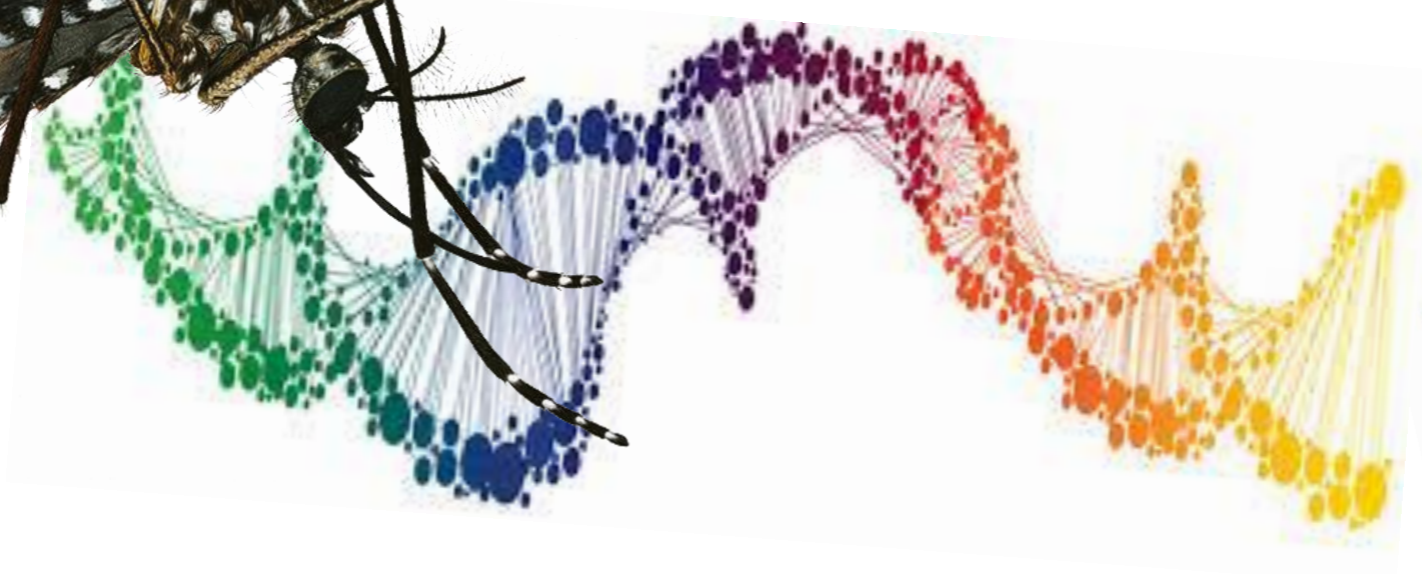


Biotechnology Products and Public Perception:

An Unrequited Love Story

Raul F. Medina







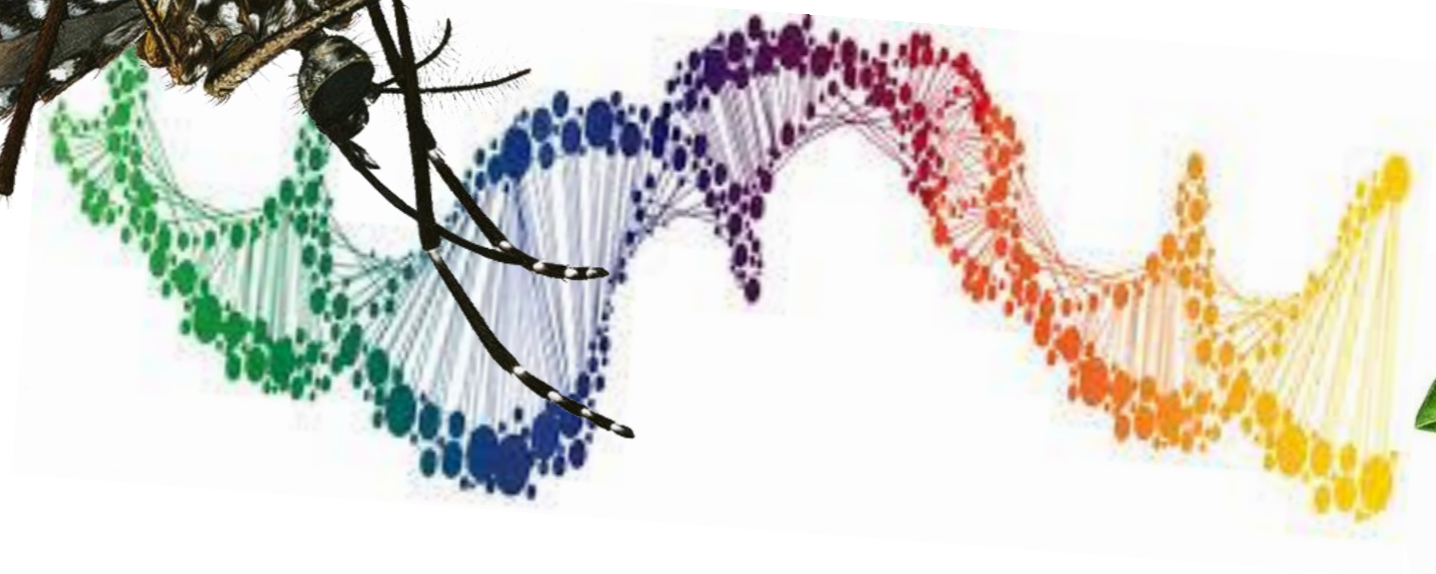
SUSTAINABLE DEVELOPMENT GOALS

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION 	7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES 	 THE GLOBAL GOALS For Sustainable Development			12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION 				14 LIFE BELOW WATER





MULTISPECIES



G M O S ?

