Student Voice Report[1]

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Each year, the North American Agricultural Biotechnology Council (NABC) holds a conference as a platform for all stakeholders of biotechnology in North America to discuss immediate issues. For 2013 (NABC 25), the theme was *Biotechnology and North American Specialty Crops: Linking Research, Regulation and Stakeholders* and bringing smaller-scale genetically-modified (GM) crops to market despite challenges of policy and perception. The NABC reserves a portion of the conference, the *Student Voice*, for students to offer their insight.

The *Student Voice* program was inaugurated at NABC 19 in 2007 to promote graduate student participation in NABC. A single representative from each member institution is sponsored by the NABC with a travel grant of up to $750 to cover travel costs and lodging at the meeting with the conference registration waived. The student representatives attend all of the plenary sessions, the breakout session, and meet separately to develop key points of interest that were presented at the conference. The following are the issues and concerns deemed important by the NABC-25 *Student Voice* representatives.

Potential Problems for the Future and Solutions

Our concerns for the future fall into three general categories: Communication, Education and Funding.

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Communication

There is a lack of interdisciplinary collaboration and communication outside of the life sciences. Life scientists do not consistently collaborate with sociologists, economists, or marketing experts, whereas, in industry, such collaboration is standard. Increasing interdisciplinary cooperation could lead to improved public perception of genetically modified organisms (GMOs).

Also important is communication between scientists and the general public. There is a preference on the part of the public to be informed by arbitrary events and opinions of celebrities—frequently disseminated as "tweets"—rather than by scientifically substantiated discoveries. Although many celebrities do not necessarily speak out against GMOs, they may lobby in favor of labeling GM foods/ingredients. An ongoing campaign (justlabelit.org, 2012) is advocating a petition to oblige the FDA to enforce mandatory labeling of all GM foods. Interestingly, the *Just Label It* campaign is organized by a self-titled group called the *Organic Voices* whose major partners are organic producers, and, what is more, their petition was written by attorneys representing the Center for Food Safety. The Center for Food Safety is a public-interest group that is "working to protect human health and the environment by curbing the use of harmful food production technologies and by promoting organic and other forms of sustainable agriculture" (Center for Food Safety, 2013).

Nutrition Facts

Per 3/4 cup (175 g)

Amount	% Daily Value
Calories 160	
Fat 2.5 g	**4 %**
Saturated 1.5 g + Trans 0 g	**8 %**
Cholesterol 10 mg	
Sodium 75 mg	**3 %**
Carbohydrate 25 g	**8 %**
Fibre 0 g	**0 %**
Sugars 24 g	
Protein 8 g	

Vitamin A	2 %	Vitamin C	0 %
Calcium	20 %	Iron	0 %

Figure 1. Nutrition facts table (Health Canada, 2008).

Many groups are fighting to have GM foods labeled, but we have yet to see one fighting to label all cultivar-development methods, or—for example— water-usage rate per acre. If mandatory labeling will go beyond specific nutrient composition, there must be guidelines for what information beyond nutrient composition must be included, and they must be applied to all foods and at the same time. Figure 1 shows an example of the "Nutrition Facts" label required by Health Canada (2008) for all foods:

None of this information is of use to a consumer trying to make an informed, rational decision with regards to genetics, environment, or the economics of the production method. Other labeling options, which are fairly similar between the United States and Canada, include health claims that are convoluted for the average consumer. Also "Organic" or "Irradiated"—as words or symbols—may influence a consumer's decision based on emotion rather than on rationality.

We propose a change to mandatory labeling of foods to include information on how the crop was produced and what, if any, modifications were made (Figure 2): It provides context to the consumer—in terms of cultivar-development technology, production method and environmental impact—enabling a wiser decision on whether to purchase. However, inconsistencies exist within this label. Whereas the "Irradiation" symbol is international, the "Organic" symbol is country-dependent, and there is no official international logo for GM or GE (genetically engineered), implying that common definitions of "organic"

