To Label or Not To Label?

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1. Quick background on genes, genetics and genetic engineering (aka biotechnology, GMOs)

2. What engineered (GM, GE) crops have been commercialized and might be in foods?

3. What about the labeling issue with GE foods?
Animals and plants are made of cells – humans too – billions of them!
Inside each of those cells is the genetic information, its DNA, that determines its host’s characteristics.
Genes are the individual recipes in the DNA that specify the characteristics and now we can find where those recipes are on the DNA.
How are the genes and chromosomes manipulated to create a new plant variety... by classical breeding?

*Triticum monococcum*  
**Ancient variety**

*Triticum aestivum*  
**Modern bread variety**
Information in the wheat genome

Chemical units represented by alphabetic letters

...CTGACCTAATGCCGTA...

1700 books
1000 pages each

1700 books
(or 1.7 million pages)
Hybridization or cross breeding of wheat

Random retention of information from each parent

1700 books (or 1.7 million pages)
But there are other ways to create new varieties using the modern tools of genetics.

How do you perform genetic engineering – a.k.a. biotechnology – to create new GM or GE varieties?
Genetic Engineering Methods

1700 books (or 1.7 million pages)

+ One-half page equivalent to a gene

= 1700 books (or 1.7 million pages)

Inserts randomly in genome

Inserted gene(s)
<table>
<thead>
<tr>
<th><strong>Classical Breeding</strong></th>
<th>compared to</th>
<th><strong>Genetic Engineering</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Uses plant machinery in plant</td>
<td>Uses plant machinery in laboratory</td>
<td></td>
</tr>
<tr>
<td>Gene exchange is random involving whole genome</td>
<td>Gene exchange is specific involving single or few genes</td>
<td></td>
</tr>
<tr>
<td>Source of gene primarily within genera – not between kingdoms like plants &amp; bacteria</td>
<td>Source of gene from any organism</td>
<td></td>
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</tbody>
</table>
GE Cotton
93% of 2010 acreage
(Insect Resistant: 15%  Herbicide tolerant: 23%  Stacked gene: 58%)

GE Canola
88% of 2010 acreage

GE Soybean
93% of 2010 acreage
(Herbicide resistant: 93%)

GE Corn
86% of 2010 acreage
(Insect Resistant: 16%  Herbicide resistant: 23%  Stacked gene: 47%)
1% of corn with Bt (ECB) + Bt (rootworm) + herbicide

GE Sugarbeet
96% of 2010 acreage

GE Alfalfa
5% of 2006 acreage

GE Cotton
93% of 2010 acreage
(Insect Resistant: 15%  Herbicide tolerant: 23%  Stacked gene: 58%)

GE Squash
10% of 2004 acreage

GE Papaya
53% of 2006 acreage

GE crops presently grown commercially

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Although there are few GE whole foods, use of ingredients from corn, soybean, canola, sugarbeet leads to estimates that 75% of U.S. processed foods have GE ingredients. This fact has led to demands by some for mandatory labeling of foods containing GE ingredients.
Why Doesn’t FDA Have a Labeling Policy for GE Foods?

Actually it does...

GE foods are subject to same labeling laws as all other foods and food ingredients

This label information relates to composition not agricultural or manufacturing practices

No label needed if food is essentially equivalent in safety, composition and nutrition

GE food must be labeled if it has:
1. Different nutritional characteristics
2. Genetic material from known allergenic source e.g., peanut, egg
3. Elevated levels of antinutritional or toxic compounds
Also, for whole fresh foods, there are existing PLU labels that indicate whether they are GE or organic.
But other nations have specific mandatory labeling laws for GE, although they vary dramatically among countries, making international trade difficult.

### National GM Labeling Laws and Policies

<table>
<thead>
<tr>
<th>Type of GM labeling</th>
<th>Countries that enforce labeling policies</th>
<th>Countries with partially enforced or unenforced labeling policies</th>
<th>Countries with probable plans to introduce a labeling policy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mandatory</td>
<td>Australia, Brazil, China, European Union, Japan, New Zealand, Norway, Russia, Saudi Arabia, South Korea, Switzerland, Taiwan</td>
<td>Croatia, Ecuador, El Salvador, Indonesia, Malaysia, Mauritius, Serbia, Sri Lanka, Thailand, Ukraine, Vietnam</td>
<td>Nigeria, Uganda, UAE, Zambia</td>
</tr>
<tr>
<td>Voluntary</td>
<td>Argentina, Canada, Chile, Hong Kong, Kenya, Philippines, South Africa, USA</td>
<td>Peru</td>
<td></td>
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</table>

One place is the E.U. Where very little is labeled. Two GE soy cooking oils Margarines in processed foods Minor products, like soy lecithin No GE-maize or -canola products in U.K. Other EU countries have more, some with GE maize.

There is adventitious GE- free labeling on products that do not have ingredients likely to be GE
66% of UK consumers think GE food labeling is important...

But only 2% actively look for GE content when buying foods”
In November 2012 California voted on a Proposition to require mandatory labeling of foods with GE ingredients.