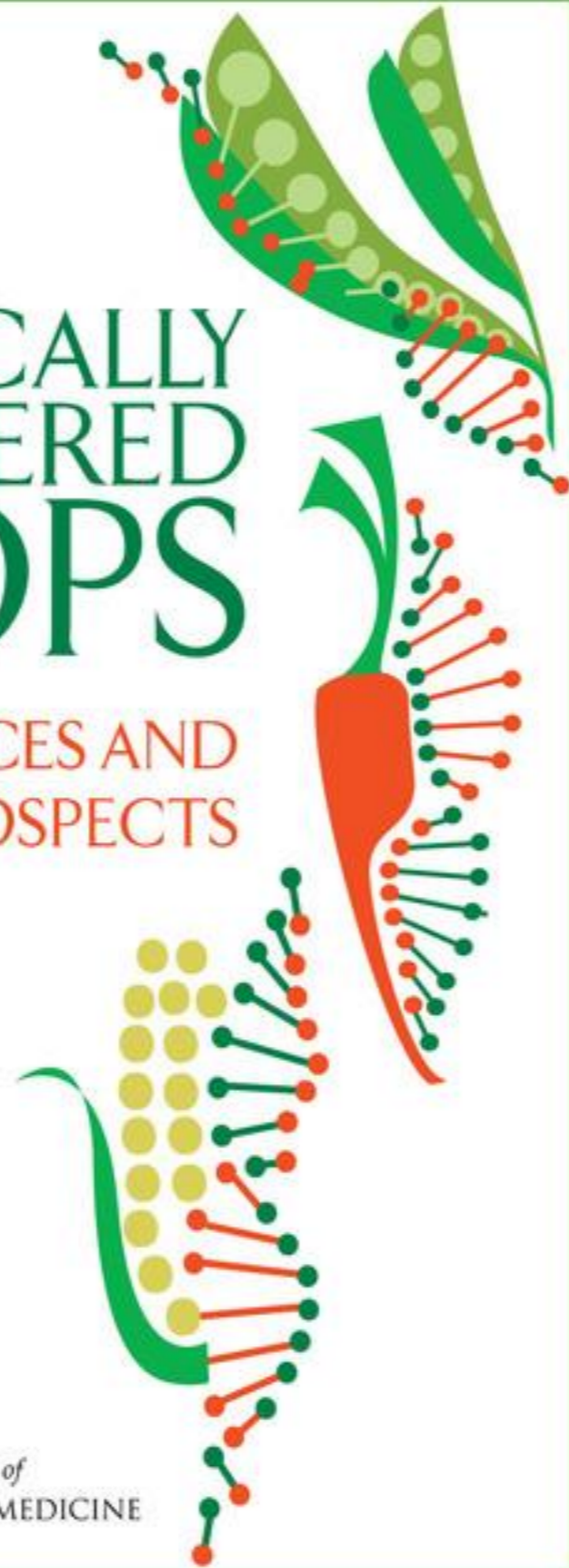




GENETICALLY ENGINEERED CROPS

EXPERIENCES AND
PROSPECTS

The National Academies of
SCIENCES • ENGINEERING • MEDICINE





**NO
GMO**

LET **US**
DECIDE!
LABEL FOODS
CONTAINING GMO'S

**GMO
OMG
WTF**
Are we eating?

GMO

**STOP
MONSANTO**

MONSANTO
Helping you eat wrong
or sicker

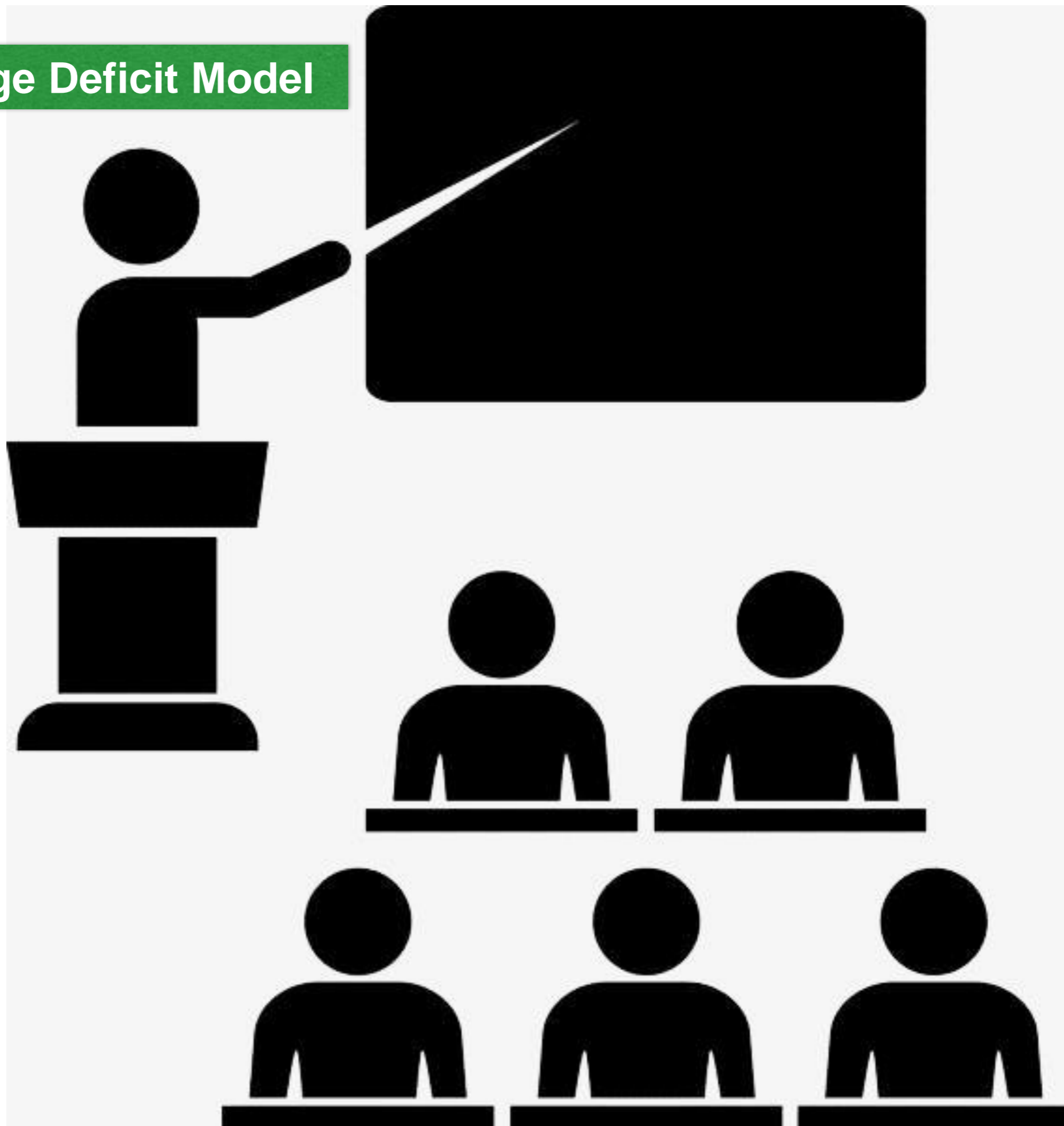
**KEEP
POISON
OFF
YOUR
PLATE**

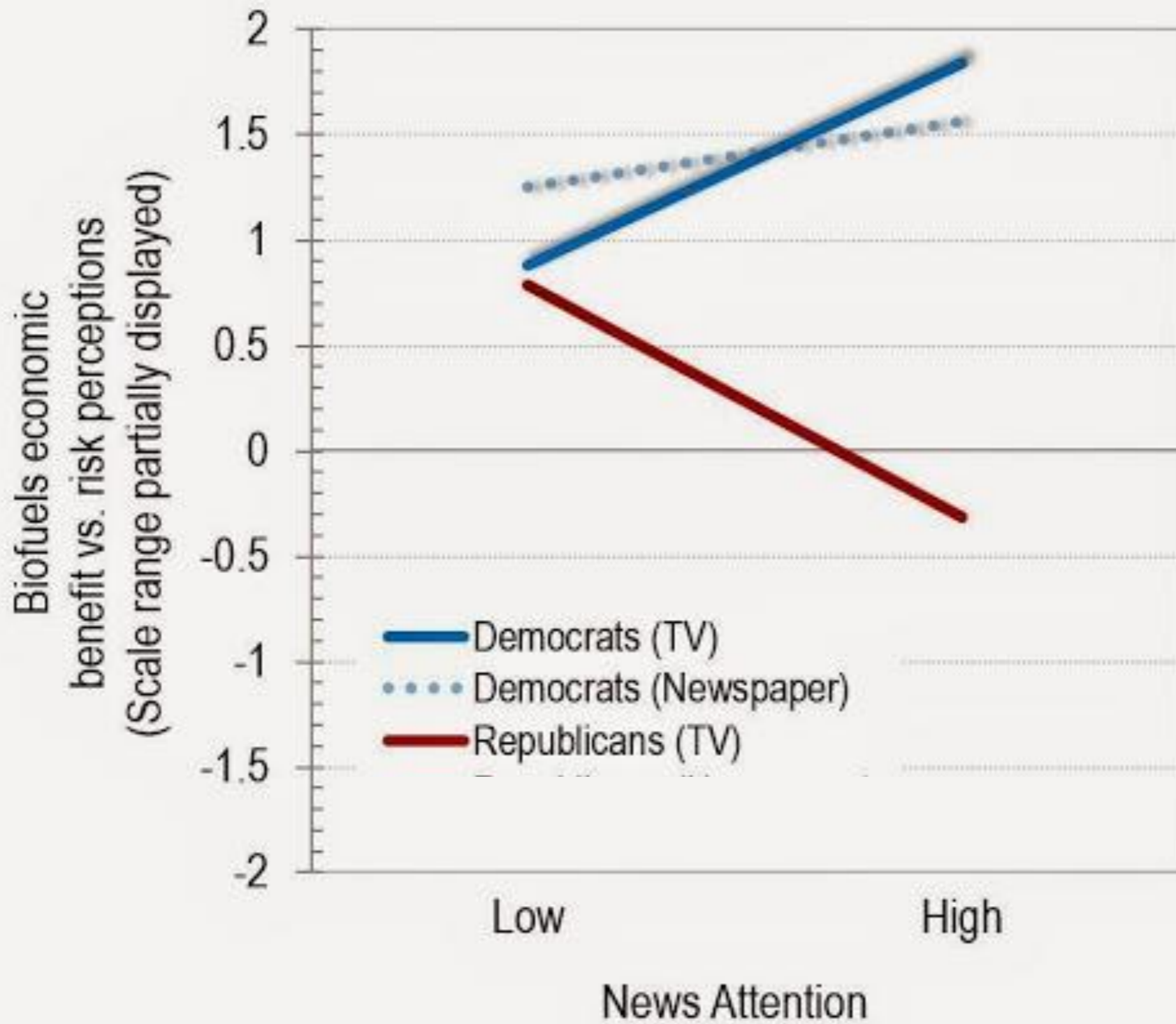
**MONSANTO
IS SATAN
L YOUR
GMO PLAIN**

**NO MORE
MONSANTO**



Knowledge Deficit Model



