# Gene ‘Editing’ or Genome Scrambling?

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GMOs are a failed technology. The future is GMO Free,
Mar 10th, 2021
Navdanya

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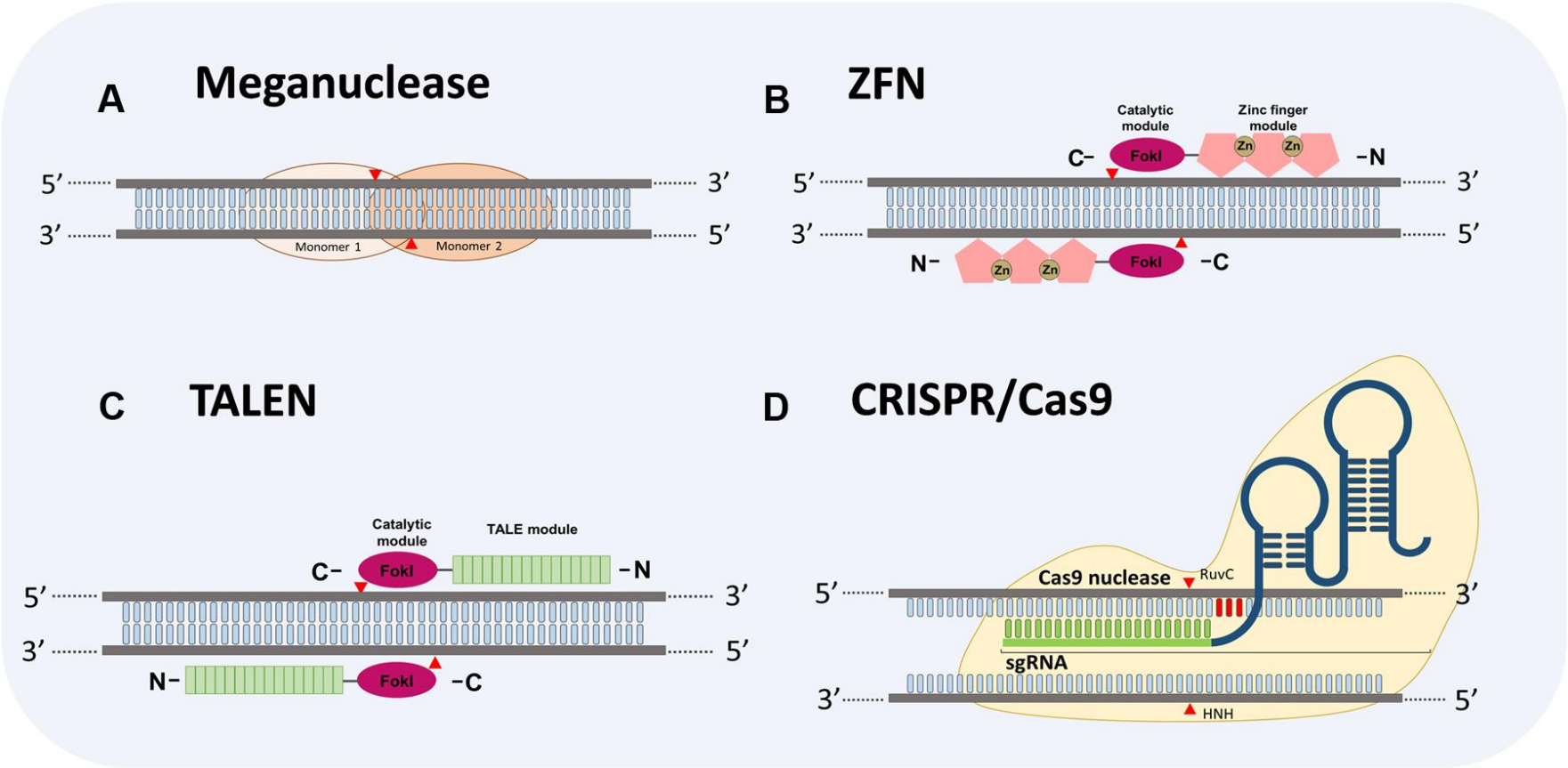
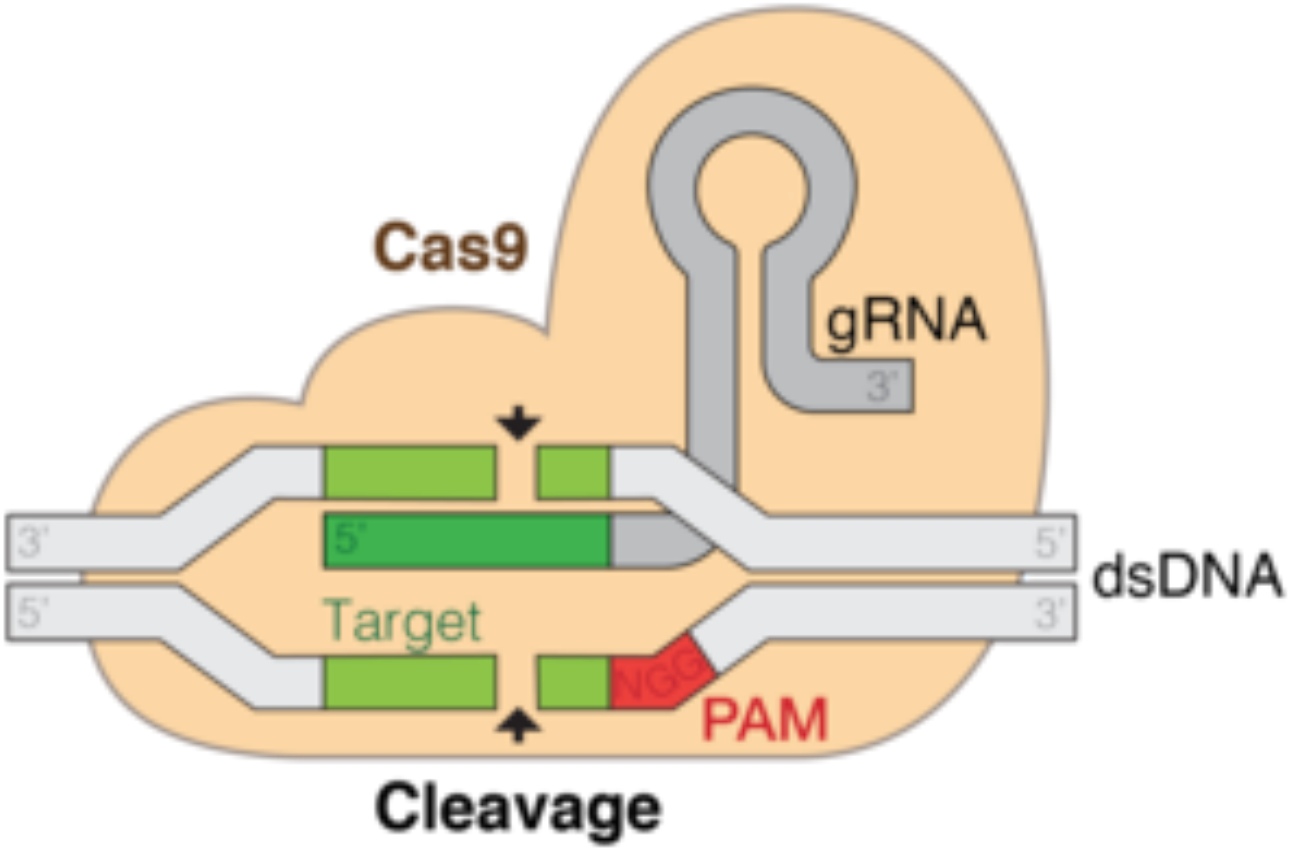
# Genome ‘editing’: mechanisms



