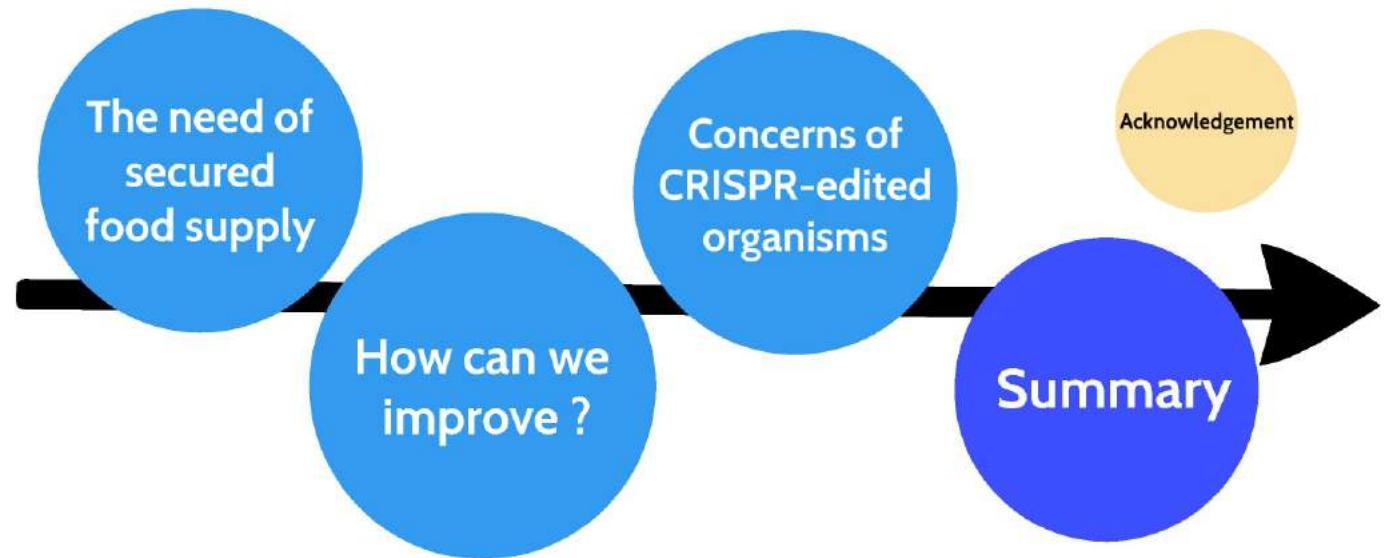


CRISPR - A Tool for Redefining GMOs



Mohammed Kyum
Wei-Yuan Chen

@ ANSC 691
2020.Jul.02



McGill

The Need of GMOs



"Kevin Carter's Pulitzer Prize-winning photograph (1994) of a starving Sudanese child and a vulture in the background"

https://1.bp.blogspot.com/-iOVFs3KcqP4/V2SJc1PpeLI/AAAAAAAAAKZE/MsQcmIFa3yI9TgJPSq3ANZ_qK5NN7lfJwCLcB/s1600/The%2Bvulture%2Band%2Bthe%2Blittle%2Bgirl.jpg

Quantity



Quality

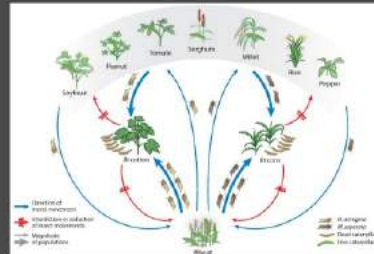


Stress
Resistance



However...

We learn from the cases of GMOs



Li Y. et al. (2020)

Farmer practice of "Refuge strategy"
 -Difficult to implement in countries with small-scale farms

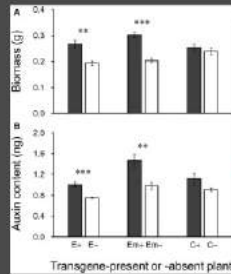
of GMOs



Bollinedi H. et al. (2017)

Unintended trait due to the genomic effects: "Golden Rice" (provitamin A) in other rice background

-Disrupted the native *OeAur1* gene



Fang J. et al. (2018)

