Science Supporting GMOs and Genetically Modified Salmon

Dave Edwards, PhD

Biotechnology Industry Organization

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Bio Biotechnology Industry Organization


Ames, IA

Conversation Today

- Needs for technology in animal agriculture
- Animal biotechnology opportunities
- Opponents to biotechnology
- What are we doing about it

Challenges to Address

- Food Security
- Animal Health
- Animal Welfare
- Environmental Footprint

BIO is…

- Working to Heal, Fuel, and Feed the World

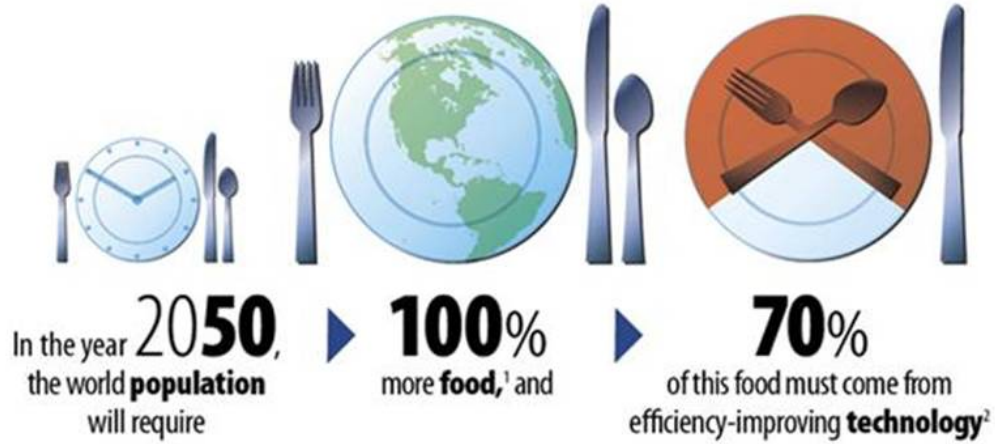
- World's largest biotechnology trade association
  - More than 1000 companies, academic centers, state and regional affiliates, and related organizations

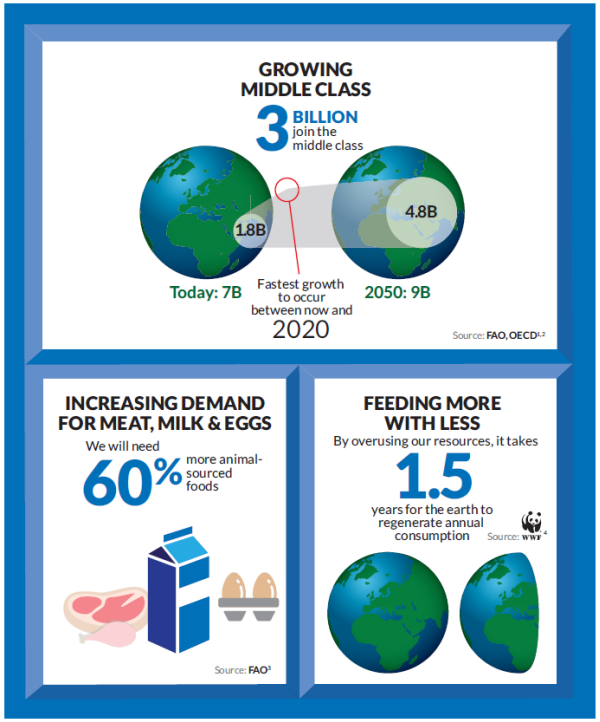
- R&D of technologies
  - Human Health
  - Industrial & Environmental
  - Food and Agriculture

Technology is Crucial

- Seventy percent of the world's additional food needs can be produced only with new and existing agricultural technologies.