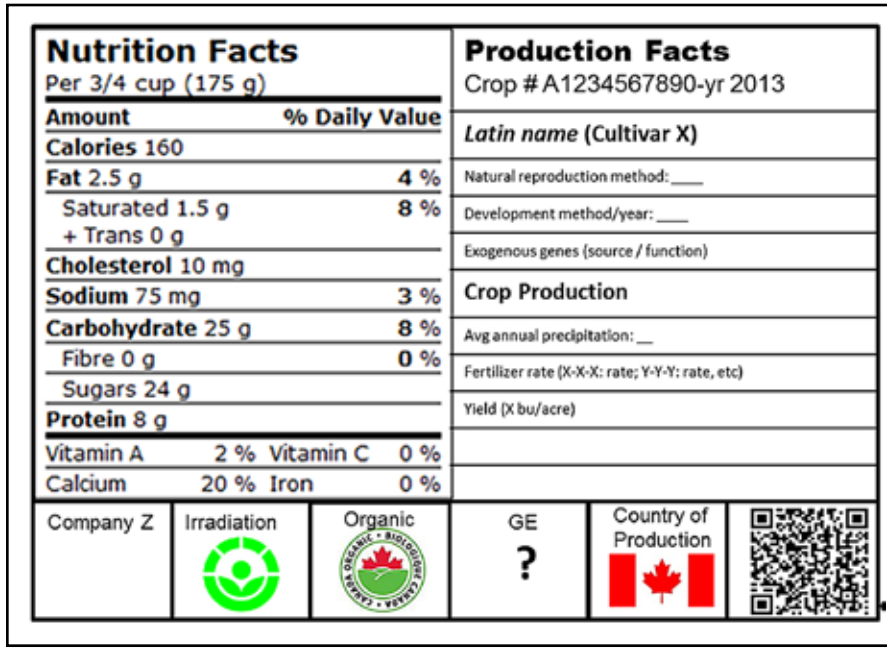

Figure 2: Nutrition Facts (Health Canada, 2008) with a proposed change to include crop-production data.

Figure 3: A QR code (Kaywa, 2013)

and "GMO" are yet to be reached. It seems imperative that international definitions and standards should be determined before discussions about labeling occur.

Another easy improvement to labeling would be quick-response (QR) two-dimensional bar-codes (Figure 3), which have been used for nearly twenty years in Japan. Extremely versatile, they can impart many types of data, including a website link to in-depth information. Although a specific application ("app") is needed for downloading and a smartphone is required for scanning, the readers are available online free of charge (iTunes, 2013; Mobile-Barcodes.com, 2013;). Some 47% and 56% of Canadian and American adults now have smartphones (Ipsos, 2013; Pew Internet, 2013).

Once linked to a website, an abundance of information may be accessed. For example, the first link from the QR code may provide a simple sentence-long definition; at the end of that definition there may be an option to view an abstract about the same topic, and finally a third linked option may be available with an article or protocol about the technology. If the information is from an online unbiased database, such as PubMed[2], it would help build consumer trust.

[2]http://www.ncbi.nlm.nih.gov/pubmed.

Another opportunity for labeling change is serving size. If nutrition calculations were based on a consistent portion size, consumers could more readily compare products. This would be important in a situation where a GM crop undoubtedly demonstrates a nutritional advantage over a non-GM or organic competitor. As serving sizes exist now, consumers can easily be misled. Furthermore, certain websites could be more user-friendly. For example, the Health Canada website[3] contains many fragmented, redundant labyrinths with a poor internal search engines; even the advanced search options often produce countless absurd results unrelated to the inserted keyword.

In mentioning these ideas during NABC 25, typical responses were "no," and "labeling is already established." This attitude perpetuates a stagnant mindset and accomplishes nothing. Obviously it will cost more initially, but there is so much potential to streamline the self-education system, that the cost should be examined from a long-term perspective. Ability to access information about all types of foods will empower consumers to have meaningful discussions with those in industry about legitimate concerns.

Many opponents of GMOs run stylish, yet simplified, advertising campaigns (Mercola, 2012). Of course, no credential pre-requisites are required to create an anti-GM website. Superficially, these sites may appear to be neutral, but within a few paragraphs of reading, the "anti" message becomes clear. Celebrity names may be mentioned (Afifi, 2012), current events in biology quoted (Latsch, 2007), and emotion used (Flores, 2013) to persuade the lay reader. It is necessary to investigate these sources to comprehend the scope of the challenge of properly educating the general public.

As food-label content and regulatory decisions with regards to food production are typically imposed by food manufacturers and/or the government, there is an urgent need to assemble a third-party arbitration group. Ideally, this group would include representatives of the government, industry, public-interest groups and lawyers. It could be responsible for final decisions on food labeling and on manufacturing and production standards. Primarily, it would assure the public of being minimally biased, reaching timely resolutions while maintaining the best interests of all stakeholders. Educational outreach programs could be facilitated by this group to foster a better-informed public. It would be best if such a group could be set up across national borders, as new ideas and perspectives are often gained in the absence of geographical constraints; otherwise, arbitration groups set up within each country should convene annually, at least, to discuss progress. The NABC-25 forum is a good example of how insight can be gained from this type of meeting.