What did that Proposition look like?
CA Labeling Proposition

Labeling Relating to Genetic Engineering

- Any retail product that has been or may have been partially or wholly produced with genetic engineering must be labeled.
- Any raw retail agricultural commodity must contain on the front of its package in clear and conspicuous words, “Genetically Engineered”.
- Any processed foods, unless exempted, must have conspicuous language on package stating, “Partially Produced with Genetic Engineering” or “May be Partially Produced with Genetic Engineering”.

Labeling Relating to Using “Natural”

If food meets GE definitions above, or is processed, it may not be labeled for retail or in advertising that the food is “natural”, “naturally made”, “naturally grown”, “all natural” or any similar wording.
What Exemptions Were There?

- Non-GE animals whether fed GE feed or injected with GE drugs.
- Raw commodities grown without intentional use of GE seed.
- Foods certified as “organic”.
- Alcoholic beverages.
- Processed food with no one ingredient >0.5% of weight of food.
- Processed food for immediate consumption in restaurants.
- Medical food.
- Processed food labeled solely because it has one or more GE processing aids or enzymes.
- Processed foods with one or more GE substances added during processing but removed or present in very low amounts.
After over $40M was spent convincing voters one way or the other, the proposition was defeated 51.4% to 48.6%
End of Story?

GMO Food Fight: Round Two 2013

"This gives us hope that you can, with a well-funded, well-organized, well-executed campaign, defeat a ballot initiative and go directly to the voters. We hope we don’t have too many of them, because you can’t keep doing that over and over again . . .".

- Jennifer Hatcher, Food Marketing Institute, on Big Food and Big Biotech’s narrow defeat of Prop 37, the California Right to Know GMO ballot initiative.

Not in California, nor a number of other states, like Washington, Oregon, Vermont...
And some Individuals have decided to start their own labeling efforts

SOURCE: http://labelityourself.org/liy/
And some companies have decided to voluntarily label.

browning, he said. Use of sliced
apples in restaurants and food
services would increase over-
all apple consumption, he said.
“As a company, labeling
doesn’t bother us. We intend
to label our Arctic apples as ge-
netically modified. We want
people to make an informed
decision,” Carter said. “But
we’re not for mandatory label-
ing because it undermines the
credibility of the FDA, which
does its review. It has standards
for food safety. This is man-
dating labeling of something
that has no risk. I don’t agree
with that. It becomes too much
negative marketing.”

The battle isn’t as much
about food safety as it is about
market share between the or-
ganic and natural food side ver-
sus big, biotech corporations,
Carter said.

“We’re a small company,”
he said. “We can’t engage in
that.”

The recession shrunk the or-
ganic industry, which “wants
to use labeling to scare people
into buying organic,” he said.
That’s the wrong motivation,
he said, and it should be about
around for 15 years, fed 4 tril-
ion people and never been a
single health risk, yet nine peo-
ples died from organic bean
sprouts in Germany last year,”
he said. “Organics can kill peo-
ple with E.coli.”

But the Pacific Northwest
apple industry, fearing nega-
tive public reaction, is on the
record against USDA approval
of genetically engineered ap-
plies.

The Northwest Horticultu-
ral Council in Yakima, Wash.,
representing tree fruit growers
and packers in Washington,
Oregon and Idaho, sent USDA
Secretary Tom Vilsack a letter
in 2011 asking him to reject
Carter’s application for non-
regulated status of his two ge-
netically engineered apples.

Carter president wrote in the let-
ter.

Todd Fryhover, president
of the Washington Apple Com-
mission, has said genetic mod-
ification raises public concerns
and doesn’t seem to fit with the
image of apples as healthy and
nutritious.

Carter and other represen-
tatives of Okanagan Specialty
Fruits early this month, for the
first time, had booths to dis-
play and talk about Arctic ap-
plies at the annual meetings of
the Washington State Horti-
cultural Association and the Great
Lakes Fruit, Vegetable and Farm
Market Expo in Michigan.

It was an educational out-
reach with lots of grower ques-
tions answered, he said.

Contacts were made for po-

http://www.capitalpress.com/orewash/djw-GMOapples-w-art-121912
Putting a label on a whole food is relatively easy, but...
Processed foods are more difficult. For example, tomato sauce contains many varieties. Depending on type of label required, GE varieties would likely need to be tracked to assure correct content information.

May contain genetically modified tomatoes

Contains genetically modified tomatoes

Contains tomatoes genetically modified with polygalacturonase gene from tomato, phosphinothricin acetyl transferase from *Streptomyces hygroscopicus*, crystal toxin from *Bacillus thuringiensis*, alpha amylase gene from barley, s-adenosyl methionine transferase gene from tobacco, N protein gene from tobacco, coat protein gene from tomato bushy stunt virus
If there is demand, might another solution be to allow the creation of a specialty market for labeled GE-free foods – for which people pay a premium price and for which farmers are paid premium prices to grow them?

But other consumers have the choice to buy GE foods.
Where to get more information on the issues and on labeling?

http://ucbiotech.org