-United Nations FAO, 2002





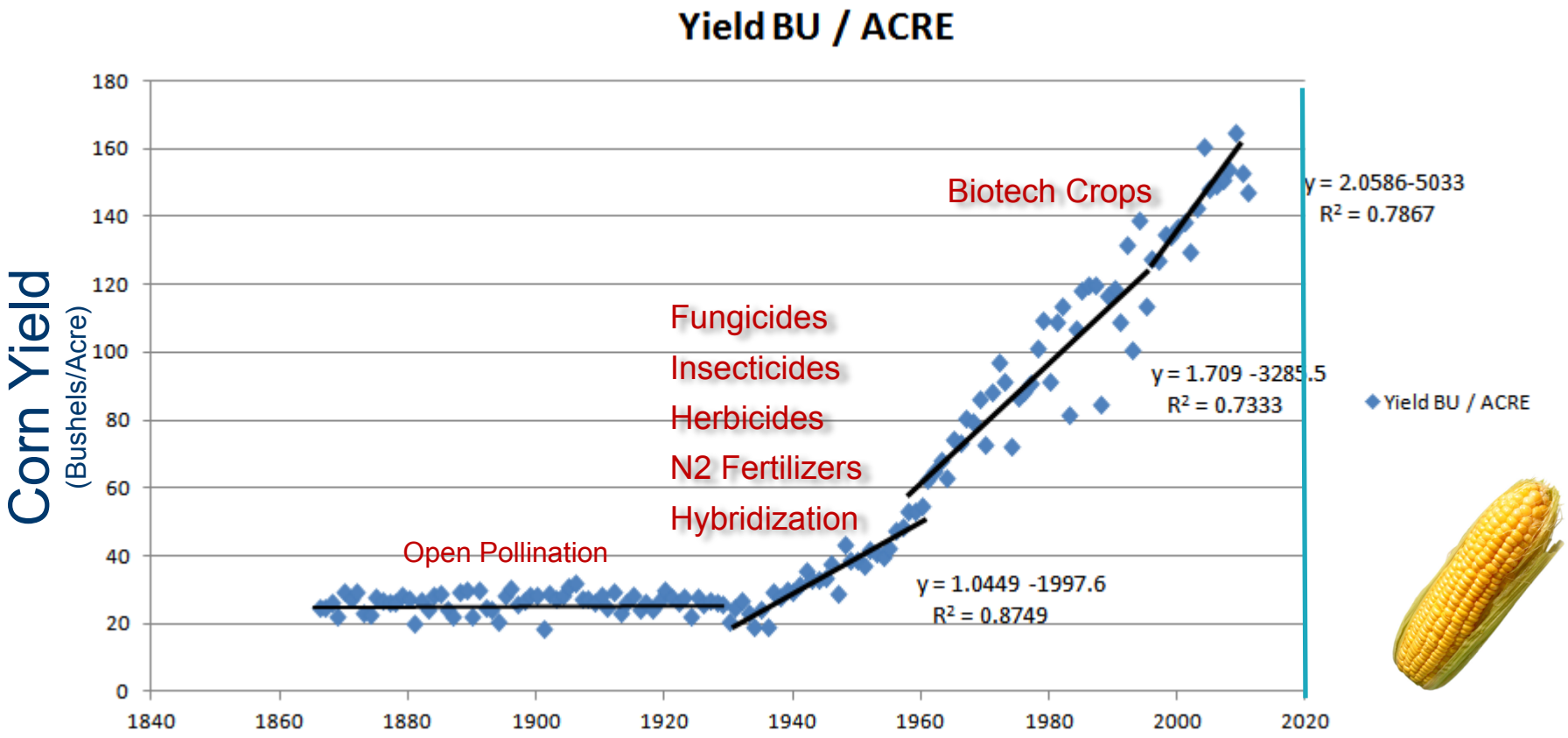
Images courtesy of Elanco Animal Health

Need for Aquaculture

- "Overall, if we're going to continue to consume the amount of seafood we consume — or put more apocalyptically, if we're going to adequately nourish the increasing number of billions of people on this planet, more and more protein is going to have to come from aquaculture."

-Michael Conathan, Director of Ocean Policy at the Center for American Progress

Impact of Technologies



USDA, National Agricultural Statistics Service: http://www.nass.usda.gov/

Animal Biotechnology Applications

- **Opportunities to impact**
  - **Food availability, cost, & production**
  - **Biomedical research, treatments, & production**

- BIO report, "Genetically Engineered Animals and Public Health" available from http://www.bio.org/articles/genetically-engineered-animals-frequently-asked-questions

Why Aquaculture Biotechnology?