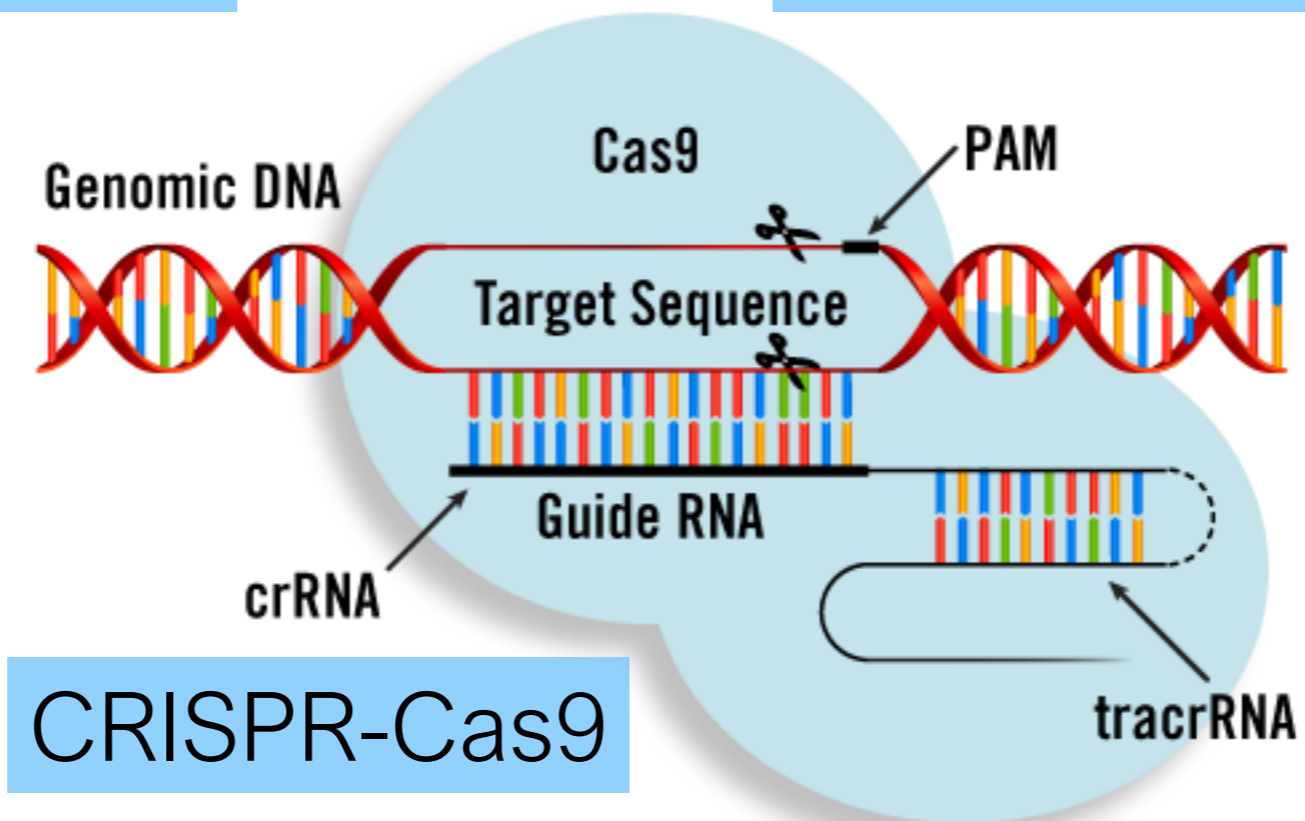




Dr. Jennifer Doudna



Dr. Emmanuelle Charpentier



CRISPR-Cas9

SN

DNA Sketch-Artist

Beeswax Goes Way Back

Pluto's Latest Surprises

Fossil Hunting From Home

SCIENCE NEWS MAGAZINE
SOCIETY FOR SCIENCE & THE PUBLIC
DECEMBER 12, 2015

The Power and the Peril



Gene drives could save lives, but also eradicate whole species. Are we ready?



SEEK AND DESTROY
PAM sequences recruit and activate in CRISPR/Cas9 genome-edited



NATIONAL GEOGRAPHIC
AUGUST 2016

The DNA REVOLUTION

