



*OECD Working Party
on Agricultural Policies and Markets*

Gene Editing

*Activities in the OECD Working Party
of Biotechnology, Nanotechnology
and Converging Technologies*

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Biotechnology, Nanotechnology and Converging Technologies
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30th November 2016

BNCT Workshop on Gene Editing

‘Gene Editing in an International Context: Scientific, Economic and Social Issues across Sectors’

- 29th – 30th September 2016, Ottawa, Canada
- Attendees from 14 countries, industry, academia, and pressure groups
- Objective:
 - Information exchange and cross-disciplinary discussion on on the science, governance, and economics of gene editing innovations in:
 - Applications in Agriculture & Aquaculture
 - Environmental Applications, and
 - Applications in Human Medicine





BNCT Workshop on Gene Editing: The Preparation

Background Paper
for the
Workshop on

*Gene Editing in an International Context:
Scientific, Economic and Social Issues
across Sectors*

29th - 30th September 2016
Ottawa, Canada

organised by the
OECD Working Party on Biotechnology, Nanotechnology
and Converging Technologies (BNCT)

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BNCT Workshop on Gene Editing



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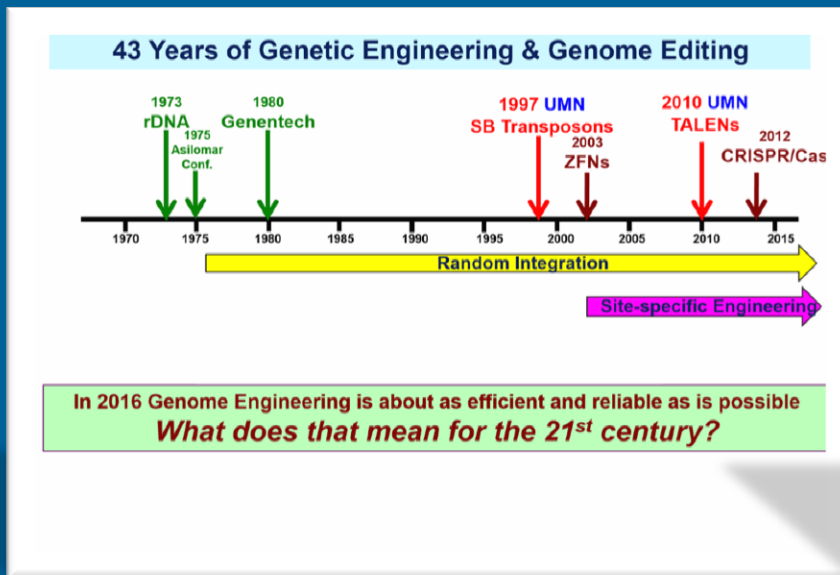
Excited to participate in Gene Editing in the International Contact Workshop this morning in Ottawa hosted by the @OECD and @GenomeCanada



The Workshop Structure:

1. Setting the Scene

- Key-Note 1: *Global R&D in Gene Editing Techniques / The Technological Breakthrough of Gene Editing: Past, Current and Future Developments* (Perry Hackett, Recombinetics, USA)
- Key-Note 2: *Editorial Discretion: Texts and Contexts of Human Genome Editing* (Sheila Jasanoff, Harvard University, USA)



[Source: Perry Hackett, OECD BNCT Workshop on Gene Editing]

Ontological Politics in a Global World

- 31
- **What sorts of entities do we want in the world?**
 - H-bombs, GM foods, greenhouse gases, human genome, human-animal chimeras, nanodevices, stem cells, CRISPR humans?
 - **Who makes the decisions to create new things?**
 - Experts: scientists, lawyers, judges, ethicists
 - Publics and their elected (or non-elected!) representatives
 - **What if principal players don't agree on visions of "the good"?**
 - Are there forums for airing disagreements?
 - Who can participate and how?
 - Are there institutions with authority to resolve disputes?
 - What principles apply? SHOULD APPLY?

