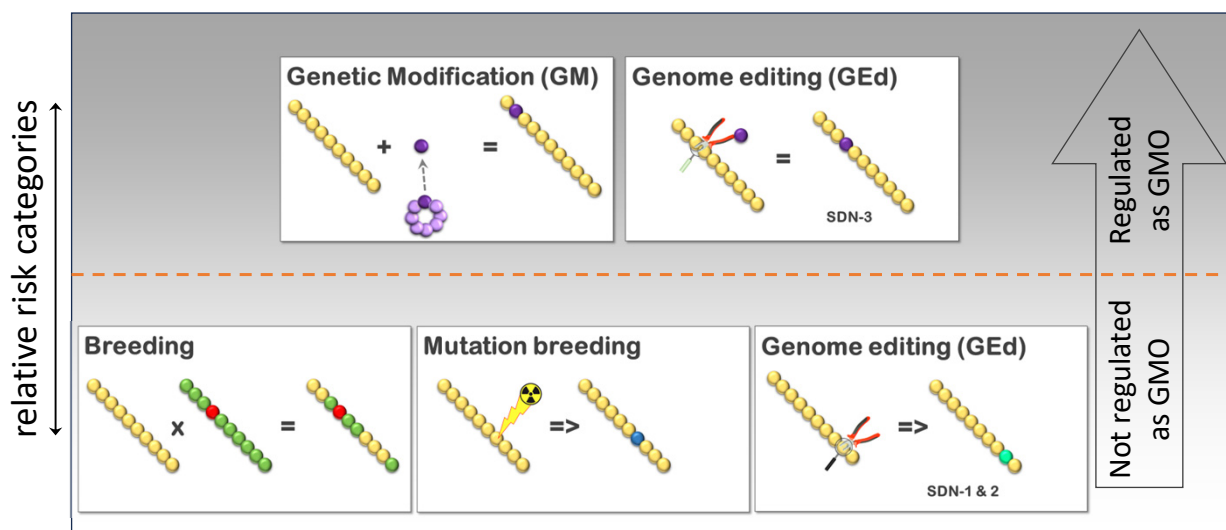


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GM introduced a novel risk context

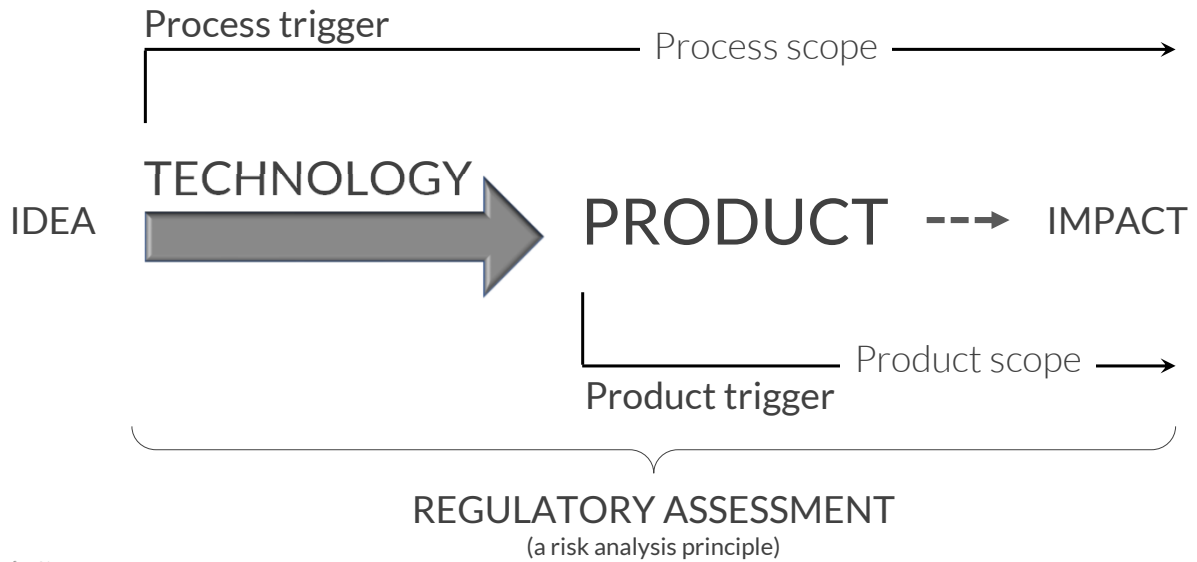


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Regulatory -trigger vs -scope vs -assessment