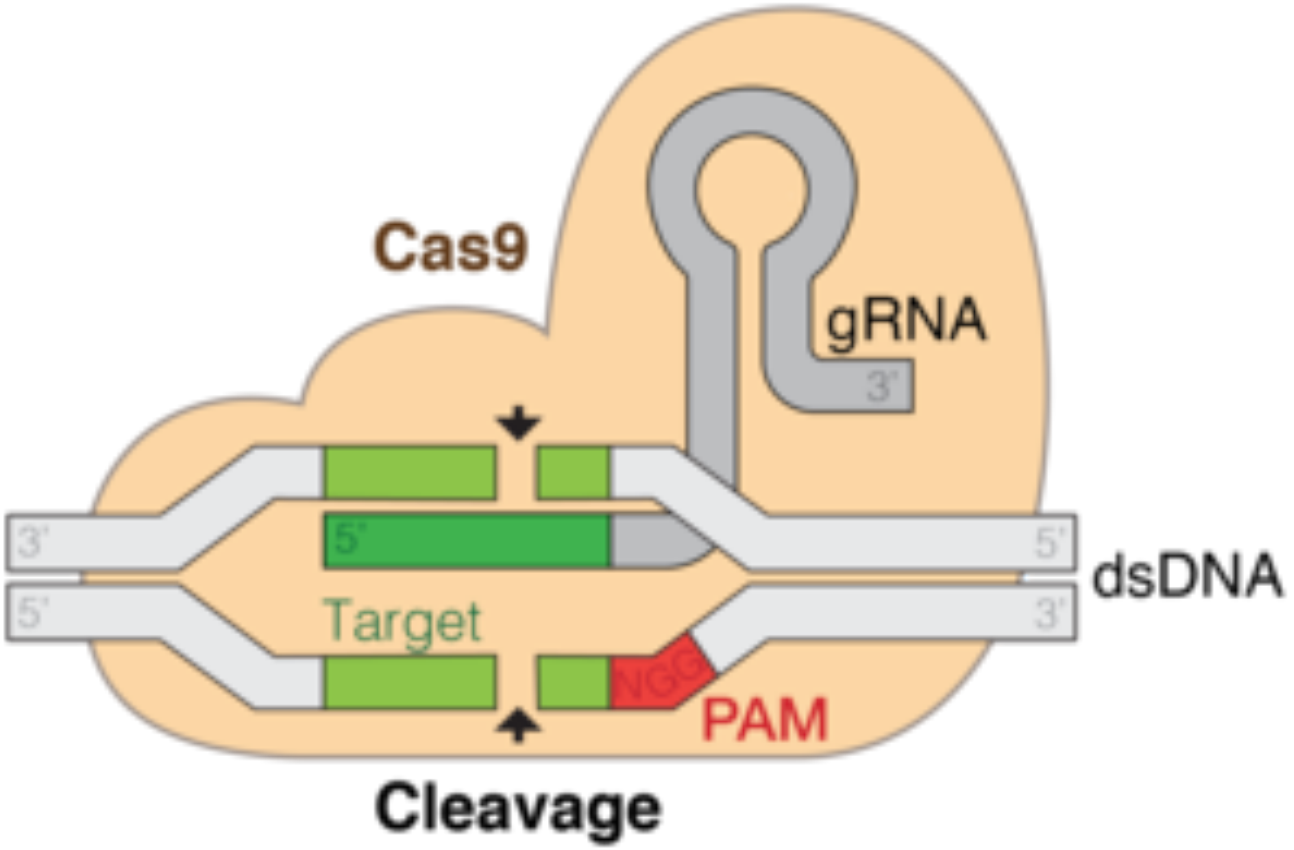

Meganucleases
ZFN: Zn Finger Nucleases
TALEN: Transcription Activator-Like Effector Nucleases
CRISPR: clustered regularly interspaced short palindromic repeats
Oligonucleotides

# Genome ‘Editing’ Mechanisms: CRISPR/ Cas9




1.

# Genome ‘Editing’: mechanisms II




2.

dsDNA

# Gene ‘edited’ Foods

1. Mushroom (Penn State; CRISPR; Non-browning)

2. Soybeans (Calyxt; TALEN; High Oleic oil)

?

3. Wheat (Calyxt; TALEN; High Fibre)

?

4. Canola (Cibus; ODM; Sulphonyl Urea Herbicide tolerance)

5. Tilapia (Intrexon; CRISPR; Growth)

?

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# Gene ‘Editing’: Imprecision



nature biotechnology

## Repair of double-strand breaks induced by CRISPR–Cas9 leads to large deletions and complex rearrangements

Michael Kosicki, Kärt Tomberg & Allan Bradley

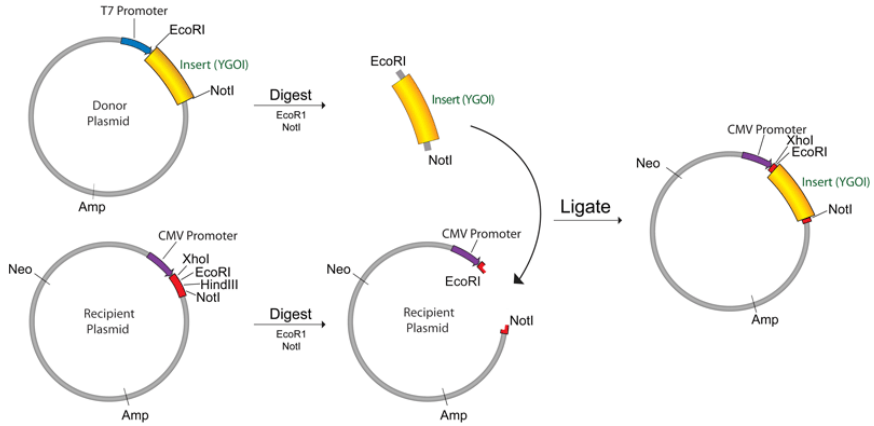


**CRISPR–Cas9 is poised to become the gene editing tool of choice in clinical contexts. Thus far, exploration of Cas9-induced genetic alterations has been limited to the immediate vicinity of the target site and distal off-target sequences,**