[Source: Sheila Jasanoff, OECD BNCT Workshop on Gene Editing]



The Workshop Structure:

2. Giving Examples

AFTER

Case Study – ***Hypothetical!***

Gene Drives for Malaria Elimination - INDONESIA



[Source: Nicole Achee, OECD BNCT Workshop on Gene Editing]



The Workshop Structure:

3. Panel on Innovation Ecosystems

Regulatory Challenges – the Regulatory Soup

- Innovation- and commercialization development and impact of GMO (with a view to a likely future for gene editing)
- Patenting in the ...

Montagues of Berkeley and Capulets of Cambridge?

In fair Verona: “All Are Punish’ed”



Economic losses from delay of decisions

Table 5: Discounted Net Benefits (in billions of \$) of Adoption of GM Corn, Wheat, and Rice

Elasticity Interest Rate Time Horizon	$\eta=0.35$				$\eta=0.8$			
	4%		10%		4%		10%	
	30 Years	Infinite	30 Years	Infinite	30 Years	Infinite	30 Years	Infinite
Corn (7.5%)	136	214	61	67	139	220	63	69
Corn (15%)	254	402	115	126	268	423	121	\$133
Wheat (10%)	178	282	81	88	184	290	83	\$91
Wheat (20%)	328	518	148	162	347	548	157	\$172
Rice (10%)	349	551	158	173	360	568	163	\$178
Rice (20%)	641	1,013	290	318	679	1,073	307	\$337
Total (low)	\$663	\$1,047	\$300	\$328	\$682	\$1,078	\$309	\$338
Total (high)	\$1,223	\$1,933	\$554	\$606	\$1,294	\$2,045	\$586	\$641

- The aggregate benefits of adoption of GM corn, wheat, and rice over the next 30 years range from \$300 billion to \$1.29 trillion.
- The aggregate benefits of adoption of GM corn, wheat, and rice over an infinite time horizon range from \$328 billion to \$2.04 trillion.