- Fish is a healthy food and an efficient source of high quality protein
- Many of world's fisheries are maximally exploited
- Aquaculture accounts for 50% of fish consumed
- Aquaculture must at least triple by 2030 to hold per capita fish supply constant (FAO)
- Genetics and husbandry practices generally primitive
- Biotechnology can improve efficiency and sustainability

Aquaculture Biotechnology

AquAdvantage Salmon: An Atlantic salmon that is genetically engineered to grow more rapidly

Cohorts of the same age

Environmental Impact of Importing Salmon

Fly halfway around world
1847 fully loaded 747's
=
66,359,178 gallons of fuel
=
94,799 cars per year

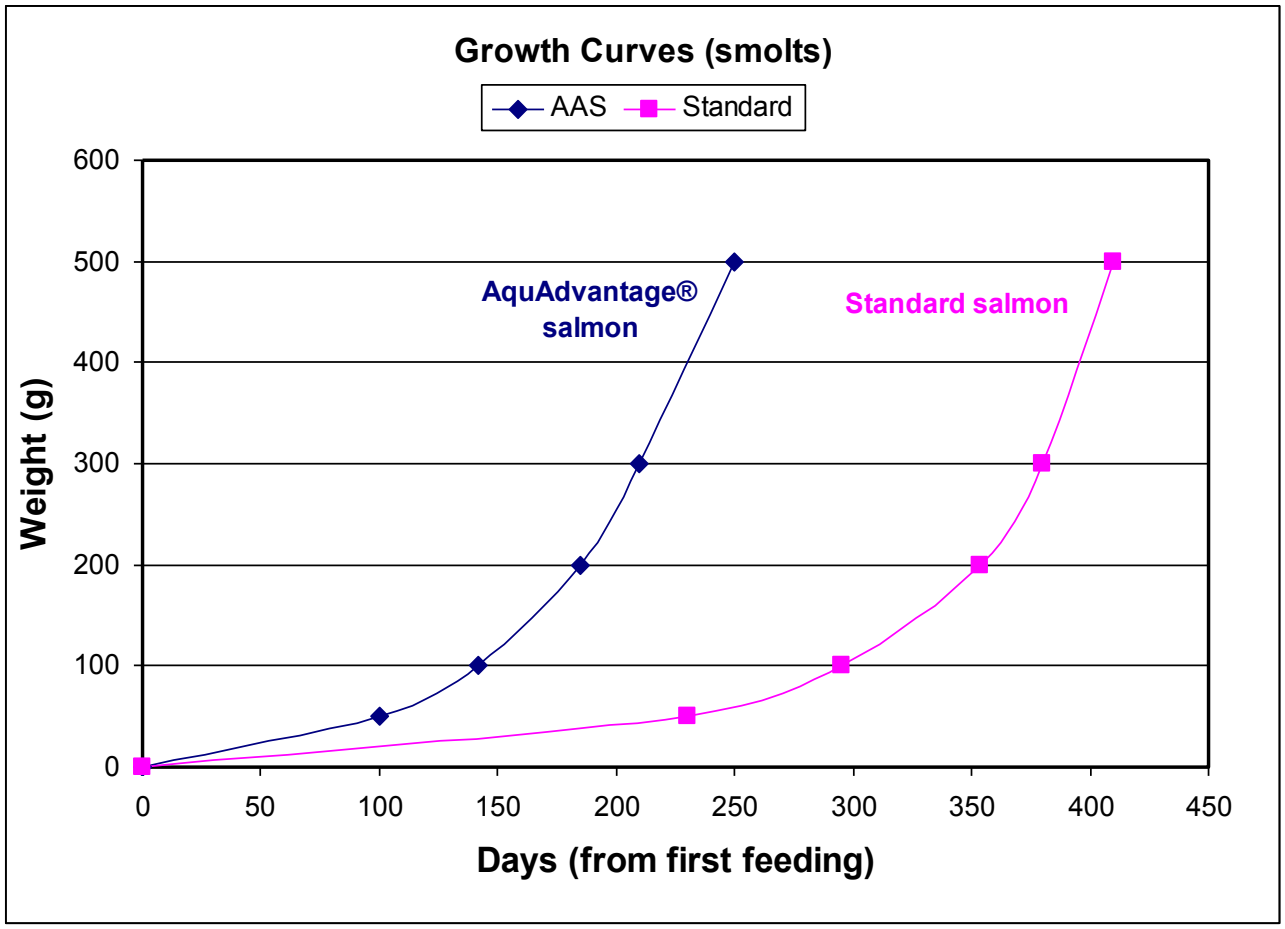
Image courtesy of AquaBounty

Land-based Aquaculture

- Sustainable intensification
  - Increased productivity
  - Better feed efficiency
- Less impact on coastal areas
- Local sources of fish
- Greater disease control

- Recirculating Salmon farming in WV currently supplying DC

Gains in Growth – Smolts (AAS vs. Nontransgenics)