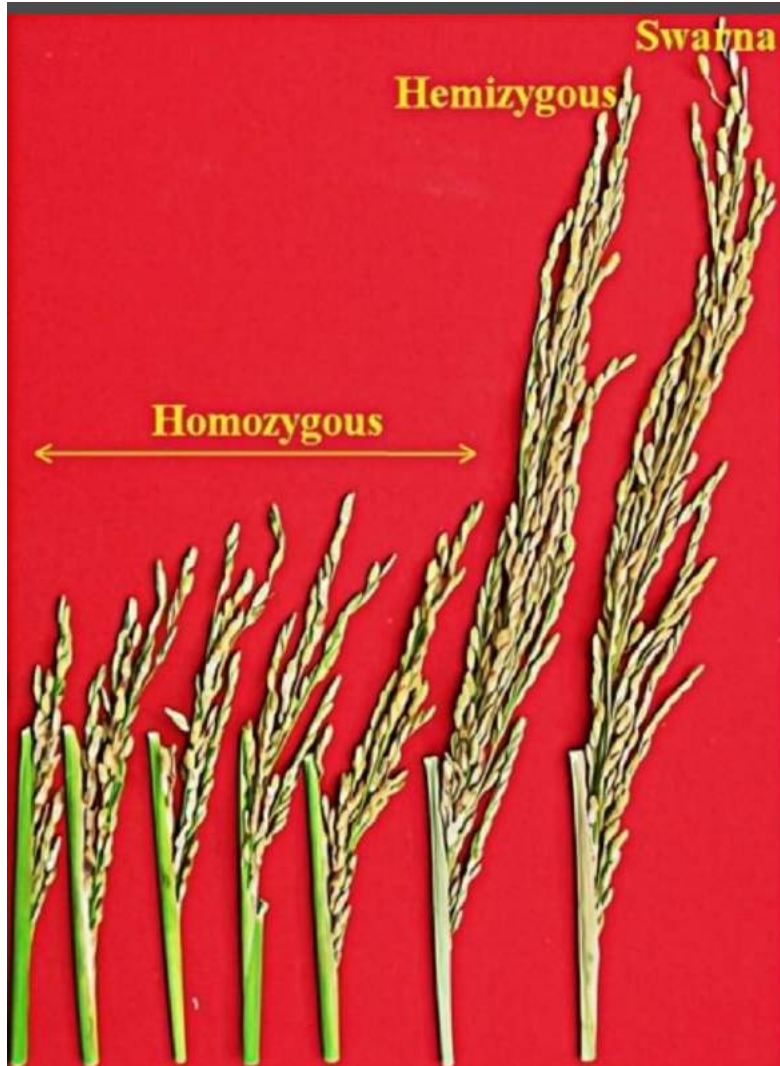
Unintended trait due to novel gene

-EPSPS enzyme increases the auxin content and biomass

E=EPSPS
 Em= EPSPS mutant

There are many problems of GMOs

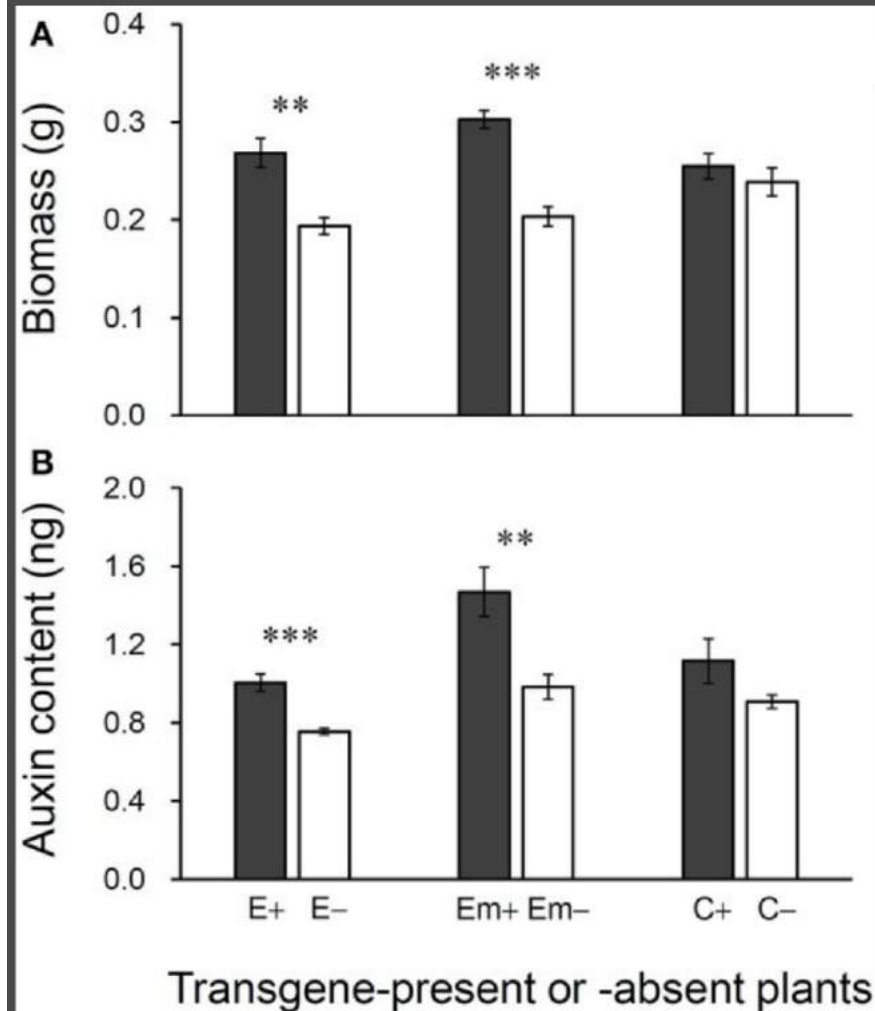
