WRITTEN STATEMENT OF DR. NINA FEDOROFF

BEFORE THE

HOUSE COMMITTEE ON AGRICULTURE

RE: THE COSTS AND IMPACTS OF MANDATORY BIOTECHNOLOGY LABELING LAWS

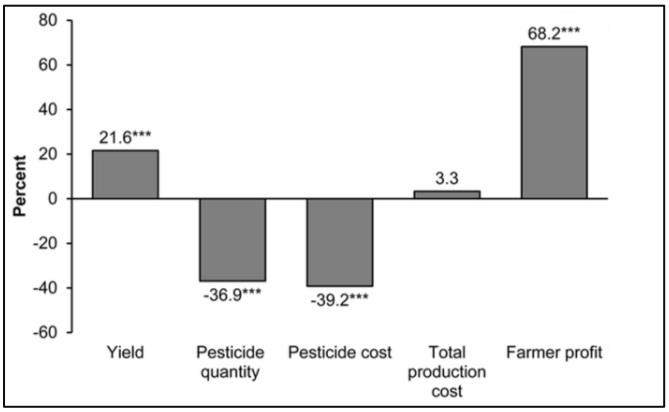
24 MARCH 2015

Chairman Conway, Representative Peterson, Members of the Committee, thank you very much for the opportunity to testify before you today. My name in Nina Fedoroff and I am a professor of plant molecular biology and genetics. My laboratory pioneered in the adaptation of genetic modification of GM techniques to plants more than 35 years ago. I am a member of the US National Academy of Sciences and a National Medal of Science laureate. I served as the Science and Technology Adviser to Secretaries of State Condoleeza Rice and Hillary Clinton. I co-authored a book titled Mendel in the Kitchen: A Scientist's View of Genetically Modified Foods[1].

I am here to tell you why mandatory labeling of foods containing GM ingredients is counterproductive to Americans' ability to make healthful food choices. More than that, I will tell you why such labels could well undermine humanity's efforts to achieve food security.

A recent poll of scientists and the public on GMOs gave startling results: only 37% of the public believes GMOs are safe, compared with almost 90% of scientists[2].

So what's the evidence? GM crops have been in commercial production for almost 20 years[3]. They have an impeccable safety record and multiple environmental benefits[4]. Despite anecdotal reports, often never published or subsequently retracted, no allergies, illnesses or deaths have been reproducibly linked to the consumption of GM food or feed[5,6,7].

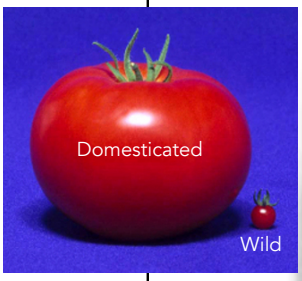


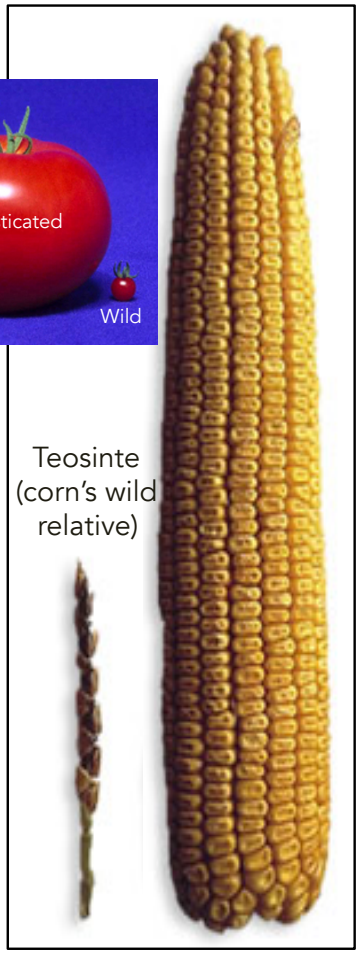
GM crops have boosted yields and farmers' incomes[4,8]. The figure on the right illustrates these impacts graphically (from the cited Klümper and Qaim reference). Environmental impacts for the period 1996-2012 include the application of 503,000 tons **less** pesticide (active ingredient), greenhouse gas reductions of 16 million tons CO_2 and increased soil carbon sequestration from no till farming estimated at more than 200 million tons CO_2[4].