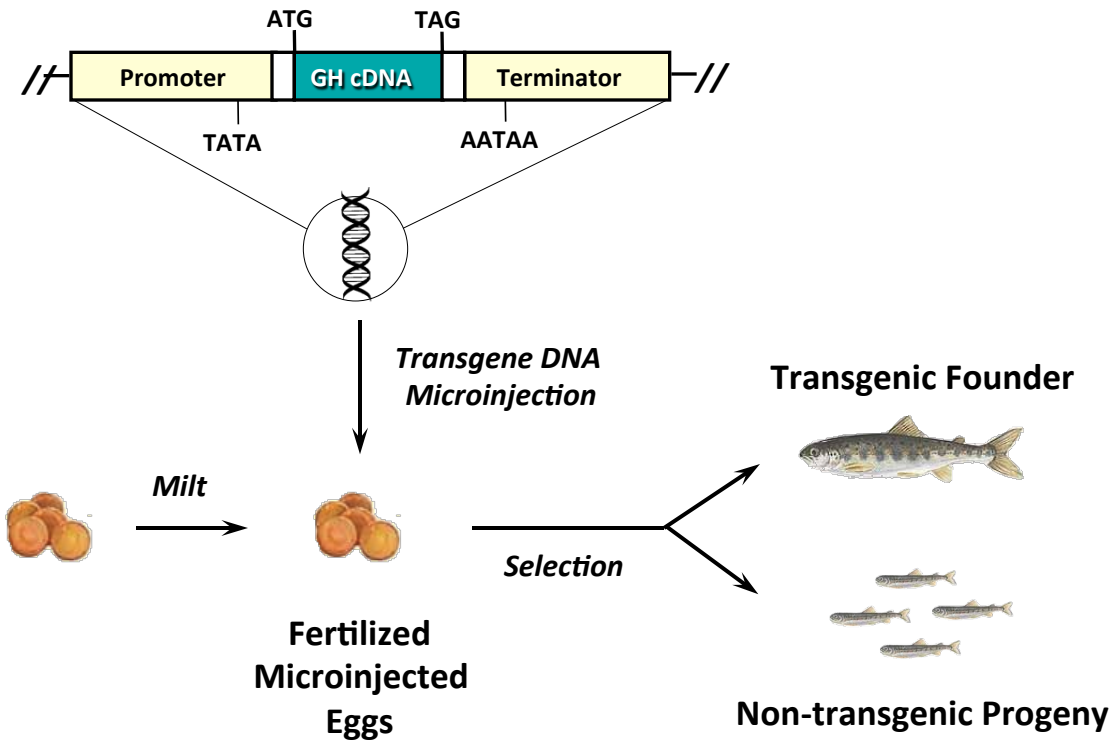


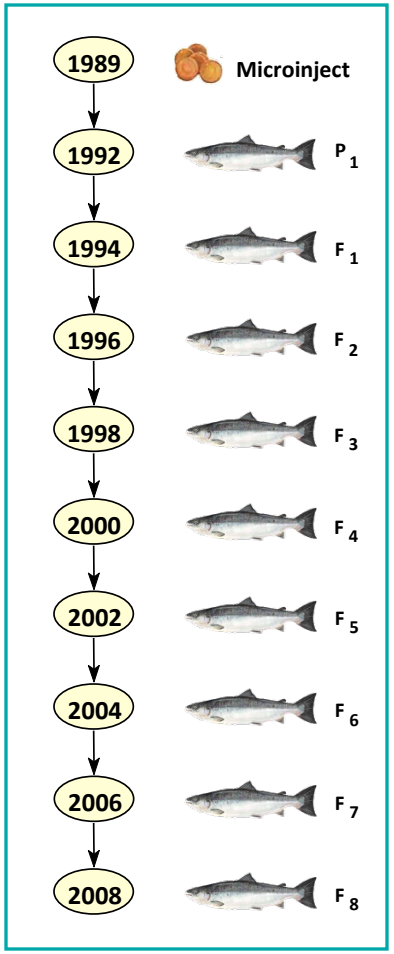
- Pooled growth data collected at ABT-PEI for year classes 2004-2006.
- Full sibs
- Triploid transgenics, diploid controls

- NOTE: these growth studies were carried out at an average annual temp. of 9-10° C.

AquaBounty TECHNOLOGIES

Regulatory sequences from ocean pout AFP gene & coding domain from chinook salmon GH-1 cDNA