With new gene-editing techniques, we can transform life—but should we?



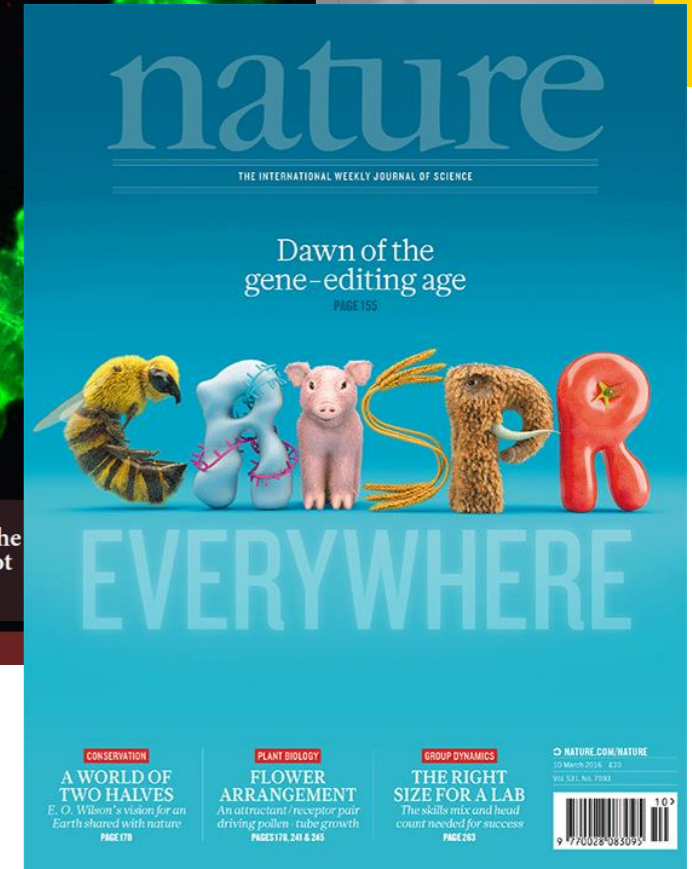
Mosquito CONTROL
MAGAZINE
SUMMER 2015 | ISSUE 8

The Latest High Tech Weapons against Disease
Larvae Engineered in the Lab
PAGE 3

Tap into Courage
PAGE 6

Guard the Tee Shot
PAGE 8

West Nile Virus: Hard Truth ... 4



nature
THE INTERNATIONAL WEEKLY JOURNAL OF SCIENCE

Dawn of the gene-editing age
PAGE 155



EVERYWHERE

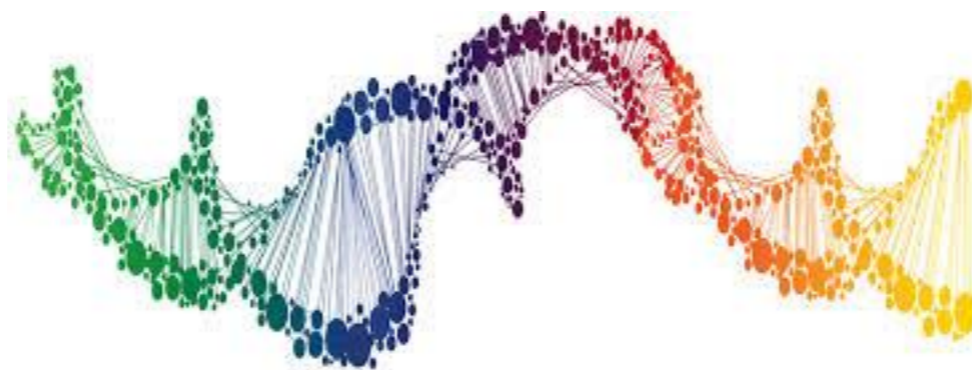
CONSERVATION
A WORLD OF TWO HALVES
E. O. Wilson's vision for an Earth shared with nature
PAGE 178