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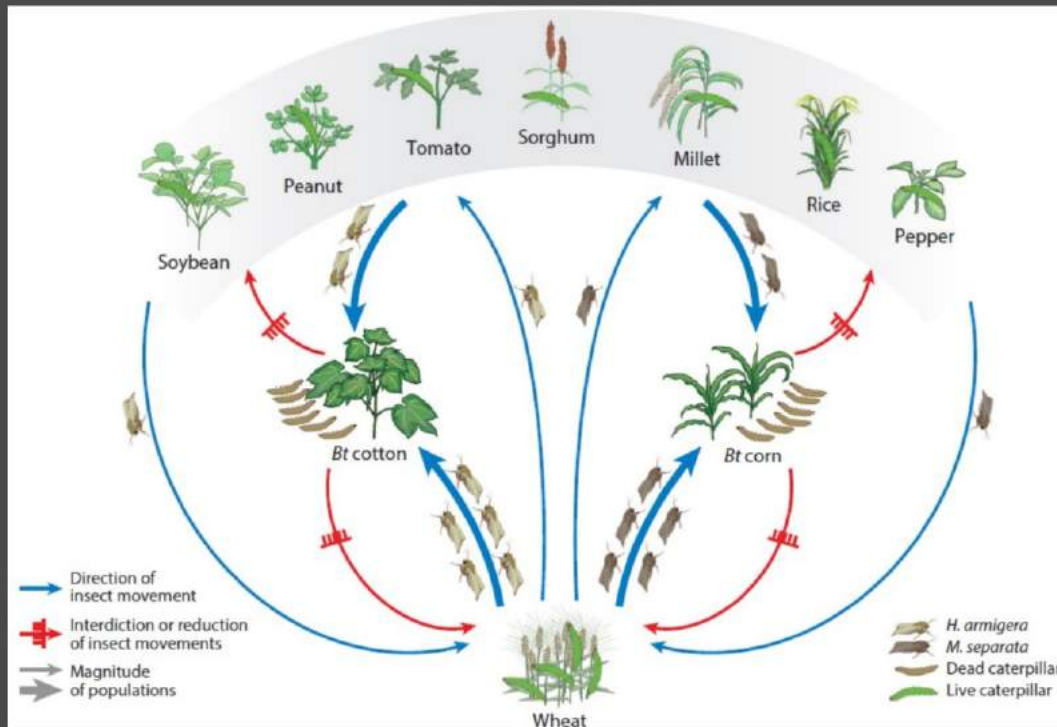
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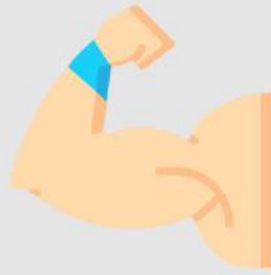
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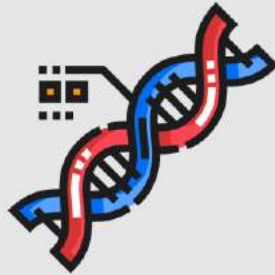