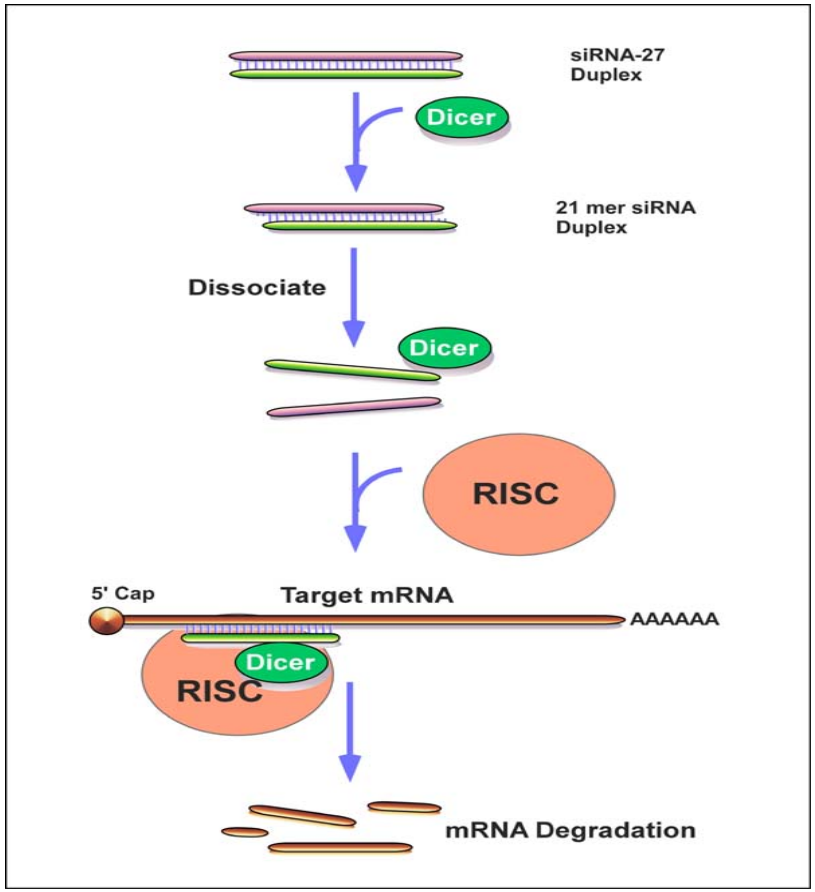




Newer Technologies

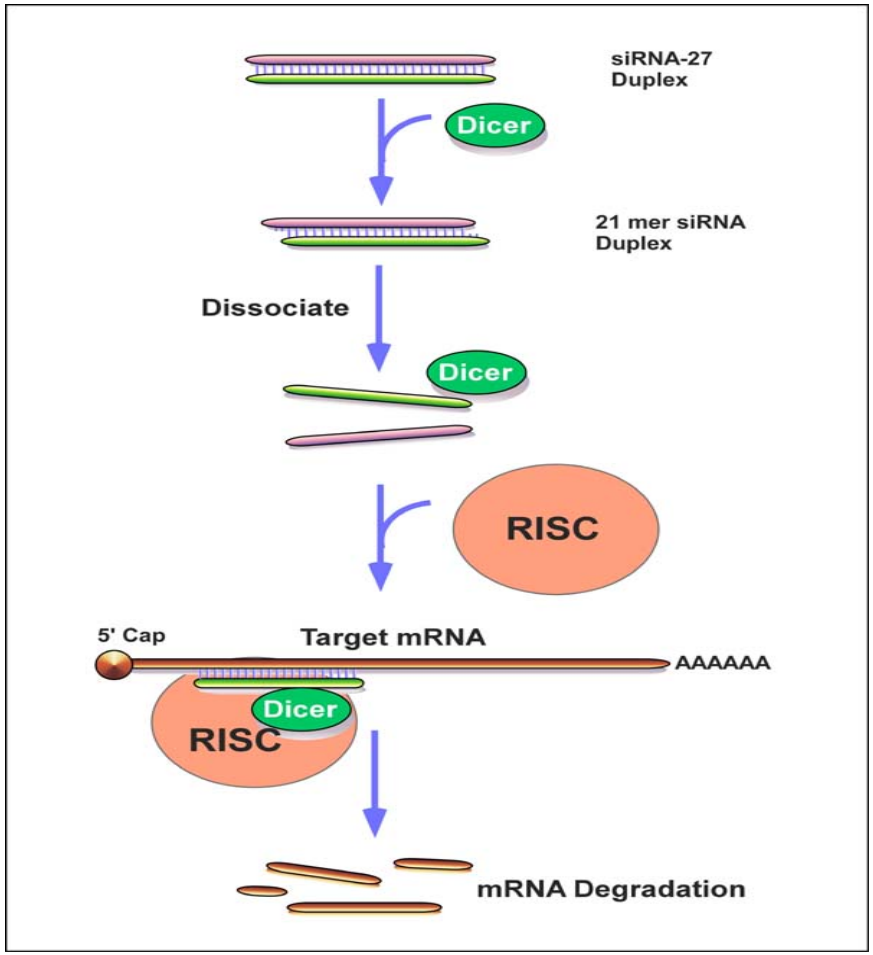
- Gene editing
  - Make single changes to DNA
  - Turn horned cattle gene to polled
- RNA interference
  - Small segments of RNA keep genes from being expressed
  - 2006 Nobel Prize

RNAi Mechanism



The use of si-RNA technology may represent an opportunity for specific therapeutic solutions