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Consumers and Foods Made with New Technologies

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Director, Biotechnology Project
Center for Science in the Public Interest
June 9, 2016

Summary of Presentation

- Background on CSPI and the Biotechnology Project
- Consumers, Food and Technology
- New Technology Foods in the Pipeline
- Consumer acceptance
  - Regulation
  - Information/transparency
  - harmonization

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Center for Science in the Public Interest -- Background

- Food and Nutrition consumer organization – more than 45 years old
- Advocacy and education based on the best available scientific evidence
- Called “Food Police” by some

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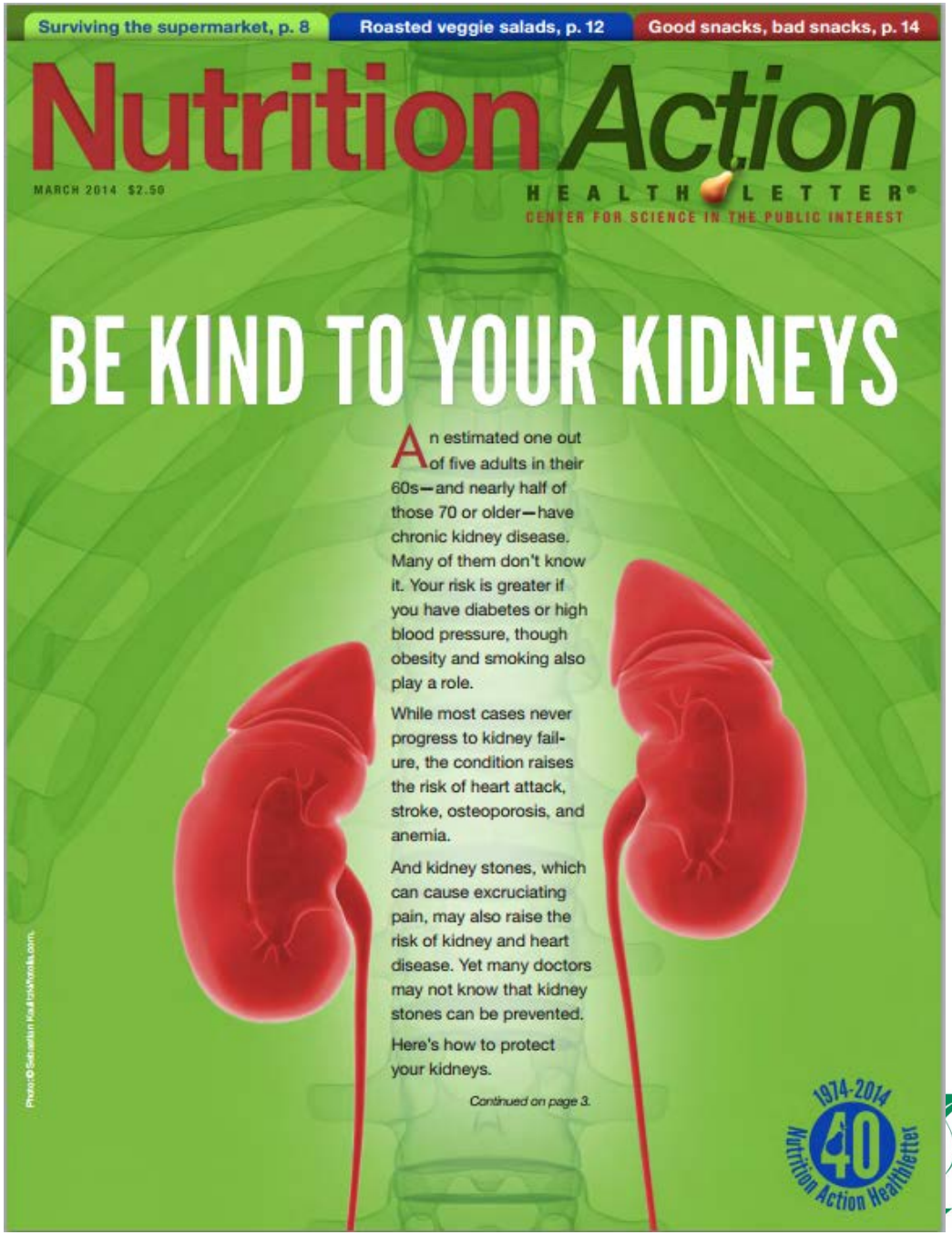

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CSPI (cont.)

- Nutrition Action Healthletter -- 600,000 subscribers in US
  - Useful health and nutrition information to consumers
  - Ranking of products
  - recipes
- No funding from industry or government

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CSPI Biotechnology Project's Positions

- Current crops in the US are safe to eat
- Some benefits from some crops
- Products need to be assessed on a case by case basis
- Functional biosafety regulatory systems that ensure safety and allow safe products to be marketed are essential

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Consumers, Food, and Technology

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Consumers and Food

- Primary concern – safe food
- Also, want healthy, nutritious food
- Taste is important
- Food also serves many other objectives:
  - Culture
  - Tradition
  - Religion
  - Social

Not necessarily rational or scientific

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Consumers and the environment

- Consumers care about the environment
- What will be the impact on the environment?

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Consumers and Science

- Some consumers know a lot of science; some don't know much at all
- Many different sources of information about science – internet, government, scientists, academic institutions, etc…
- Opinion leaders – may be NGOs
- For some consumers, if they believe something, scientific data or arguments may not change their minds