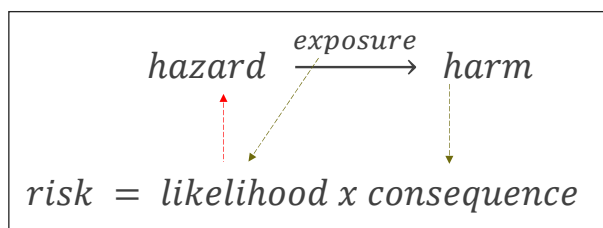
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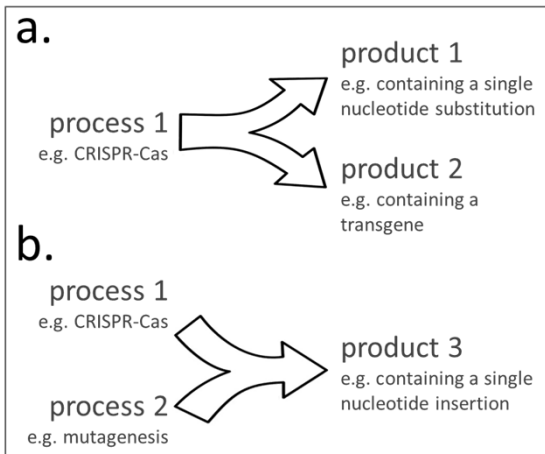
Why does only a product-based trigger make sense?

I. Risk principles



GMO...? GM...?

II. Scientific, legal & administrative coherence



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GMO definitions

European Union

“genetically modified organism (GMO)” means an organism in which the genetic material has been altered in a way that does not occur naturally by mating and/or natural recombination.

Within the terms of this definition:

- (i) genetic modification occurs at least through the use of the techniques listed in Annex I A Part 1;
 - (ii) the techniques listed in Annex I A Part 2 are not considered to result in genetic modification;
- (Article 2 of Directive 90/220/EEC)