Summary



- Stronger traits could compete with wild relatives

- Changes in other organisms in the environment



- Insertion causes genetic effects

- Overdose of chemicals

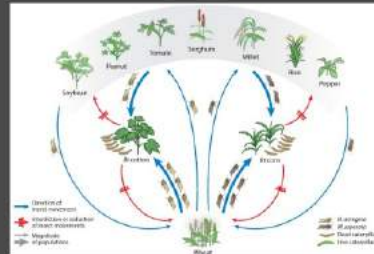


- Genetic contamination

- Other stresses could induce unintended traits



We learn from the cases of GMOs



Li Y. et al. (2020)

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of GMOs

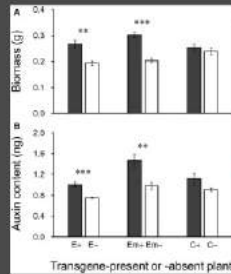
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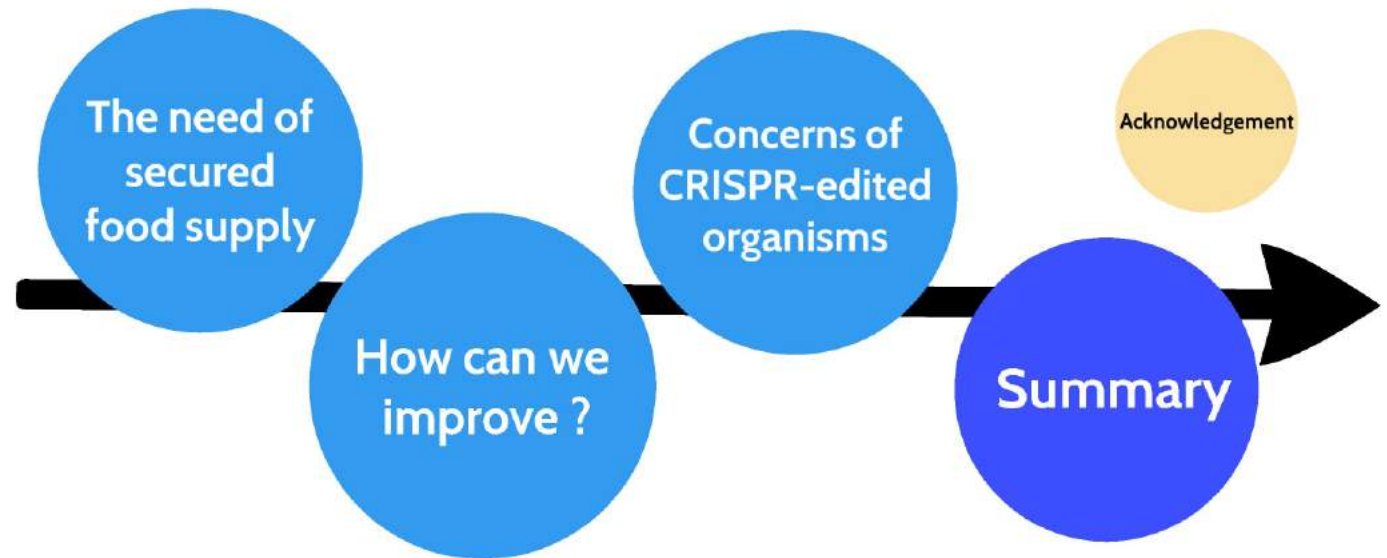


Stress Resistance



However...

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**CRISPR is
better than
GMOs in ...**



- Introducing a gene from other species



- Almost the same as Wild-Type



- May be accepted as non-GMO

The practices that are being employed :



- Risk assessment

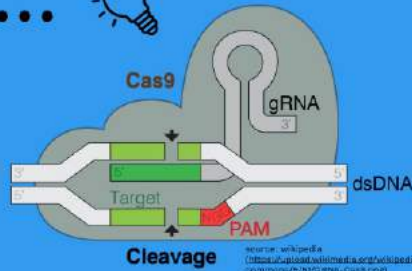


- Refuge strategy (e.g.- Bt cotton)

But now we have...