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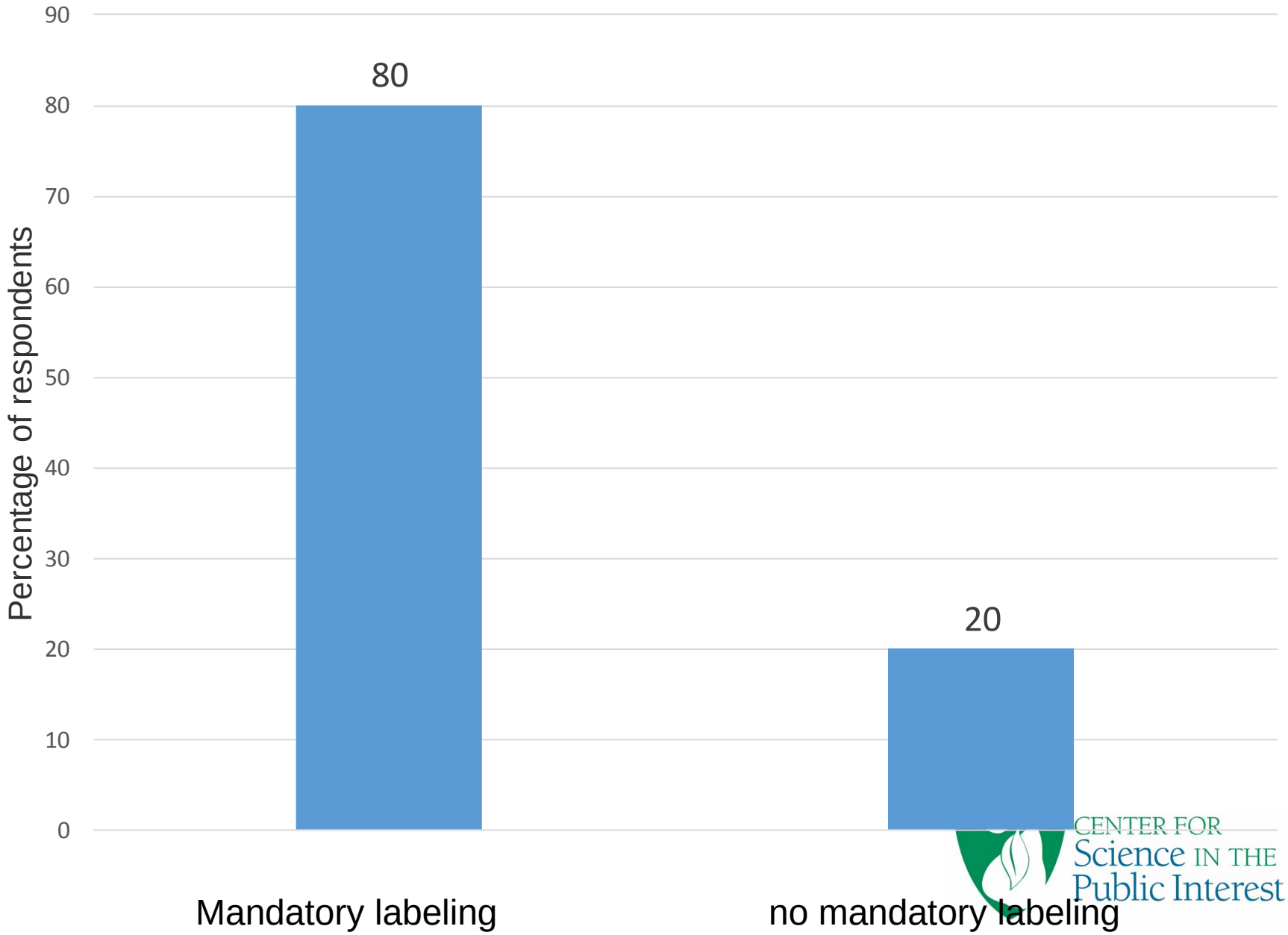
Harris Poll April 29 - May 3, 2016



Harris Poll 2016

- GMO labeling is a:
  - Health and safety issue – 81%
  - Environmental issue – 19%

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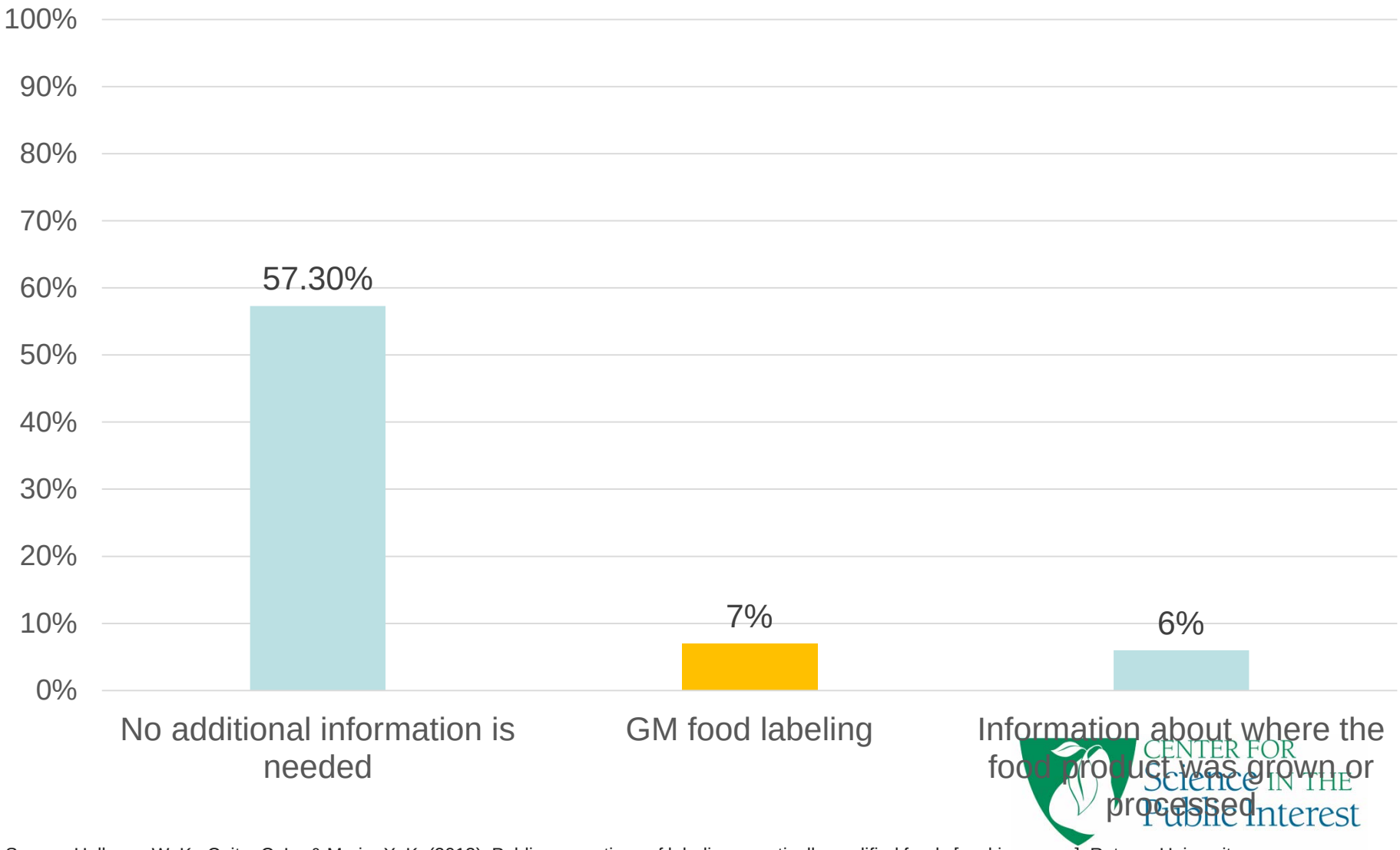
Before introducing the idea of GM foods, survey participants were asked:

What information would you like to see on food labels that is not already on there?