PLANT BIOLOGY
FLOWER ARRANGEMENT
An attractant/receptor pair driving pollen-tube growth
PAGES 176, 241 & 245

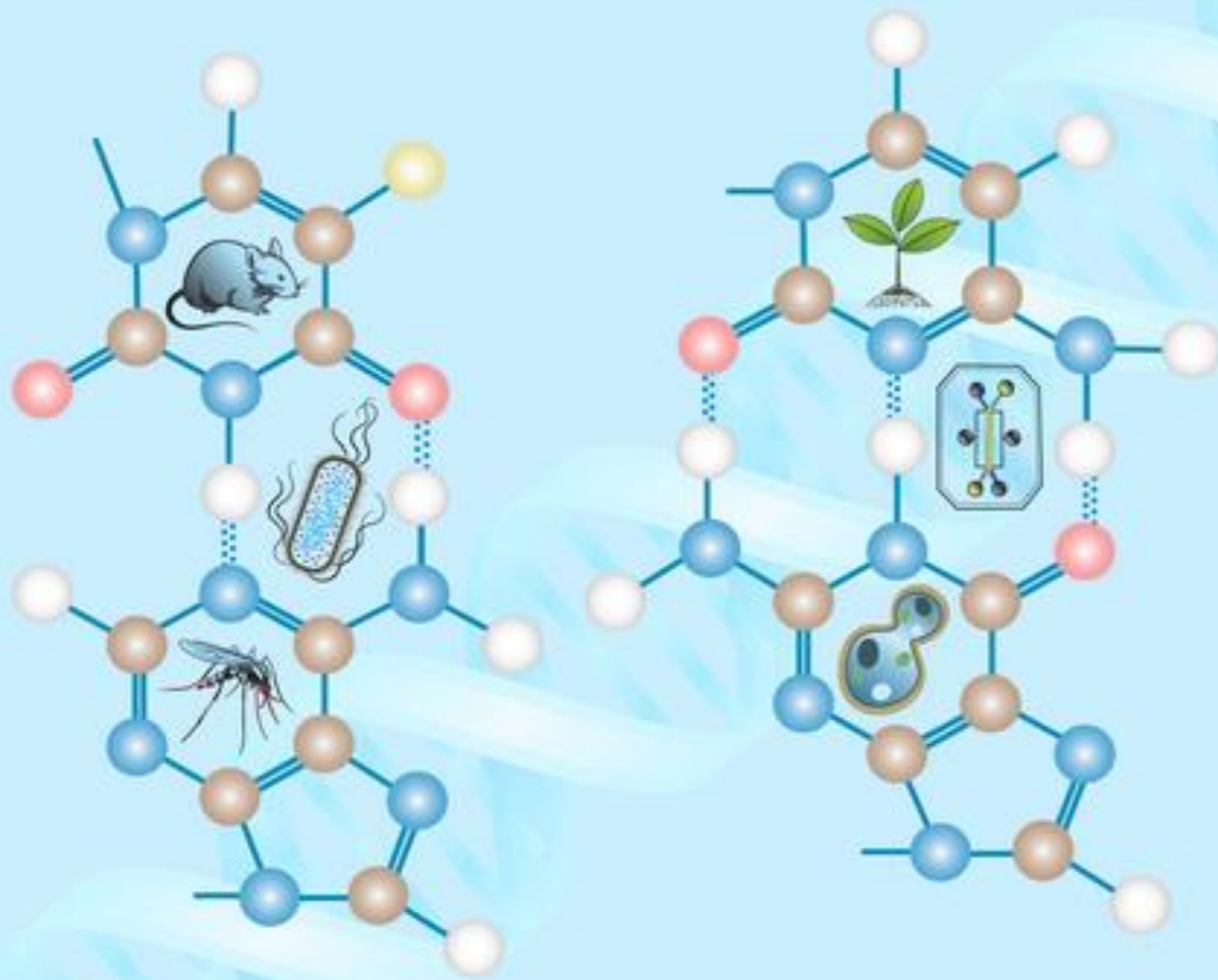
GROUP DYNAMICS
THE RIGHT SIZE FOR A LAB
The skills mix and head count needed for success
PAGE 263