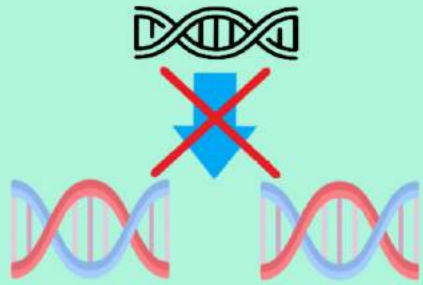


CRISPR



CRISPR is better than GMOs in ...

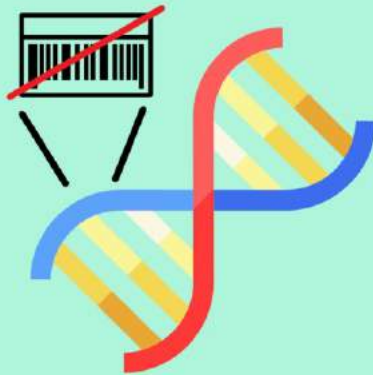
And CRISPR can improve even more...



Integration-free



Reduce Risks



Marker-free



Sustain Biodiversity

The practices that are being employed :



• Risk assessment

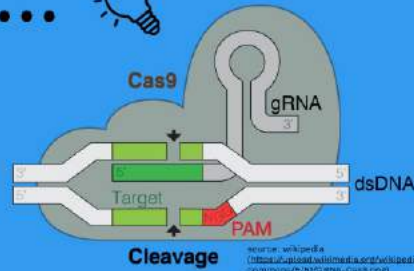


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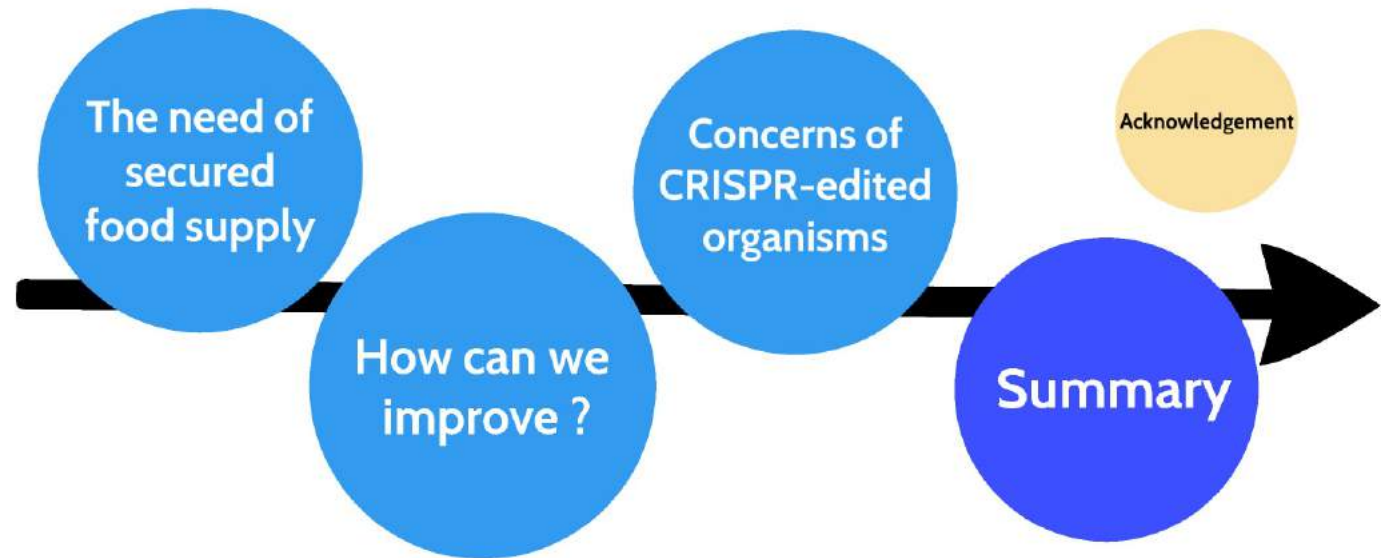
CRISPR



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CRISPR is good, but still we need to be aware of...



1. Will the CRISPR-ed organism change its fitness in challenging environment ?

2. Is there any chance that CRISPR-ed organism reduce biodiversity?

3. In case of pest resistance, is it possible for a line to fight against all pests?

4. Is there any improvement we can make for risk assessment and farmer practices?

**1. Will the CRISPR-ed
organism change its
fitness in challenging
environment ?**



- Can change, still!
- Physiological balance is altered
- For example: Phytohormones

Solution: Try to cover more aspects in trials

CRISPR is good, but still we need to be aware of...