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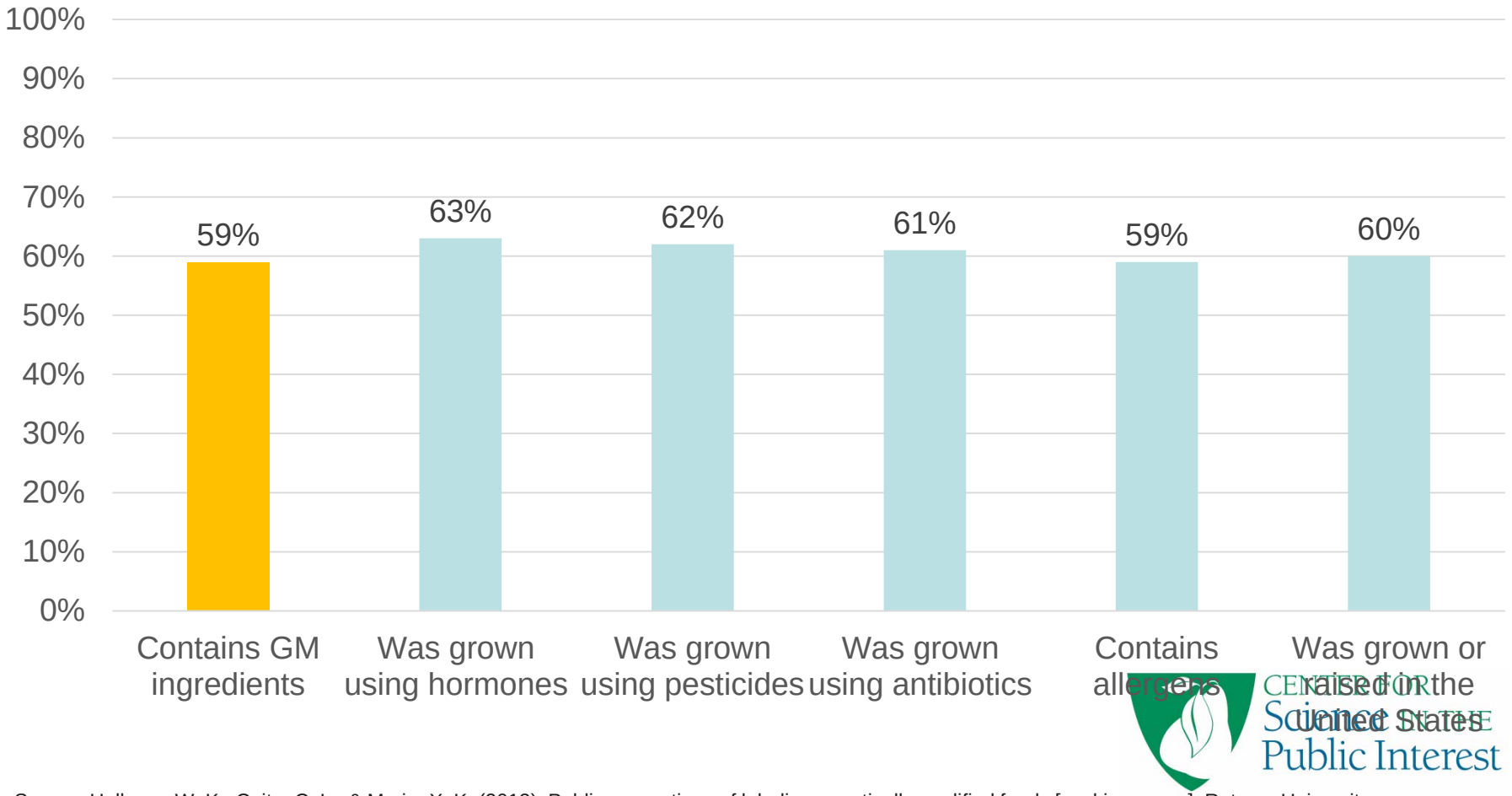
Source: Hallman, W. K., Cuite, C. L., & Morin, X. K. (2013). Public perceptions of labeling genetically modified foods [working paper]. Rutgers University.