NATURE.COM/NATURE
12 March 2016 £10
ISSN 0028-280X



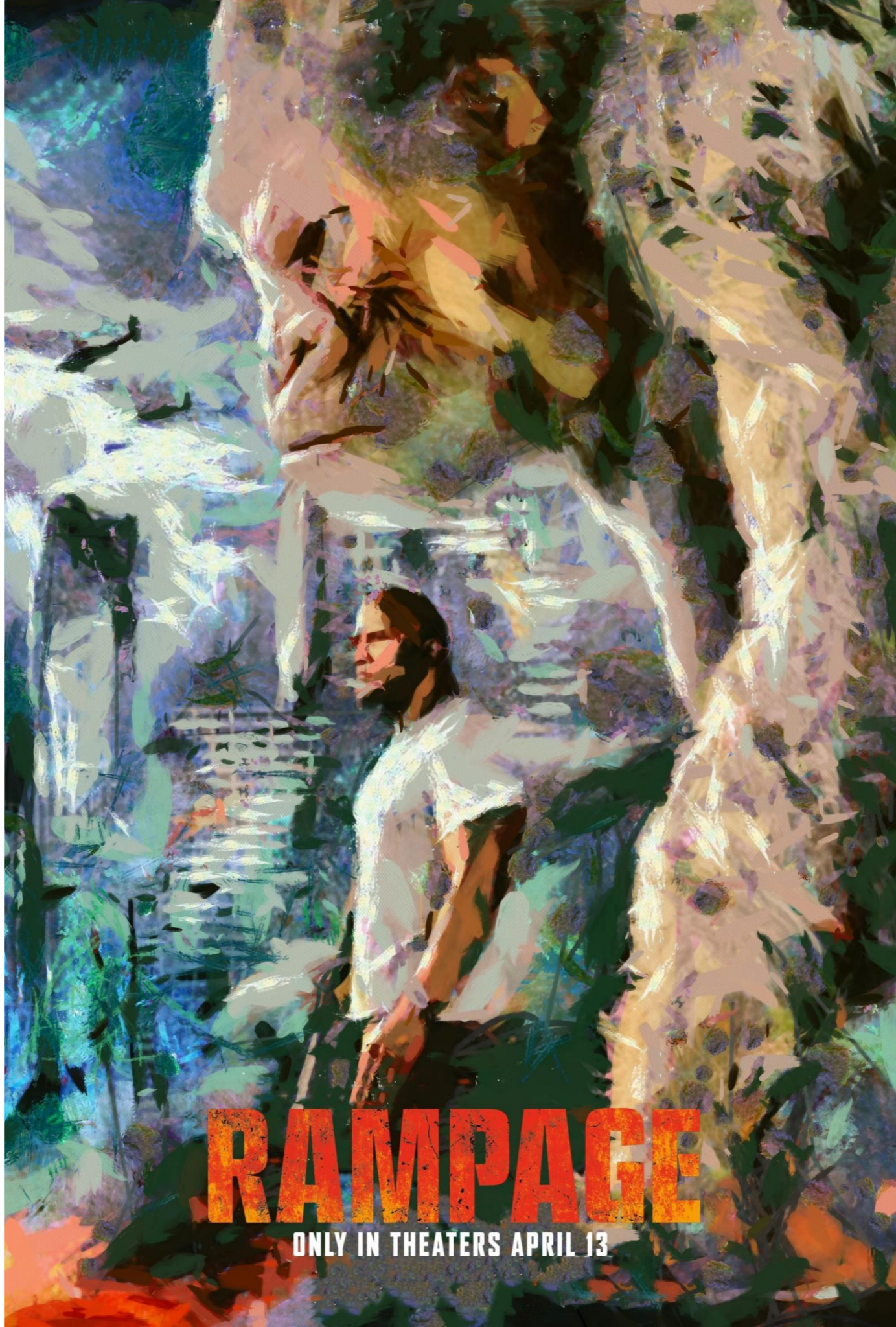


Preparing for Future Products of Biotechnology



	Product Description	On Market ^b	Under Development ^c	Early-Stage Concept
Plants and Plant Products	<i>Bt</i> crops with recombinant DNA (rDNA)	✓		
	Herbicide-resistant crops with rDNA	✓	✓	
	Disease-resistant crops with rDNA	✓	✓	
	RNAi modified crops	✓	✓✓✓	✓✓✓
	Fragrant moss		✓	
	Do-it-yourself glowing plants		✓	
	Genome-edited crops		✓✓✓	✓✓✓
	Crops with CRISPR knockouts		✓✓✓	✓✓✓
	Grasses for phytoremediation		✓	
	Plants as sentinels		✓	
	Crops with increased photosynthesis efficiency		✓	
	Ever-blooming plants			✓
	Nitrogen-fixing nonleguminous plants			✓
	Bioluminescent trees			✓
	Plants with gene drives for conservation purposes			✓
	Plants with gene drives for agricultural purposes			✓
Animals and Animal Products	Fluorescent zebra fish	✓		
	Sterile insects		✓	
	Genome-edited animals (e.g., polled cattle)		✓	✓
	Reduced-allergen goat's milk		✓	
	Landmine-detecting mice		✓	
	Animals revived from near extinction or extinction			✓
	Animals with gene drives for control of invasive mammals			✓
	Animals with gene drives for control of insect pests			✓
Microbes and Microbial Products	Biosensors/bioreporters		✓	
	Bioremediation		✓	
	Engineered algal strains		✓✓✓	
	Nitrogen-fixing symbionts		✓	
	Probiotics			✓
	Genomically engineered microbial communities			✓✓✓
	Biomining/bioleaching			✓✓✓
Synthetic Organisms/ Nucleic Acids	Cell-free products		✓	
	DNA barcodes to track products	✓	✓	
	RNA-based spray for insect-pest control		✓	
	Genomically recoded organisms			✓
	Biological/mechanical hybrid biosensors		✓	✓





RAMPAGE

ONLY IN THEATERS APRIL 13





"Give your throat a vacation...

Smoke a **FRESH** cigarette"

If the cigarette you have been smoking stings or burns your throat, switch to Camels and see the difference.

It's the peppery dust left in tobacco by inefficient cleaning methods that makes you cough.

It's the unkindly hot smoke of harsh, dried-out tobacco that burns and irritates your throat.

There is no peppery dust in Camels—that's whisked away by a special vacuum-cleaning process.

There are no stale, crumbly, parched tobaccos—the fine Turkish and mild Domestic tobaccos of which Camels are blended come to you in prime, factory-fresh condition, thanks to the Humidor Pack.

This scientific germ-safe wrapping—not plain ordinary Cellophane, but moisture-

proof Cellophane which costs nearly twice as much—seals in all the natural aroma and freshness, seals it so tightly that wet weather cannot make Camels damp, nor drought weather make them dry.

Camels are milder and more throat-friendly because they are dust-free and fresh.

Give your throat a vacation, switch to Camels for just one day. Then leave them—if you can.

There is NO CAMEL SMOKELESS TOWEL containing Menthol, Menthol and Very Mild or Camel Protection, American Jockey Brand or Columbia Cigarettes—except eight except Humidor.