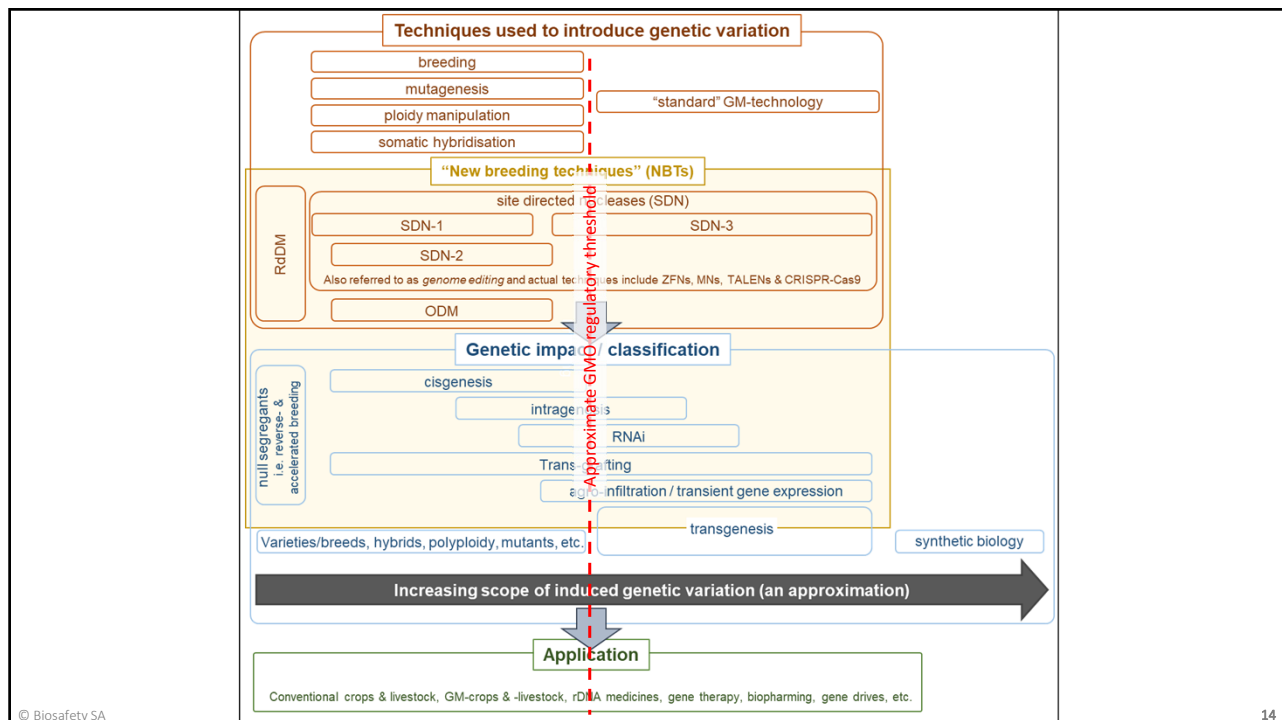
South Africa

“genetically modified organism” means an organism the genes or genetic material of which has been modified in a way that does not occur naturally through mating or natural recombination or both, and **"genetic modification"** shall have a corresponding meaning;

Cartagena Protocol on Biosafety

“Living modified organism” means any living organism that possesses a novel combination of genetic material obtained through the use of modern biotechnology;

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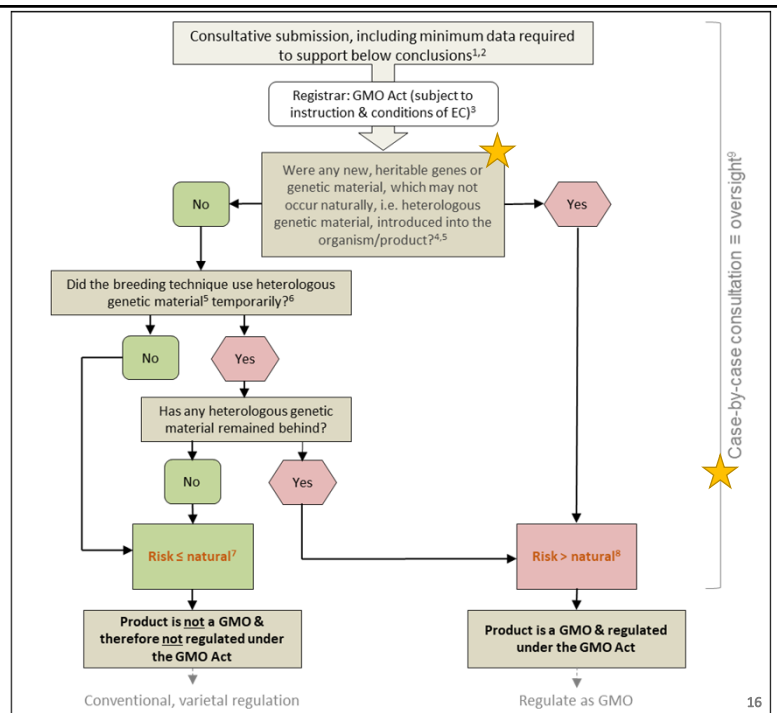
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A fit-for-purpose governance framework for NBTs / genome editing