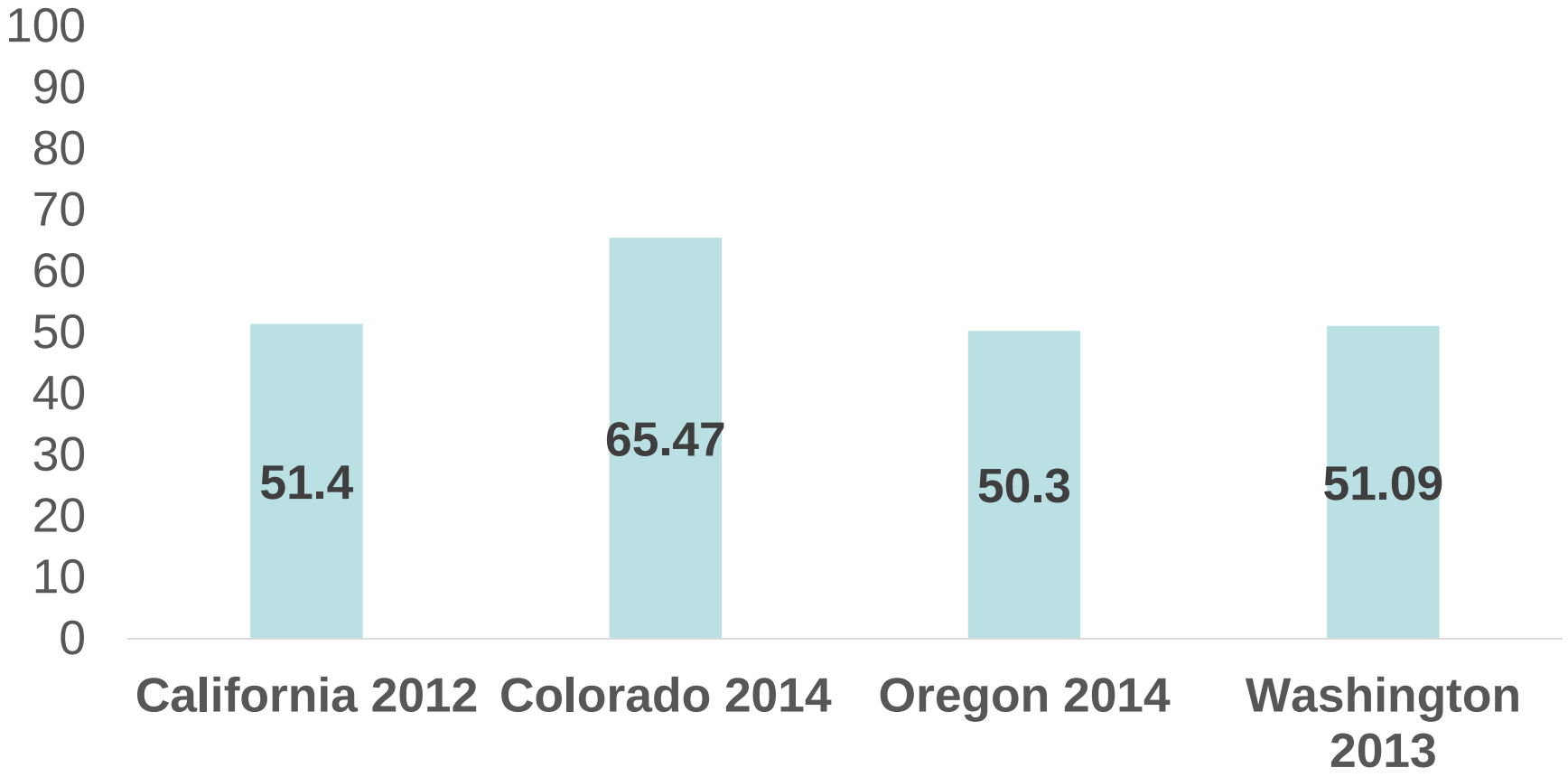
Contextualizing consumer opinions about GM food labeling

Participants believed that it is very or extremely important to have information about whether the product:



Source: Hallman, W. K., Cuite, C. L., & Morin, X. K. (2013). Public perceptions of labeling genetically modified foods [working paper]. Rutgers University.

Percentage of No Votes on State Mandatory GE-Labeling Initiatives



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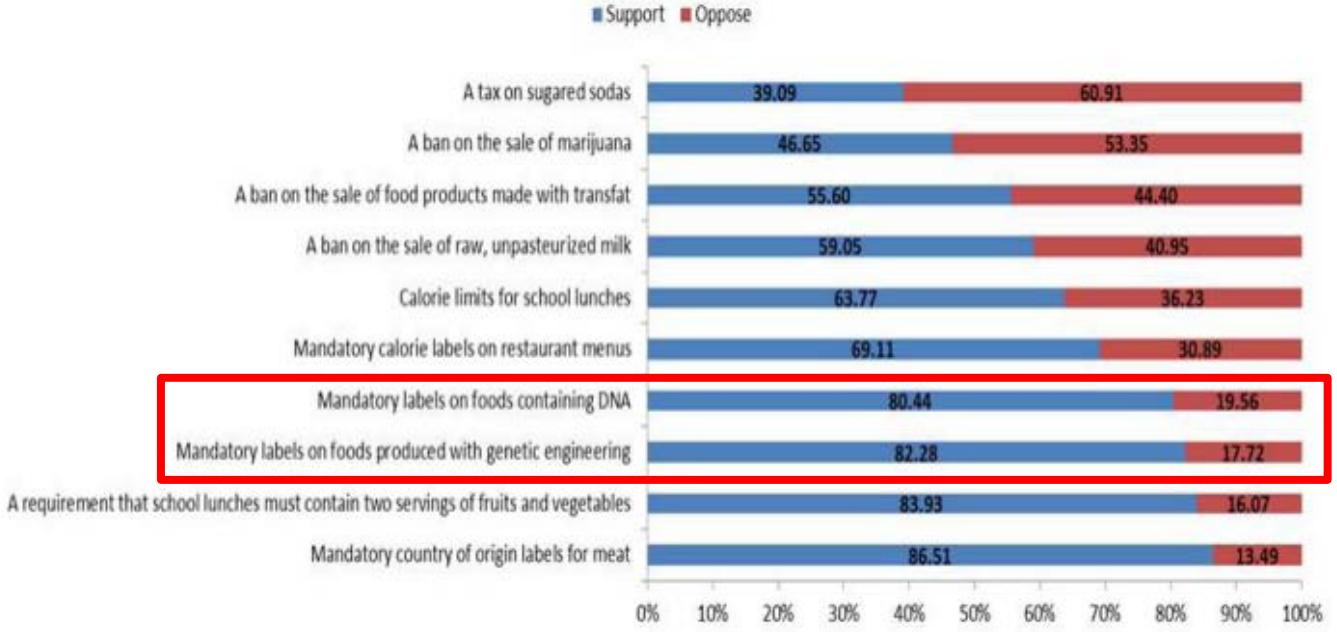
FooDS: Food Demands Survey

Oklahoma State University 2015



Mandatory labels on foods **containing DNA**: **80%**

Mandatory labels on foods **produced with genetic engineering**: **82%**

http://agecon.okstate.edu/faculty/publications/4975.pdf

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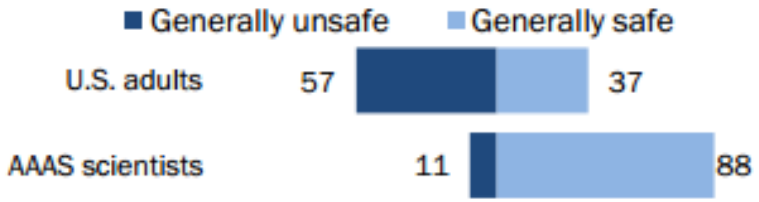
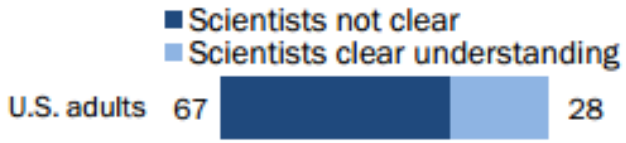
Wide Differences Between Public and Scientists on Safety of GM Foods

% of each group saying it is generally safe or unsafe to eat genetically modified foods



Public Largely Skeptical of Scientific Understanding of Health Effects

% of U.S. adults saying that scientists have or do not have a clear understanding about the health effects of GM crops



Survey of U.S. adults August 15-25, 2014.Q38-39. AAAS scientists survey Sept. 11-Oct. 13, 2014. Other responses and those saying don't know or giving no answer are not shown.