To summarize, "genetic modification" and similar terms have negative connotations. A good example of what we can do to overcome this is the tactic being used by the creators of non-browning apples[4] who are using a trademark to denote genetic modification (Arctic® apples; arcticapples.com, 2013). They are educating the public on how they made the apple, both on their website and in their talks to the public. This goes hand-in-hand with

[3]http://www.hc-sc.gc.ca/index-eng.php.
[4]Pages 87–94.

our proposal to make labels more educational. Voluntary labeling will bring goodwill and separation from the large biotech companies. We also need a unified voice to respond to spurious negative claims about the safety of GMOs and we need a social-media presence to combat adverse claims in real time. Opponents of GMOs, such as Greenpeace and Non-GMO, are pouring large amounts of money into fighting GMOs. We can combat this effectively only with calm, reasoned logic. Furthermore, it would not be appropriate for the voice of reason to be from industry; perhaps the NABC can be that voice.

Education

In the United States, there has been a decrease in science- and math-test scores over the last few years. This trend applies to students when tested from fourth to twelfth grades (National Center for Education Statistics, 2013). Furthermore, many students have little understanding of where food comes from or what it takes to grow crops and produce meat. This problem may be solved as follows:

- The first way is for scientific and mathematical organizations to come together and advocate to national, state/provincial, and local governments to stop decreasing spending on STEM[5] education; potentially, this is a role that NABC can be a part of.
- The second way is for universities and scientific organizations to promote STEM and agricultural experiences for primary and secondary students, to educate on how food is grown and to show STEM in action. A good example of how this can be successfully accomplished is the outreach program administered by the Arkansas Center for Plant Powered Production (P3, 2013). One of the mission goals for P3 is to promote plant sciences in the state of Arkansas. P3 has developed plant-science kits, which science teachers can borrow, containing everything for a plant experiment, such as making biofuel. Additionally, P3 also recently sponsored a workshop for middle-school students in Jonesboro, AR, to come and transform a plant and extract DNA from strawberries. NABC-member institutions could promote similar programs in their respective areas and increase exposure of students to science.
- A third way that NABC could help to improve STEM education is to bring students to visit GMO trials so that they can see for themselves what these crops can do. By increasing the quality of STEM education and having an outreach to the public, we can begin to reverse the negative public perception of GMOs.

Funding

The state of STEM funding in North America is discouraging. Due to budget cuts, funding for research has been drastically decreased in the United States. For example, the NIH budget for 2013 was reduced significantly and is lower than for FY 2003 by 22%, or about $4.7 billion (aaas.org, 2013). Most other agencies have had minor cuts or stayed about the same. Details for FY 2014 have not been finalized yet, but more cuts are

[5]Science, technology, engineering and mathematics.
[6]$5.7 billion with adjustment for inflation.

expected based on the US House of Representatives budget (faseb.org, 2013). If the NIH budgetary trend is an indication, then funding opportunities will be greatly reduced and the number of new projects funded severely cut. As emerging scientists, we feel that this trend will negatively impact both innovation and advancement. If the US government had not funded the $3.6 billion[6] Human Genome Project in 1988, we would not be seeing the renaissance of genetics and the related "-omic" branches that have led to $1 trillion worth of biotechnology companies. Given that there is a high return on research-funding investment (at least a 30% return and up to 100%), we are not only short-changing ourselves but also future generations (Center for American Progress, 2012). The NABC must stand with other scientific organizations, and concerned citizens, to stop the slashing of research funding currently occurring in Washington.

Conclusions

NABC is composed mainly of universities and does not have the "baggage" in promoting GMOs so commonly observed in industry. NABC is uniquely positioned to be a voice of reason in promoting the benefits of GMOs:

- Increase interdisciplinary and international communication
- Take advantage of media outlets available for either educating or advertising, at least to counter the anti-GMO movement that utilizes these tools already
- Find a pro-GMO celebrity with a large following to promote GMO techniques, or at least for proper education about GMOs
- Revamp food labeling to present official information about all foods in a comparable manner
- Establish a third-party arbitration group responsible for labeling, educating, and dispute resolution
- Get more involved in early education to increase the number of students that are interested in STEM
- Advocate for increased funding for STEM research or at the very least no further reductions in research funding

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[3]http://www.hc-sc.gc.ca/index-eng.php.

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