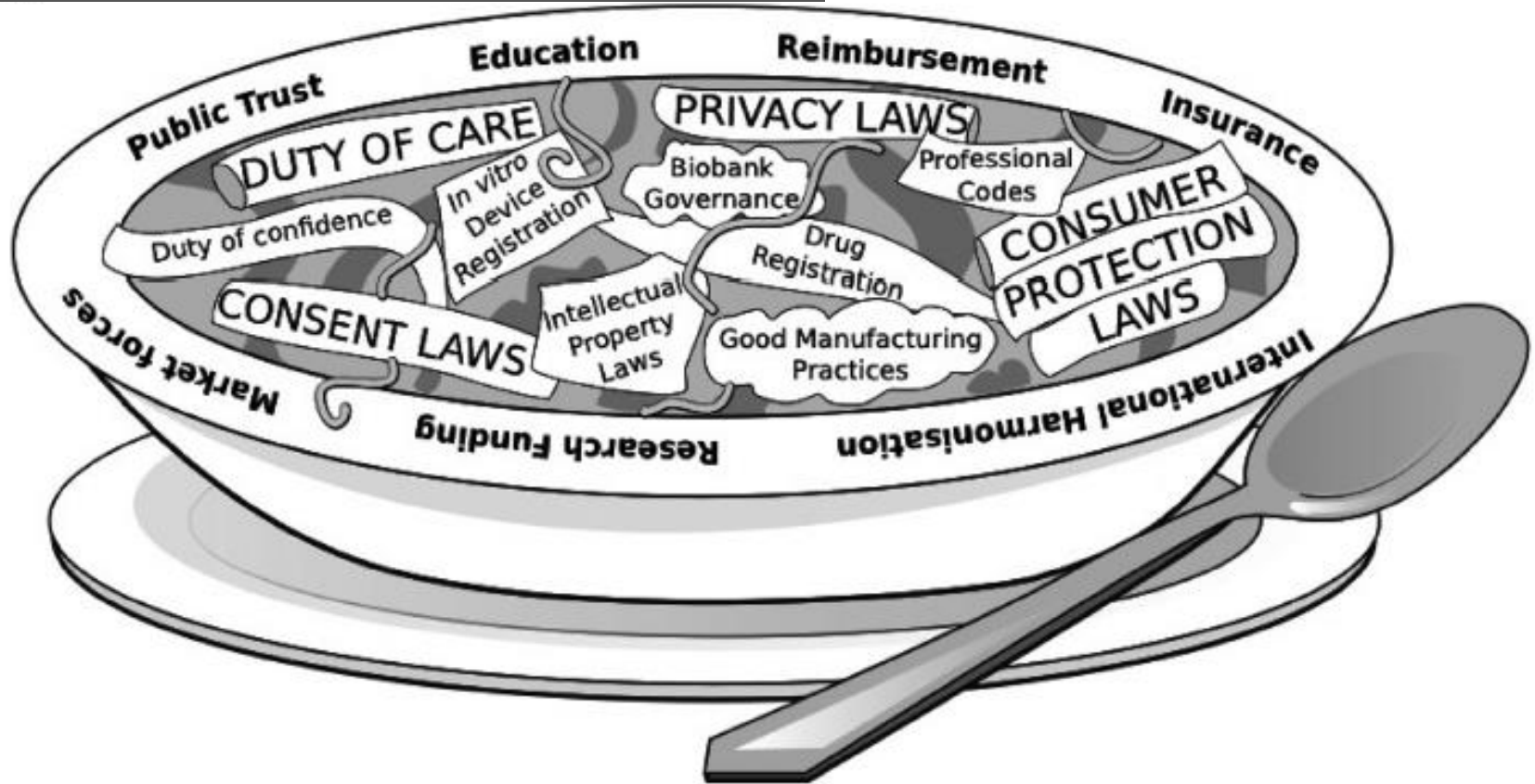
[Source: Dianne Nicol, OECD BNCT Workshop on Gene Editing]



The Workshop Structure:

3. Panel on Innovation Ecosystems

Regulatory Challenges – the Regulatory Soup



[Source: Dianne Nicol, OECD BNCT Workshop on Gene Editing]



The Workshop Structure:

4. Application Specific Breakout Sessions

- Delegates attended breakout groups according to their expertise:
 - *Applications in Agriculture and Aquaculture*
 - *Environmental Applications*
 - *Applications in Human Health*
- ... to discuss issues of:
 - a) potential benefits and risks,*
 - b) issues of governance, ethics and biosecurity,*
 - c) public engagement,*
 - d) innovation and commercialisation*



**SNEAK PREVIEW:
RESULTS FROM THE
BREAKOUT SESSIONS**



Sneak Preview: Results from the Breakout Sessions (1)

- Benefits & Risks:
 - Various risks and benefits were discussed in all application sector sessions
 - Discussions included the definition of what should be considered under the heading on 'risks and benefits'
 - Distinction between technical R/B, ethical R/B, perceived R/B ...
- Issues of Governance, Ethics and Biosecurity:
 - monitoring responsibility/feasibility,
 - inclusivity,
 - risk assessment approaches,
 - harmonization,
 - long-term effects,
 - questions of responsibility,
 - therapy vs enhancement,
 - data secrecy,
 - privacy,
 - roles / players.