Consumers have benefitted not only through continuing low food prices, but also directly from decreased mycotoxin contamination of corn[9]. GM Bt corn contains a bacterial gene that encodes a protein that is toxic to certain boring insect pests, but not to animals or people. Such insects bore holes in developing corn plants, allowing fungi to enter and grow, as illustrated on the left. The fungi, in turn, produce mycotoxins, which are compounds that are toxic and can be carcinogens for people and farm animals. Bt corn is protected from insect attack, so no insect holes, no fungi, no mycotoxins.

Scientific academies and scientific societies around the world concur that modern methods of genetic modification are as safe as those used by previous generations of plant and animal breeders, arguably safer[6]. Appendix I shows quotations from the GM statements of scientific organizations. Decades of research on GMO biosafety have simply failed to identify hazards unique to the use of GM technology for crop improvement. Quoting from a recent EU report on GMO research[10]:

> "The main conclusion to be drawn from the efforts of more than 130 research projects, covering a period of more than 25 years of research, and involving more than 500 independent research groups, is that biotechnology, and in particular GMOs, are not *per se* more risky than e.g. conventional plant breeding technologies."



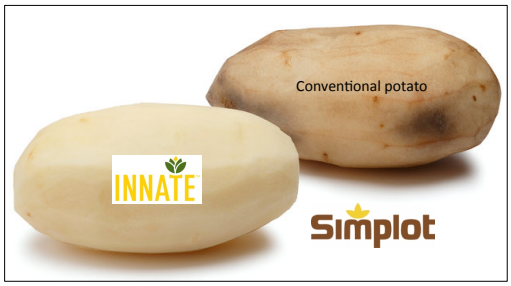


Until the development of modern GM techniques, breeders had to depend on either rare natural – or more recently – induced mutations (another name for genetic modifications) – to develop better crops. Today we know enough about genes to introduce a desired trait into an already highly productive plant or animal without the undesirable downsides of older methods[11].

It's worth pointing out that the history of plant and animal genetic modification extends back some 10,000 years. We created corn, not Mother Nature[12]; we created big, luscious heirloom tomatoes – Mother Nature's are tiny and can be deadly[13].

The FDA just approved Simplot's Innate potato that won't turn brown after it's peeled and – more importantly – contains less

asparagine, a natural amino acid that turns into the toxic compound acrylamide when the potatoes are French fried in hot oil. These genetically modified potatoes will be more healthful and less wasteful. But today, more than 60% of Americans believe that GMOs are unsafe – and probably wouldn't choose to buy them.



Why? The reasons lie in the increasingly strident efforts of determined anti-GMO activists to convince the public that GMOs are bad. Most prominent among these are NGOs, such as Greenpeace, and the organic food industry. A recent, meticulously researched "Organic Marketing Report" documents how the organic food industry has progressively demonized GMOs, while advancing organically grown food as more healthful than conventionally grown food[14].

The facts are these. Organic produce is no more nutritious than conventionally grown produce[15]. Quoting the conclusion of the cited 2009 analysis of more than 50,000 publications spanning a 50 year period:

> "On the basis of a systematic review of studies of satisfactory quality, there is no evidence of a difference in nutrient quality between organically and conventionally produced food-stuffs. The small differences in nutrient content detected are biologically plausible and mostly relate to differences in production methods."

Organic produce is more expensive because organic farming is land-inefficient and labor-intensive. Organic marketers – and many other kinds of anti-GMO activists – have openly stated that GMO labeling will help them drive GMOs out of the market. Appendix II shows representative quotations from both anti-GMO activists and organic food proponents. The anti-GMO activities of vocal NGOs, particularly Greenpeace, and the organic industry's false and misleading marketing are the primary reasons that consumers believe GMOs are bad and organic food is good.

It is often claimed that consumers have a "right to know" what they are eating. However, adding a "GM" label to food containing an ingredient from a GMO will not help the consumer make meaningful distinctions about either the food's safety or its health benefits. The GM foods on the market today are as safe as and nutritionally equivalent to their non-GM counterparts. So the fact that they are GM is irrelevant information to the consumer. Research on consumer-decision making reveals paradoxically that more information, particularly irrelevant information, actually decreases the accuracy of a consumer's choice, even though it increases the consumer's confidence in the choice[16,17].

Labeling would drive up the cost of food[18] while sending the false message that there's something to worry about, because current FDA policy requires that labels contain information on food ingredients that have health (or environmental) implications (http://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/Biotechnology/ucm096095.htm).

My final point is that there are serious humanitarian implications should the GMO vilification efforts succeed in driving GM technology out of agriculture. Global agricultural productivity increases are even now lagging behind population growth[19] – and that's without figuring in the growing impact of climate warming[20].