PEW RESEARCH CENTER

Pew Research Center. Public and Scientists' Views on Science and Society. January 29, 2015. http://www.pewinternet.org/files/2015/01/PI_ScienceandSociety_Report_012915.pdf

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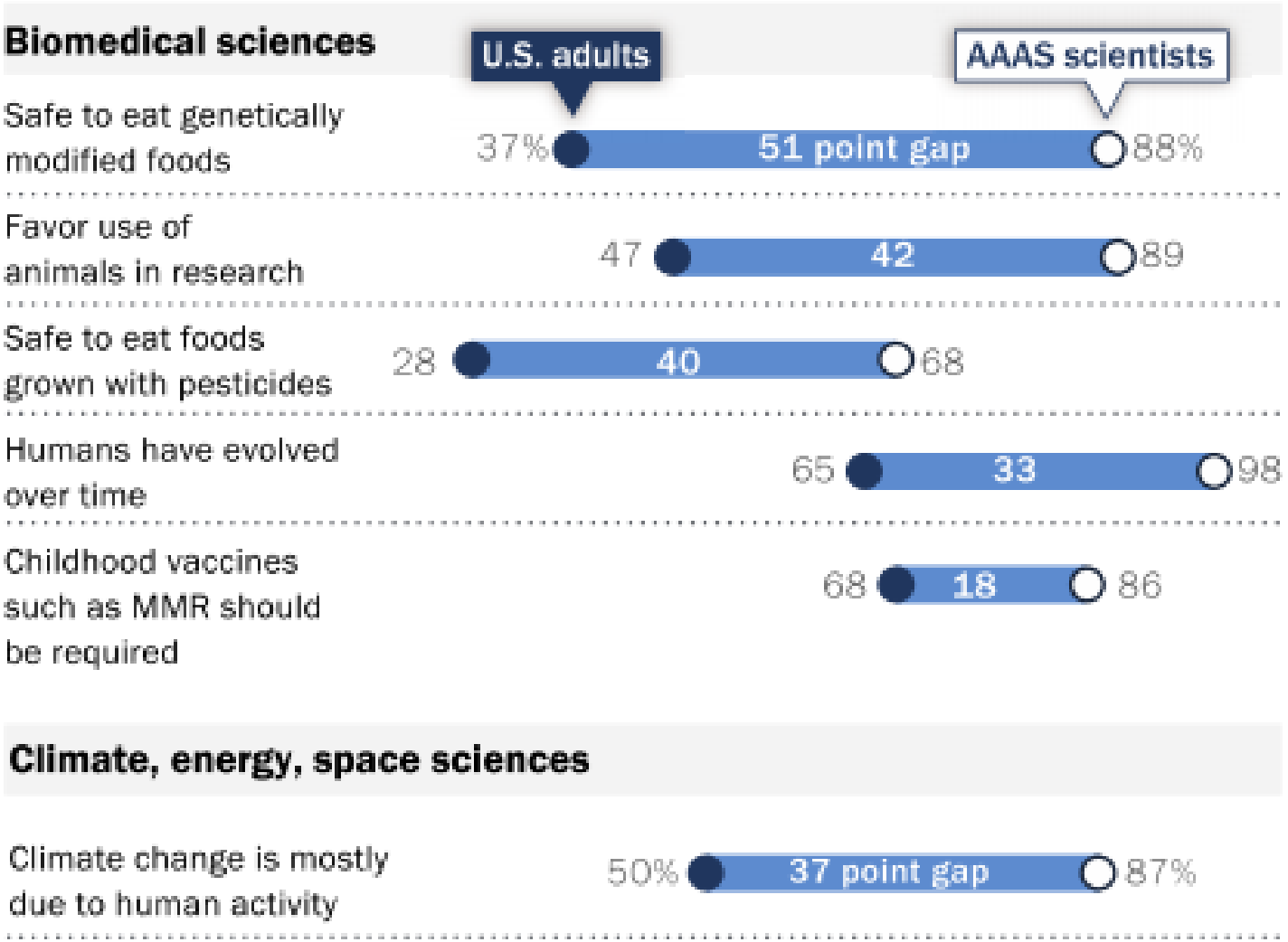
Opinion Differences Between Public and Scientists

% of U.S. adults and AAAS scientists saying each of the following



Pew Research Center. Public and Scientists' Views on Science and Society. January 29, 2015. http://www.pewinternet.org/files/2015/01/PI_ScienceandSociety_Report_012915.pdf

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New Food Technology Products in the Pipeline

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Non-Browning Arctic® Apple

- Developer: Okanagan Specialty Fruits, Inc.
- Arctic® Golden and Granny Smith Apples
- GE: Produce less Polyphenol Oxidase (PPO), preventing browning

http://www.arcticapples.com/

Public Interest

Innate™ Potatoes

- Developer: J.R. Simplot
- Five varieties of Innate™ potatoes
- GE: Silenced PPO (non-browning), reduced Asparagine (low acrylamide potential), and reduced black spot bruise

http://www.simplot.com/plant_sciences

Public Interest

GE Citrus

- Developer: University of Florida
- GE: Resistance to Citrus Greening Disease (~100% of Florida citrus is infected)
- In field trials since 2012
- ~5 years away from final approval

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http://www.npr.org/blogs/thesalt/2013/12/27/257632396/time-is-running-out-to-save-floridas-oranges

Gene Editing Techniques

- Zinc Finger Nucleases
- TALENS
- CRISPR

- More precise and cheaper

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Gene Editing Technique Examples

- Non-browning mushroom made using CRISPR – Penn State
- Virus resistant pig – U. of Missouri
- Waxy corn – Dupont
- Yogurt cultures – Dupont
- Herbicide-tolerant canola and flax -- Cibus

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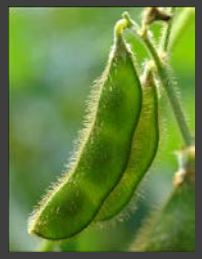
Selected Methods of Breeding Improved Crop Varieties