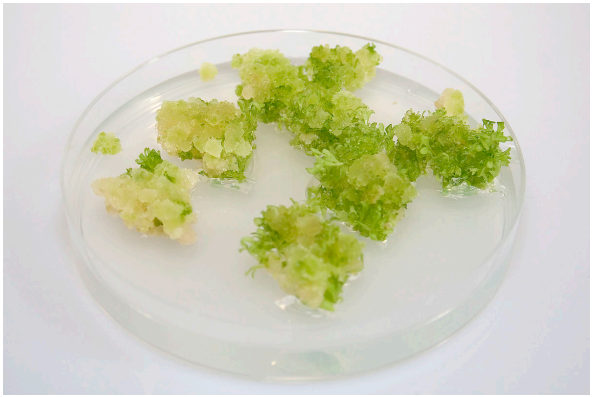
rare double-cutting events cannot be excluded[25]. Furthermore, the analysis of the alleles generated using both single and paired gRNAs has in most studies relied on amplification of short regions (<1 kb) around the target and potential off-target sites, limiting the scope

# Making an ‘Edited’ Crop

1. Assemble the DNA:

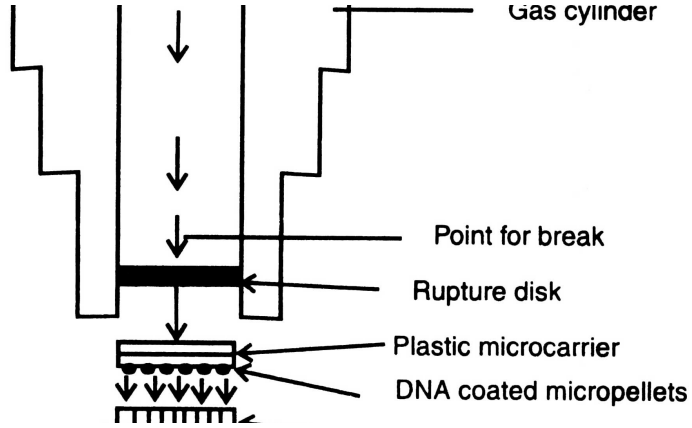



2. Prepare the plant cells



3. Shoot in the DNA

2.

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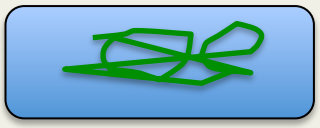
# Genetic Engineering and Genome Damage

Pellet



Chloroplast

Nucleus

# Gene editing can add E.coli DNA, bovine DNA, goat DNA.

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ARTICLE

https://doi.org/10.1038/s42003-019-0300-2 OPEN

## Exosome-mediated horizontal gene transfer occurs in double-strand break repair during genome editing

Ryuichi Ono[1], Yukuto Yasuhiko[1], Ken-ichi Aisaki[1], Satoshi Kitajima[1], Jun Kanno[1,2] & Yoko Hirabayashi[1]

The CRISPR-Cas9 system has been successfully applied in many organisms as a powerful genome-editing tool. Undoubtedly, it will soon be applied to human genome editing, including gene therapy. We have previously reported that unintentional DNA sequences derived from retrotransposons, genomic DNA, mRNA and vectors are captured at double-strand breaks (DSBs) sites when DSBs are introduced by the CRISPR-Cas9 system. Therefore, it is possible that unintentional insertions associated with DSB repair represent a potential risk for human genome editing gene therapies. To address this possibility, comprehensive sequencing of DSB sites was performed. Here, we report that exosome-mediated horizontal gene transfer occurs in DSB repair during genome editing. Exosomes are present in all fluids from living animals, including seawater and breathing mammals, suggesting that exosome-mediated horizontal gene transfer is the driving force behind mammalian genome evolution. The findings of this study highlight an emerging new risk for this leading-edge technology.

# Gene ‘editing’ or genome scrambling?

- Genetic consequences stem from the manipulation of cell cultures and the need to introduce the gene ‘editing’ components into cells (off-target)
- Genetic consequences stem from the functioning of the editing machinery itself (on-target or off-target)
- These issues place a high premium on the diligence and competence of the breeder.

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