Sneak Preview:

Results from the Breakout Sessions (2)

- Public Engagement:
 - Resounding agreement that it is absolutely necessary
 - Some breakout groups explored WHY it was so essential

- Innovation and Commercialization:
 - Patenting (e.g. pros and cons; openness vs protection)
 - What is Responsible Innovation? (e.g. potential misuse)
 - Balance of regulatory costs against the potential risks of the application
 - Timeliness and commercial opportunities vs potential barriers to innovation

CRP: Information & Excellence

- Excerpts from a presentation by Wayne Powell, CGIAR
(delivered at a CRP-funded event: 'Genome Editing and the Future of Farming',
Edinburgh, 6. September 2016)

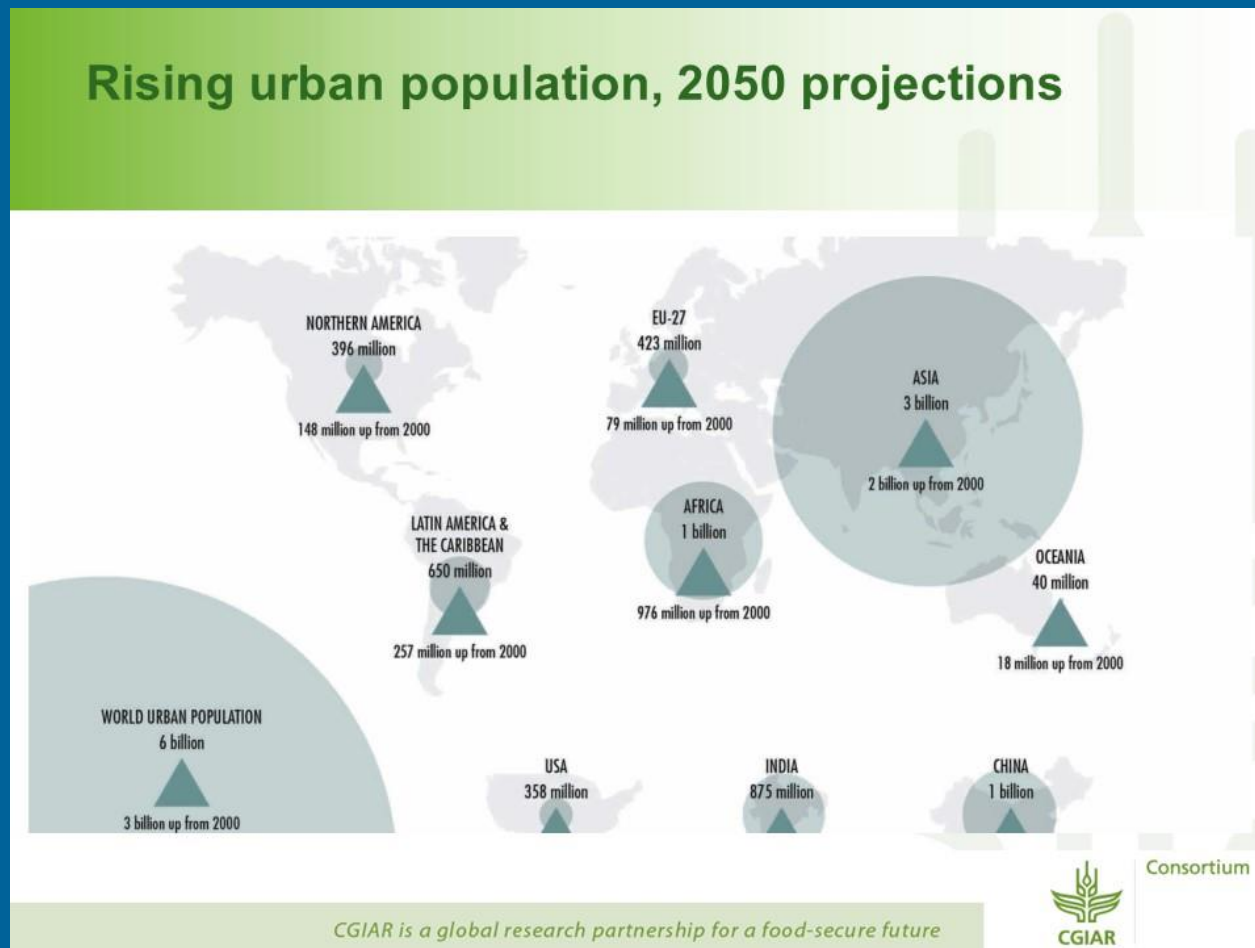
New research indicates that the Syrian refugee crisis has roots within climate change.