The future lies in "agricultural intensification"[21]. We will need to produce more crop per drop of water and square meter of land. The next big breakthrough will be in the efficiency of photosynthesis, the almost magical process by which crops turn thin air and water into food powered by sunlight[22]. Genetic modification of plants, in which the U.S. currently leads, will be the key to feeding the 9 or 10 billion people we expect for dinner in coming decades. Neither Americans nor the rest of the world can afford to lose the best methods we've ever invented to keep growing the food supply sustainably.

---

[1] Nina V Fedoroff and Nancy Marie Brown, *Mendel in the Kitchen: A Scientist's View of Genetically Modified Food*. (Joseph Henry Press, 2004).

[2] Pew Research Center, Public and scientists' views on science and society, (http://www.pewinternet.org/2015/01/29/public-and-scientists-views-on-science-and-society/), 2015.

[3] C. James, Global status of commercialized biotech/GM crops: 2014, (http://www.isaaa.org/resources/publications/briefs/49/executivesummary/default.asp), 2015.

[4] G. Brookes and P. Barfoot, GM crops: global socio-economic and environmental impacts 1996-2012, (www.pgeconomics.co.uk/pdf/2014globalimpactstudyfinalreport.pdf), 2014.

[5] H. A. Kuiper, G. A. Kleter, H. P. J. M. Noteborn, and W. J. Kok, Assessment of the food safety issues related to genetically modified foods, The Plant J **27** (6), 503-28 (2001).

[6] A. E. Richroch, Assessment of GE food safety using '-omics' techniques and long-term animal feeding studies, New Biotechnol **30**, 351-54 (2013).

[7] AL Van Eenennaam and AE Young, Prevalence and impacts of genetically engineered feedstuffs on livestock populations, J Animal Sci **92** (10), 4255-78 (2014).

[8] Wilhelm Klümper and Matin Qaim, A meta-analysis of the impacts of genetically modified crops, PloS one **9** (11), e111629 (2014).

[9] Erin Bowers, Richard Hellmich, and Gary Munkvold, Vip3Aa and Cry1Ab proteins in maize reduce Fusarium ear rot and fumonisins by deterring kernel injury from multiple Lepidopteran pests, World Mycotoxin Journal **6** (2), 127-35 (2013).

[10] European Commission, A decade of EU-funded GMO research, 2010.

[11] Peggy G Lemaux, Genetically engineered plants and foods: a scientist's analysis of the issues (Part I), Annu Rev Plant Biol **59** (1), 771 (2008).

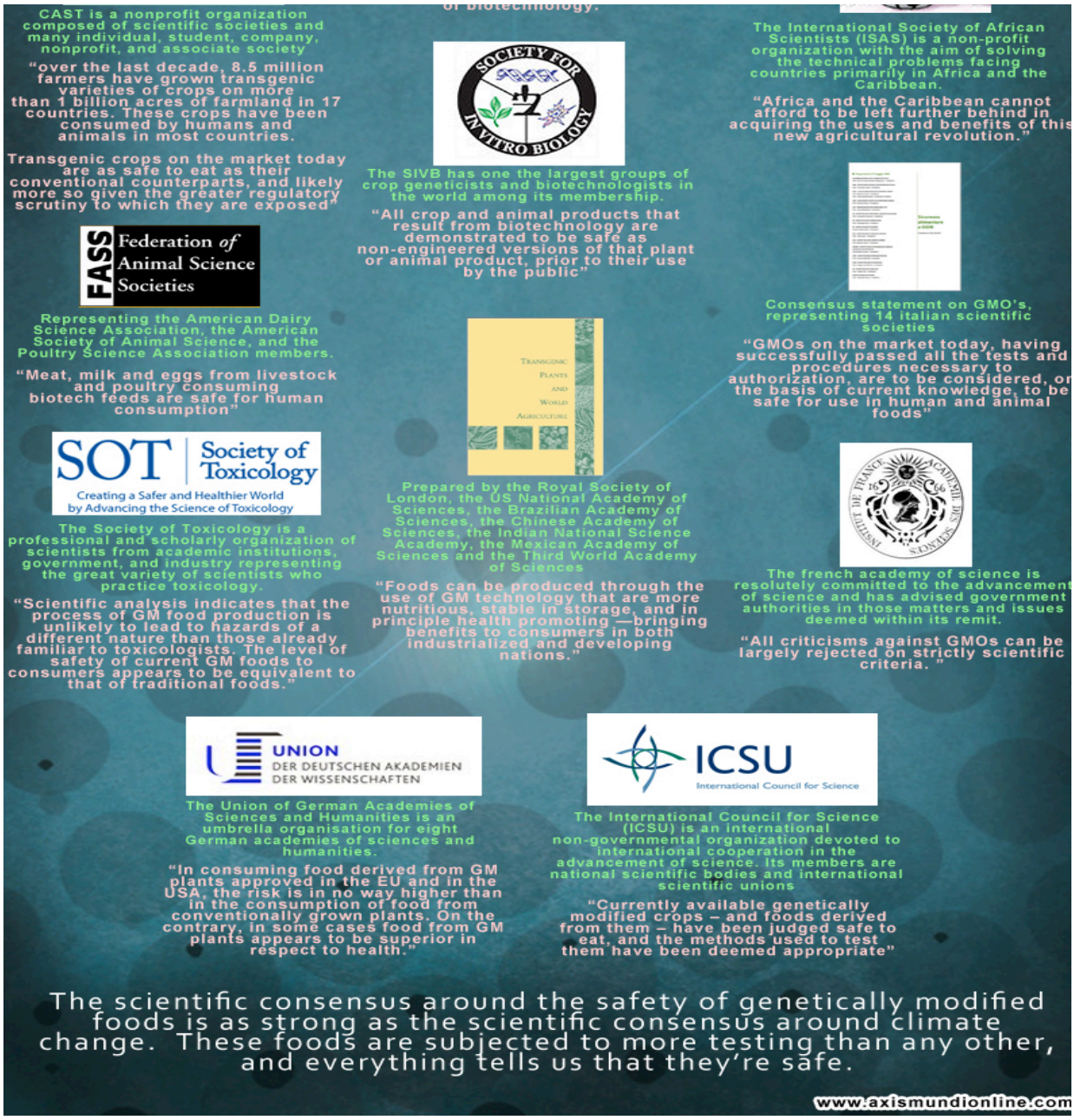
[12] Nina V Fedoroff, Prehistoric GM corn, Science **302** (5648), 1158-9 (2003).