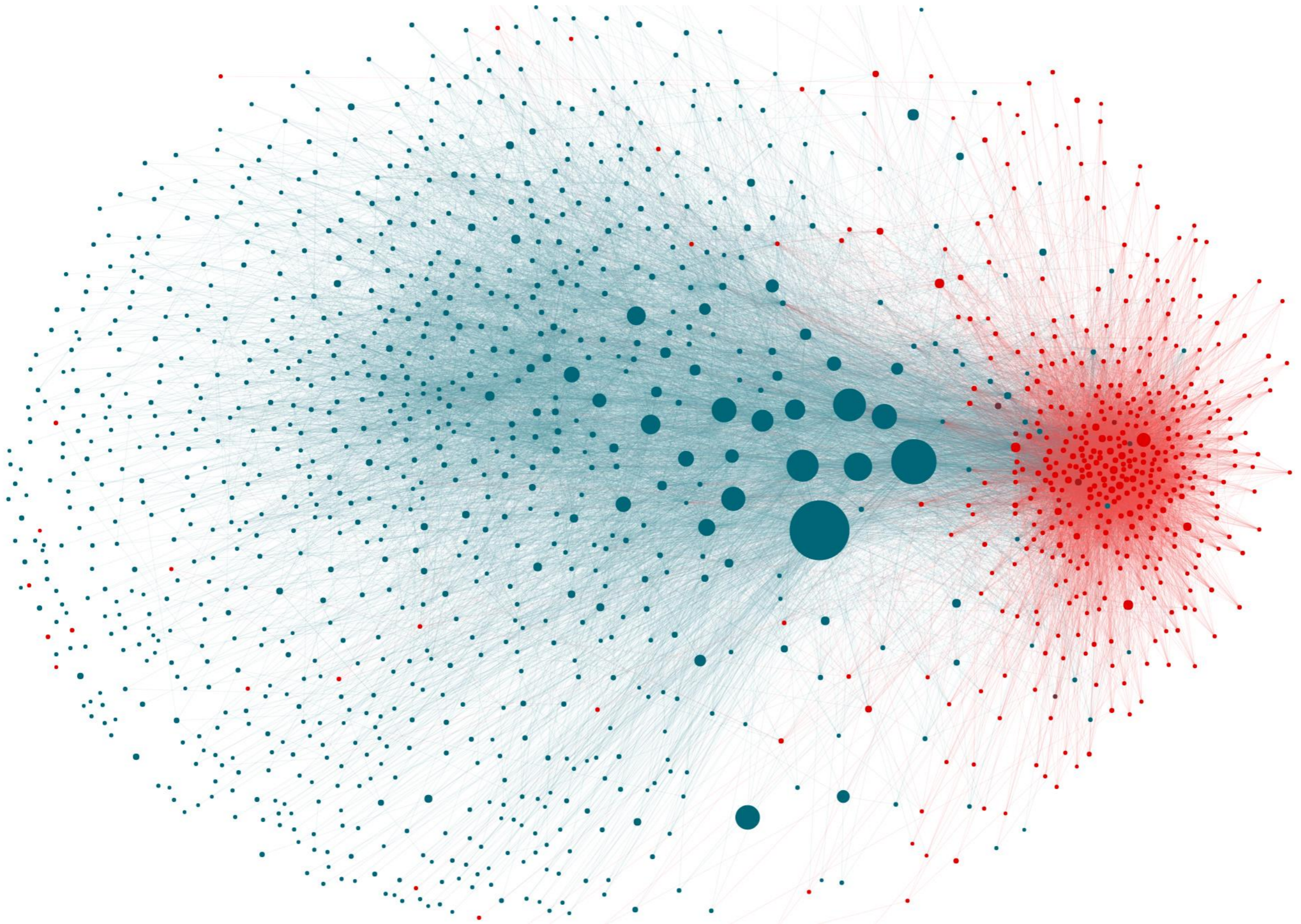
CAMELS

Mild... NO CIGARETTE AFTER-TASTE



Don't remove the moisture-proof wrapping from your package of Camels after you open it. The Humidor Pack is protection against dust and germs. It allows and allows, even in the dry atmosphere of artificial heat, the Humidor Pack delivers fresh Camels and keeps them right until the last one has been smoked.