Transgenic



Ht Soybean

Foreign DNA inserted with agrobacterium or gene gun

Cisgenic

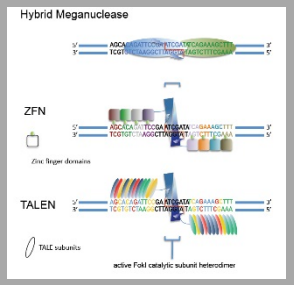
Arctic® Apple

Transformation with DNA from the same type of plant

ZFN-3

Targeted gene addition of foreign DNA

Genetic Editing



ZFN-1 & ZFN-2
TALENs
CRISPR

Mutagenesis

Rio Red Grapefruit

"Traditional" breeding
Chemicals, X-Rays, Gamma Rays

Hybridization

Hybrid Corn

"Traditional" breeding
Cross-breeding different varieties of crops

- Introduced DNA
- Breeding Method
- Trait
- Level of Knowledge
- "natural"

Other Foods from Technology

- Lab grown meat – less fat? Safer?
- Synbio vanillin – Evolva - current in market but not publicly acknowledged
- Synbio saffron – Evolva

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Consumer Acceptance

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Factors for Consumer Acceptance

- Safety, safety, safety
  - Who is ensuring safety? Industry or government
- What do opinion leaders say about it?
  - Government officials, trusted NGOs, academics, etc…
- How much information is known about the product and process?
- Scientific knowledge of the consumer
- Comparison to existing products
- Who benefits?
  - Corporate control
  - Intellectual property

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U.S. Coordinated Framework

New Trait/Crop	Agency	Review
Insect resistance in food crop (e.g., Bt maize)	USDA EPA FDA	Agricultural and environmental safety Environmental, food/feed safety of pesticide Food/feed safety (voluntary)
Herbicide tolerance in food crop (e.g., glyphosate tolerant soybean)	USDA FDA	Agricultural and environmental safety Food/feed safety (voluntary)
Herbicide tolerance in ornamental crop	USDA	Agricultural and environmental safety
Modified oil in food crop (e.g., high oleic acid soybean)	USDA FDA	Agricultural and environmental safety Food/feed safety (voluntary)
Herbicide-tolerant bentgrass using agrobacterium	USDA	Agricultural and environmental safety
Herbicide-tolerant soybeans using gene gun	FDA	Food/feed safety (voluntary)
Herbicide-tolerant Bluegrass using gene gun		No regulation
Gene Edited Products		No regulation?

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Transparency and Engagement

- Need to be transparent with stakeholders and public
- Engage early in the development process
- Be honest – talk about benefits and risks
- Be accurate and not misleading – hiding information suggests there is something to hide

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What to Label?

- Overarching principles:
  - Accurate
  - Neutral
  - Non-misleading
- Fitting the label into the existing food labeling system
- How far back do you go?

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Corn oil from GE and non-GE corn?

Biologically and chemically identical

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Minor ingredients derived from GE crops

INGREDIENTS

INGREDIENTS: ENRICHED WHEAT FLOUR (WHEAT FLOUR, NIACIN, REDUCED IRON, THIAMIN MONONITRATE, RIBOFLAVIN, FOLIC ACID), WATER, LOW-MOISTURE PART-SKIM MOZZARELLA CHEESE (PART-SKIM MILK, CHEESE CULTURE, SALT, ENZYMES), COOKED SEASONED PIZZA TOPPING (PORK, WATER, MECHANICALLY SEPARATED CHICKEN, TEXTURED VEGETABLE PROTEIN [SOY PROTEIN CONCENTRATE, CARAMEL COLOR], SPICES, SALT, SUGAR, SODIUM PHOSPHATE, PAPRIKA, PORK FLAVOR [MODIFIED CORN STARCH, PORK FAT, NATURAL FLAVORS, PORK STOCK, GELATIN, AUTOLYZED YEAST EXTRACT, SODIUM PHOSPHATE, THIAMINE HYDROCHLORIDE, SUNFLOWER OIL, PROPYL GALLATE], CARAMEL COLOR, SPICE EXTRACTIVES, BHA, BHT, CITRIC ACID. COOKED IN PORK FAT OR BEEF FAT OR VEGETABLE OIL), VEGETABLE BLEND (GREEN BELL PEPPERS, BLACK OLIVES, RED BELL PEPPERS, ONIONS), TOMATO PASTE, PEPPERONI MADE WITH PORK, CHICKEN AND BEEF (PORK, MECHANICALLY SEPARATED CHICKEN, BEEF, SALT, CONTAINS 2% OR LESS OF SPICES, DEXTROSE, PORK STOCK, LACTIC ACID STARTER CULTURE, OLEORESIN OF PAPRIKA, FLAVORING, SODIUM NITRITE, SODIUM ASCORBATE, PAPRIKA, NATURAL SMOKE FLAVOR, BHA, BHT, CITRIC ACID), SUGAR, CONTAINS 2% OR LESS OF WHEAT GLUTEN, VEGETABLE OIL (SOYBEAN OIL AND/OR CORN OIL), DEGERMINATED WHITE CORN MEAL, YEAST, SALT, DEGERMINATED YELLOW CORN MEAL, SEASONING BLEND (SALT, SPICE, DRIED GARLIC), BAKING POWDER (BAKING SODA, SODIUM ALUMINUM PHOSPHATE), DATEM, SODIUM STEAROYL LACTYLATE, ASCORBIC ACID (DOUGH CONDITIONER).

CONTAINS: MILK, SOY, WHEAT INGREDIENTS

NUTRITIONAL INFO

Serving Size **1/6 Pizza** (149g)	
Servings per Container 6	
Amount Per Serving	
Calories 350	**Calories from Fat 120**
	% Daily Value*
Total Fat 14g	22%
Saturated Fat 6g	30%
Trans Fat 0g	
Cholesterol 30mg	10%
Sodium 940mg	39%
Total Carbohydrates 40g	13%
Dietary Fiber 2g	8%
Sugars 6g	
Protein 16g	
Vitamin A 6%	Calcium 20%
Vitamin C 4%	Iron 15%

One pizza contains:

- 2100 calories
- 180% daily saturated fat
- 234% daily sodium
- 36 g (9 tsp) sugar

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Determining “natural’

- Scientific definition
- Reasonable person’s perspective
  - Public opinion research?