*Migration
is a legitimate
form of adaptation to
climate change*

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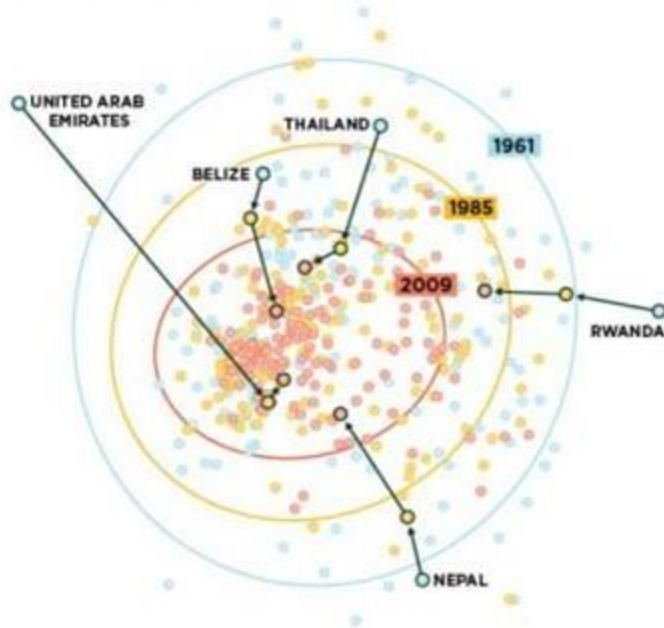


Convergence of global diets & a need for diet diversity

A study of the world's countries finds that over the last 50 years, diets have become ever more similar.

Each country's food supply composition in contribution to calories in:

1961 1985 2009

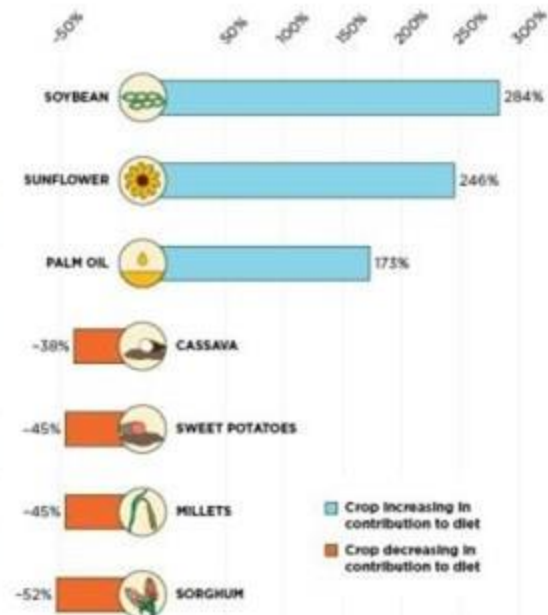


Source: Khoury et al. 2014, Proc. Natl. Acad. Sci. USA.

Over the last 50 years, the global diet has shifted dramatically, including greater amounts of major oil crops and lesser quantities of regionally important staples.

Average change in the calories from crops in national diets worldwide, 1961-2009

Percent change in calorie contribution to diet



Source: Khoury et al. 2014, Proc. Natl. Acad. Sci. USA.

Understanding & prioritizing Strategic Drivers

Today

Rural Development

Precision Farming
Industrial Agricultural System
Response to Mass Demand
Resilience (agricultural, societal)

High-Tech World

Urbanisation / Changing Diets

Intensifying Environmental Costs
Resource Use Efficiency/Waste Reduction

Sustainable Intensification

Responsible Diets
Climate Change Adapted Crop Systems

Globalised Trade System

Regionalised Trade Systems

Culture of Innovation

**Hyper-urbanisation
Rapid Change in Diets**

2030

Consortium



THANK YOU!

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