Tribalism



Tribalism

Value Systems

Public Trust

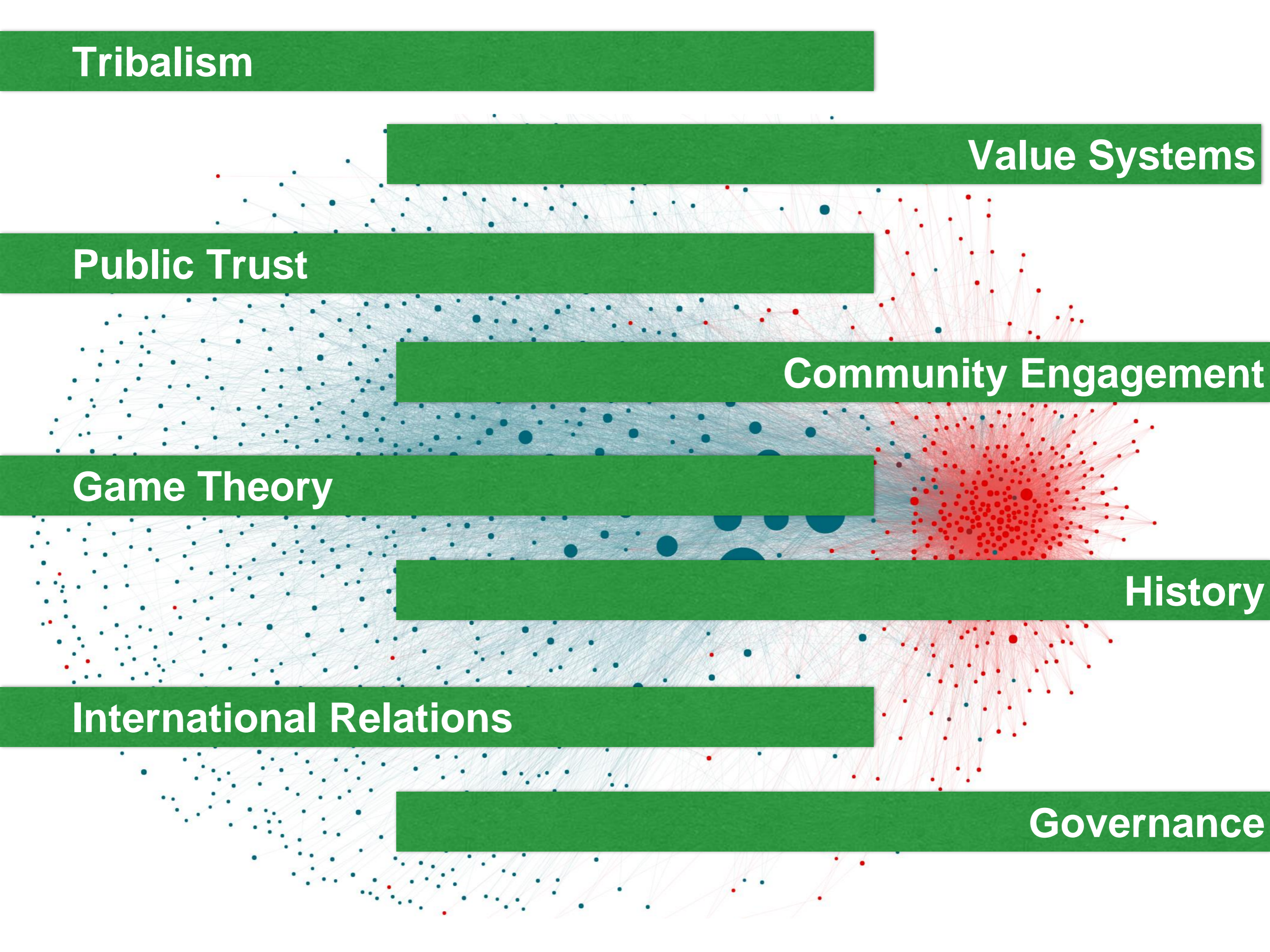
Community Engagement

Game Theory

History

International Relations

Governance



The Coordinated Framework for the Regulation of Biotechnology



Inquisitive Engagement

Deliberative Engagement



INSIGHTS



POLICY FORUM

SOCIAL SCIENCE

The crisis of democracy and the science of deliberation

Citizens can avoid polarization and make sound decisions

By John S. Dryzek¹, André Bächtiger², Simone Chambers³, Joshua Cohen⁴, James N. Druckman⁵, Andrea Felicetti⁶, James S. Fishkin⁷, David M. Farrell⁸, Archon Fung⁹, Amy Gutmann¹⁰, Hélène Landemore¹¹, Jane Mansbridge⁹, Sofie Marien⁶, Michael A. Neblo¹², Simon Niemeyer¹, Maija Setälä¹³, Rune Slothuus¹⁴, Jane Suiter¹⁵, Dennis Thompson⁹, Mark E. Warren¹⁶

That there are more opportunities than ever for citizens to express their views may be, counterintuitively, a problem facing democracy—the sheer quantitative overabundance overloads policy-makers and citizens, making it difficult to detect the signal amid the noise. This overload has been accompanied by marked

decline in civility and argumentative complexity. Uncivil behavior by elites and pathological mass communication reinforce each other. How do we break this vicious cycle? Asking elites to behave better is futile so long as there is a public ripe to be polarized and exploited by demagogues and media manipulators. Thus, any response has to involve or-

POLICY FORUM

BIOTECHNOLOGY

Global citizen deliberation on genome editing

Global governance can be informed by a deliberative assembly composed of lay citizens

By John S. Dryzek, Dianne Nicol, Simon Niemeyer, Sonya Pemberton, Nicole Curato, André Bächtiger, Philip Batterham, Bjørn Bedsted, Simon Burall, Michael Burgess, Gaetan Burgio, Yuri Castelfranchi, Hervé Chneiweiss, George Church, Merlin Crossley, Jantina de Vries, Mahmud Farooque, Marit Hammond, Baogang He, Ricardo Mendonça, Jennifer Merchant, Anna Middleton, John E. J. Rasko, Ine Van Hoyweghen, Antoine Vergne

ning potential benefits. Relevant models include citizens' assemblies, citizens' juries, deliberative polls, and consensus conferences (9). They can be game-changers: Citizens' assemblies on same-sex marriage, abortion, and climate change in Ireland led to changes not just in law but to the texture of Irish politics—overturning the presupposition that some obstacles to reform were immutable. Currently there is no experience with global citizens' forums [globally oriented multicountry exercises such as World Wide Views (10) have citizens deliberate only with fellow-nationals]. The challenge to consider complex issues in multiple languages is formidable, but Europe-wide forums such as Europolis have demonstrated the success of simultaneous translation.

GLOBAL CITIZENS ASSEMBLY

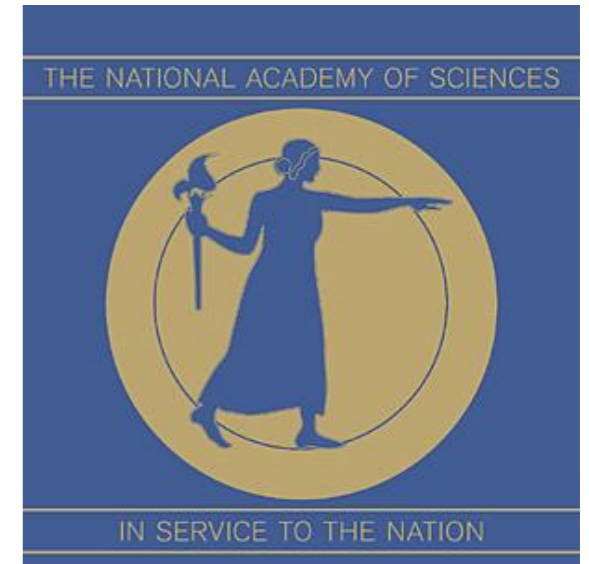
How would a global citizens' deliberation be





Acknowledgments

- *Jennifer Kuzma and Fred Gould* (NC State University)
- *Steven P. Bradbury* (Iowa State University)
- *Kevin M. Esvelt* (MIT Media Lab)
- *Zach Adelman, William West, Ken Portney, Carol, Arnold Vedlitz, Xinsheng Liu, David Kerns, and Leah Buchman* (Texas A&M University)
- *Elizabeth Heitman* (UT Southwestern Medical Center)
- *Taher Lokhandwala* (EY Parthenon)
- *Texas A&M Ento-Grads at Biotech and Ag Discussion Group*



TEXAS A&M
UNIVERSITY®