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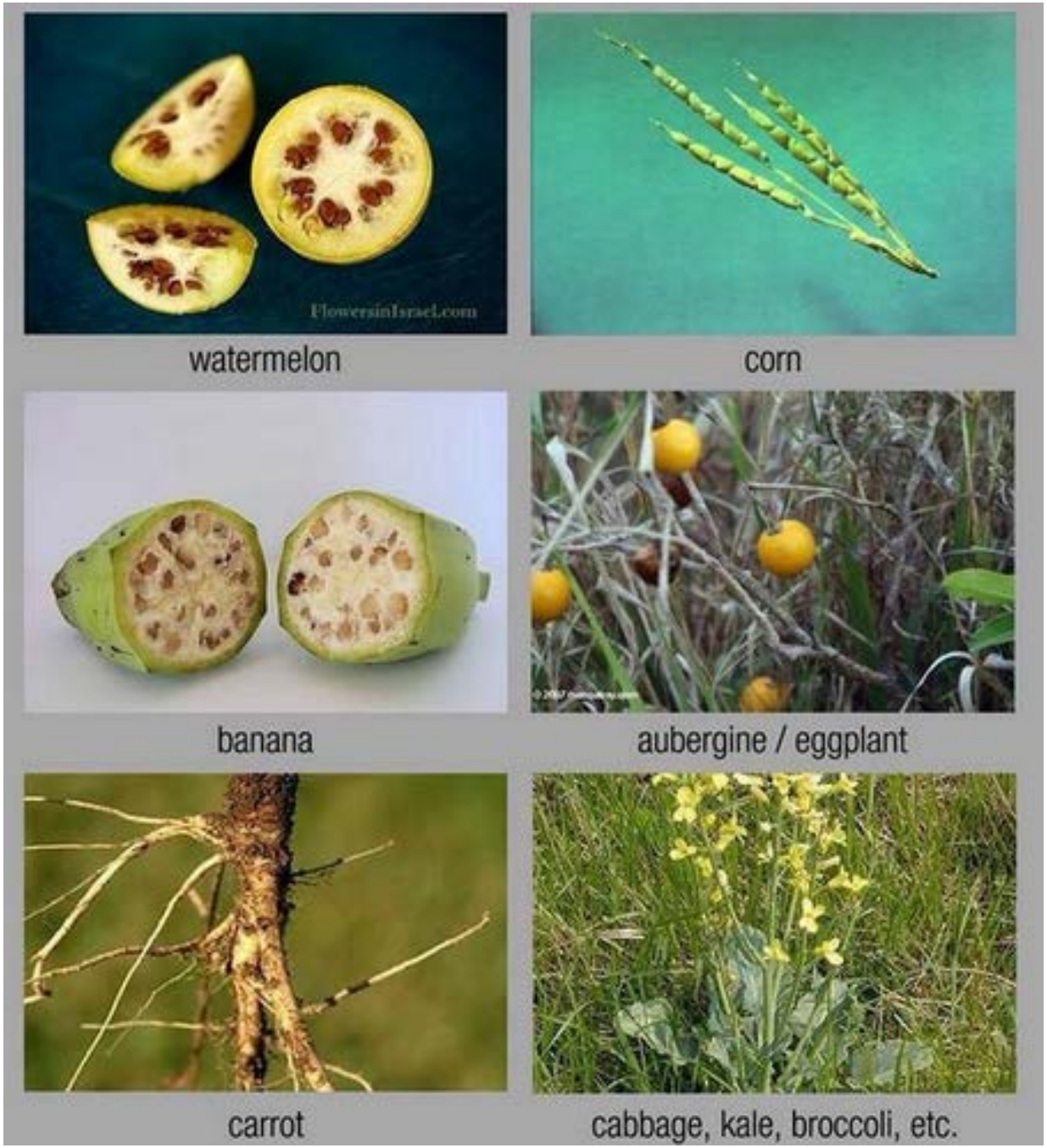
How your food would look if it hadn't been genetically modified over millennia



http://gawker.com/is-the-gmo-labeling-movement-just-a-long-con-to-get-you-1699015048

Pluots

- **NOT “genetically modified”**
- Hybrid: generally 75% plum, 25% apricot
- 46 genetic varieties developed and bred by Zaiger Genetics, including Apriums, Nectaplums, and Pluots

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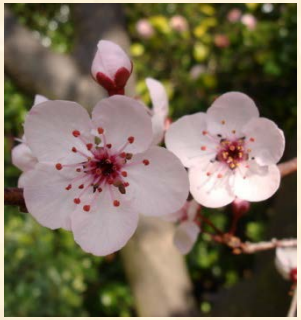
Hybridization Example: Plum x Pluot



“Father” Tree: Plum

When the blossoms are just opening to reveal the pistil, they are picked, ground up, and dried. This is the pollen that will be u[illegible] manually pollinate th[illegible]other” tree.

“Mother” Tree: Pluot

All blossoms are emasculated: everything but the pistil is stripped from the flower by pinching the blossom at the base with tweezers.

Manual Pollination

The pollen from the “Father” tree is dusted onto every emasculated blossom of the “Mother” tree in a greenhouse using a mascara brush. The resulting fruits’ pits have the hybridized genetic code. When the fruit matures, the pit is extracted and planted. After the seedlings mature, their branches are cut off and grafted onto full-grown disease-resistant rootstock.

Harvesting the Fruit

The new trees are monitored and repeatedly evaluated. They will bear fruit 5–7 years after the cross has been made. The fruit will be a new pluot variety.

Mutation Breeding

Rio Red Grapefruit

http://www.wasatchorganics.com/wp-content/uploads/2013/01/WO_RioRedImage1sm.jpg

Gold Nijisseiki Pear

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http://media.growsonyou.com/photos/products/55112.jpg

The genome of cultivated sweet potato contains *Agrobacterium* T-DNAs with expressed genes: An example of a naturally transgenic food crop

Tina Kyndt[a,1], Dora Quispe[a,b,1], Hong Zhai[c], Robert Jarret[d], Marc Ghislain[b], Qingchang Liu[c], Godelieve Gheysen[a], and Jan F. Kreuze[b,2]

[a]Department of Molecular Biotechnology, Ghent University, 9000 Ghent, Belgium; [b]International Potato Center, Lima 12, Peru; [c]Beijing Key Laboratory of Crop Genetic Improvement/Laboratory of Crop Heterosis and Utilization, Ministry of Education, China Agricultural University, Beijing, China, 100193; and [d]Plant Genetic Resources Unit, US Department of Agriculture, Agricultural Research Service, Griffin, GA 30223

Edited by Eugene W. Nester, University of Washington, Seattle, WA, and approved March 16, 2015 (received for review October 13, 2014)

"Given that this crop has been eaten for millennia, it may change the paradigm governing the "unnatural" status of transgenic crops."