[13] Véronique Bergougnoux, The history of tomato: From domestication to biopharming, Biotechnology advances **32** (1), 170-89 (2014).

[14] Joanna Schroeder, Organic Marketing Report, (http://academicsreview.org/wp-content/uploads/2014/04/Academics-Review_Organic-Marketing-Report1.pdf), 2014.

[15] Alan D Dangour, Sakhi K Dodhia, Arabella Hayter, Elizabeth Allen, Karen Lock, and Ricardo Uauy, Nutritional quality of organic foods: a systematic review, American J Clinical Nutrition **90** (3), 680-5 (2009).
[16] Anthony Bastardi and Eldar Shafir, On the pursuit and misuse of useless information, Journal of Personality and Social Psychology **75** (1), 19 (1998).
[17] Crystal C Hall, Lynn Ariss, and Alexander Todorov, The illusion of knowledge: When more information reduces accuracy and increases confidence, Organizational Behavior and Human Decision Processes **103** (2), 277-90 (2007).
[18] A. Van Eenennaam, B. M. Chassy, N. Kalaitzandonakes, and T. P. Reddick, The potential impacts of mandatory labeling for genetically engineered food in the United States, CAST report (http://www.cast-science.org/file.cfm/media/products/digitalproducts/CAST_Issue_Paper_54_web_optimized_29B2AB16AD687.pdf), 2014.
[19] Deepak K Ray, Nathaniel D Mueller, Paul C West, and Jonathan A Foley, Yield trends are insufficient to double global crop production by 2050, PloS one **8** (6), e66428 (2013).
[20] AJ Challinor, J Watson, DB Lobell, SM Howden, DR Smith, and N Chhetri, A meta-analysis of crop yield under climate change and adaptation, Nature Climate Change **4** (4), 287-91 (2014).
[21] David Tilman, Christian Balzer, Jason Hill, and Belinda L Befort, Global food demand and the sustainable intensification of agriculture, Proc Natl Acad Sci USA **108** (50), 20260-4 (2011).
[22] Veronica G Maurino and Andreas PM Weber, Engineering photosynthesis in plants and synthetic microorganisms, Journal of Experimental Botany **64** (3), 743-51 (2013).

Appendix I: Safety of GM techniques and GM foods



"The scientific consensus around the safety of genetically modified foods is as strong as the scientific consensus around climate change. These foods are subjected to more testing than any other and everything tells us that they're safe."

http://www.axismundionline.com/blog/the-new-is-gm-food-safe-meme/

Appendix II: Anti-GMO activists and proponents of organic food on labeling