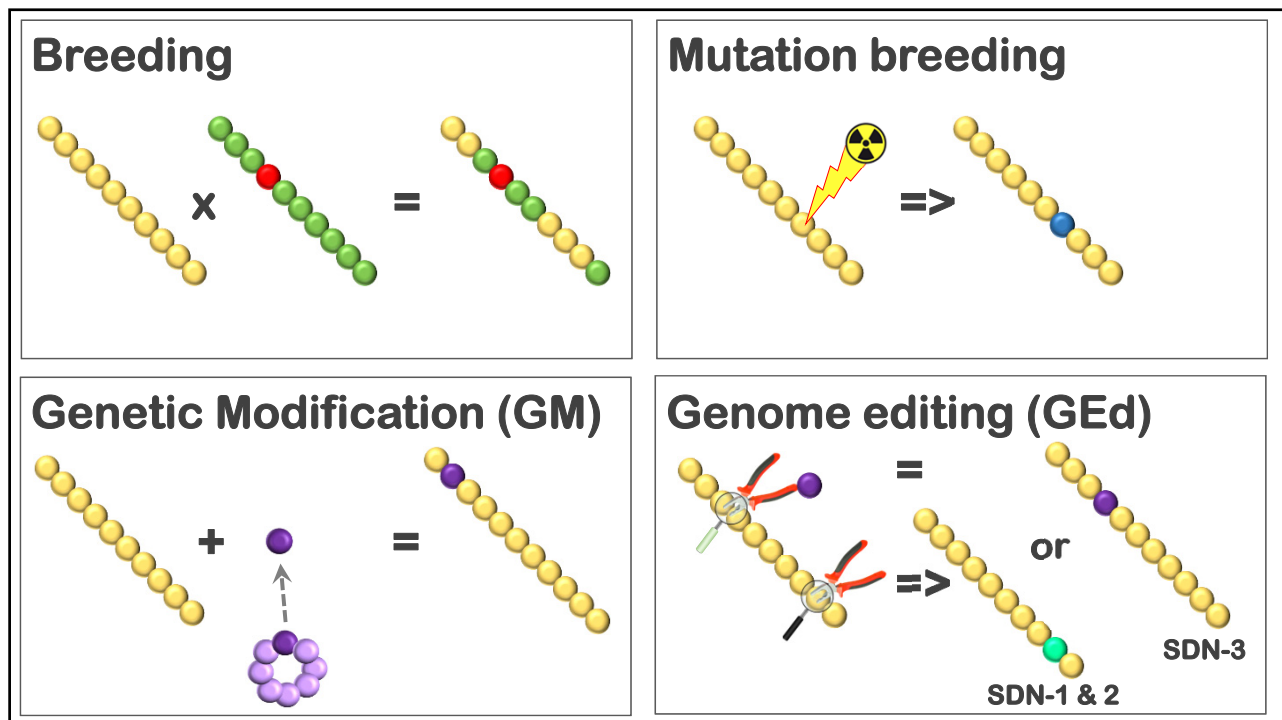
Requires amendments to GMO Act

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Should the GMO Act's definition of a GMO be interpreted as having a product or process basis?

INTERPRETATIONS

The crux of this argument is to answer the question "WHAT does not occur naturally?" -

Process argument

Readers that support a process-based interpretation, focus on the clearly delineated mid-section (sub-sentence) of the definition (highlighted in red below), which, at face value, is straight forward to interpret -

"**genetically modified organism**" means an organism the genes or genetic material of **which has been modified in a way that does not occur naturally** through mating or natural recombination or both, and "**genetic modification**" shall have a corresponding meaning;

When you focus only on this section it appears that the "occur" refers to "the way" of modification, i.e. the mechanism or process used, which, if it doesn't occur naturally, will trigger regulation = process-based regulation = all NBTs should be regulated, because all are generated via such "artificial" processes.

Product argument

To see the product-basis you need to recognise and integrate all three the descriptors in the definition, including those before & after "occur naturally" -

"**genetically modified organism**" means [1] an organism **the genes or genetic material of which** [2] **has been modified in a way that does not occur naturally** [3] **through mating or natural recombination** or both, and "**genetic modification**" shall have a corresponding meaning;

When you do this, "occur" refers to the type of modifications made to the genetic material and contrast these to those natural ones occurring through mating. I.e. It focuses on the physical changes in the DNA sequence = product-basis, which triggers regulation only when the type of change to the DNA is not likely to occur naturally. Induced modifications that can't be distinguished from those that may occur naturally, should therefore NOT be regulated under the GMO Act. Contrasting, for example, a single nucleotide mutation with a transgene insert.

In fact, it can be argued that the use of "*through*" as the preposition for the listed natural mechanisms, ONLY supports a product-based interpretation. In this syntax, it can only refer to the modifications made to the genetic material (product), not the way of modification (process) – i.e. it likens the modifications induced through mating and recombination to those introduced using genetic modification. To allow a process-based interpretation a preposition that more sensibly links mating and recombinations as processes to genetic modification as a process, should have been used - for example "...modified in a way that does not occur naturally, **like through** mating or natural recombination...".

CONCLUSION

Although a product-based interpretation is more contextually accurate and sensible, a process-based interpretation can also be read into the definition, rendering it ambiguous.

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