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Kyndt, T., Quispe, D., Zhai, H., Jarret, R., Ghislain, M., Liu, Q., et al. (2015). The genome of cultivated sweet potato contains Agrobacterium T-DNAs with expressed genes: An example of a naturally transgenic food crop. *Proceedings of the National Academy of Sciences*, 201419685.

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- Food Safety
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- GMO Info
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GMO Info

Many customers are curious about foods made from genetically modified organisms (GMOs for short). They may wonder about the GMO content of a favorite food. Sometimes they ask for our thoughts on GMOs, especially regarding labeling but also about related issues, for example, whether USDA certified organic is truly non-GMO or a possible connection between gluten sensitivity and GMOs.

Wegmans has studied this issue for over 20 years. In 2012 a team of Wegmans people was formed to listen, learn and provide advice on this and other emerging issues.

What is Wegmans' position on GMOs?

Our job is to bring you a wide array of safe, delicious, healthy foods at consistent low prices. For those wanting to avoid GMOs we point to a growing selection of certified organic products.

Here's what reassures us about the safety of GMO foods and ingredients currently available.

1. All GMO seed companies have consulted with FDA on each potential product. According to FDA, the seed companies have satisfactorily completed every additional test that FDA has asked for, even though this consultation is not required by law.

Want More Info About GMOs?

Read Mary Ellen's Blog Post to Learn More

We're Committed to Organics

Learn What Organics

http://www.wegmans.com/webapp/wcs/stores/servlet/CategoryDisplay?categoryId=284853&storeId=10052&langId=-1&catalogId=10002

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International Harmonization

- Need standard definitions
- Need harmonization by different countries for trade
- What happens if not regulated in U.S. but regulated in EU or China?

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Questions the Public Will Ask (and Food Chain need to answer)

- What are you doing? (need an answer in a scientifically accurate manner that is understandable to the general public)
- Why are you doing it?
- What are the potential risks?
- Who benefits? (who are the winners and the losers?)
- What's in it for me?
- Who is overseeing this to make sure the risks don't materialize?
- How transparent are you?

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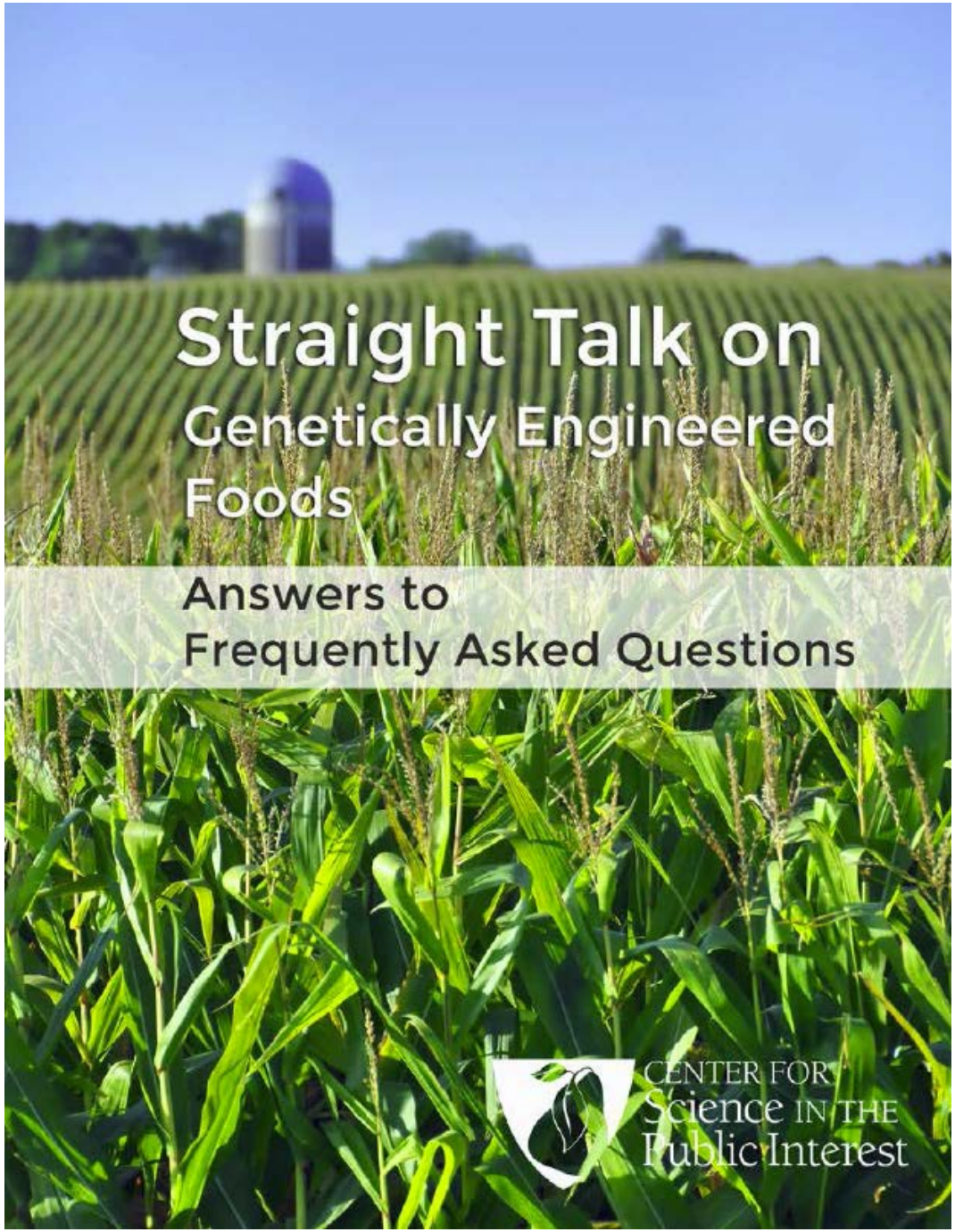

To download ‘Straight Talk’ visit:

http://cspinet.org/new/pdf/biotech-faq.pdf

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