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4. Is there any improvement we can make for risk assessment and farmer practices?

**2. Is there any chance
that CRISPR-ed
organism reduce
biodiversity?**



- Yes!
- Stronger the trait, higher the chances of reducing biodiversity.

Solution: Biodiversity conservation

CRISPR is good, but still we need to be aware of...



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3. In case of pest resistance, is it possible for a line to fight against all pests?



- Maybe not
- Plants have the ability to recognize plenty of pests
- CRISPR does not introduce new genes into plants

->More problem: Ecological impact

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**4. Is there any
improvement we can
make for risk
assessment and
farmer practices?**



- "Spatio-Temporal controllability" should be 'cut-off' criteria for a "better" assessment
- Educating the farmers
- Other: Pest management

CRISPR is good, but still we need to be aware of...



1. Will the CRISPR-ed organism change its fitness in challenging environment ?

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3. In case of pest resistance, is it possible for a line to fight against all pests?

4. Is there any improvement we can make for risk assessment and farmer practices?



Summary

- Review what GMOs brought to us: good or bad
- Current status of GMOs management
- What more can be improved by CRISPR technique
- Potential problems and management of CRISPR in the field

Acknowledgment



Genome Editing for Food Security
and Environmental Sustainability

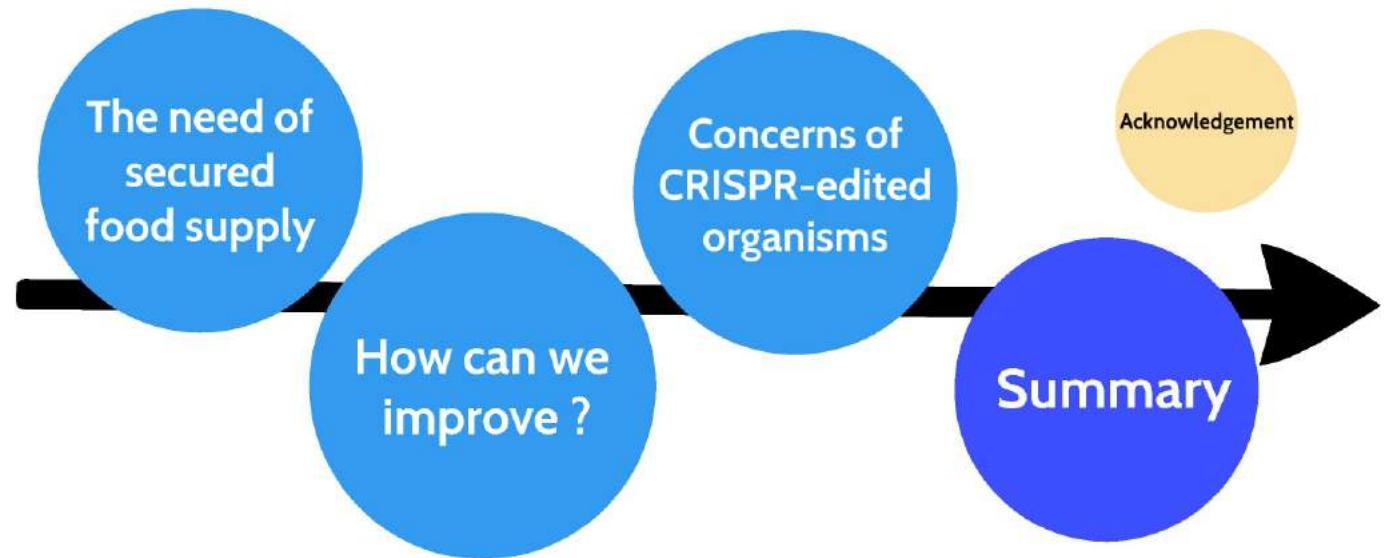
Prof. Raj Duggavathi
Prof. Jaswinder Singh
Dr. Tyler Ford
Prof. RS Sethi
Ms. Japman Kaur Kandola
...and all the classmates

Thank You!!!

Resources

- Prezi (<https://prezi.com>)
- Flaticon (<https://www.flaticon.com/>)

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