for many of the most damaging viral diseases of shrimp and fish.

AquaBounty TECHNOLOGIES



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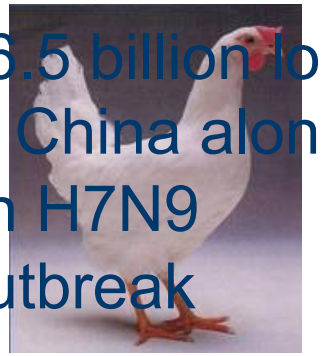
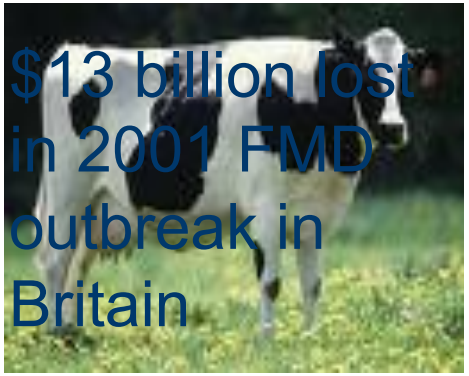
RNAi for Disease-Resistant Livestock

$6.5 billion lost in China alone on H7N9 outbreak



Influenza resistant chickens

$13 billion lost in 2001 FMD outbreak in Britain

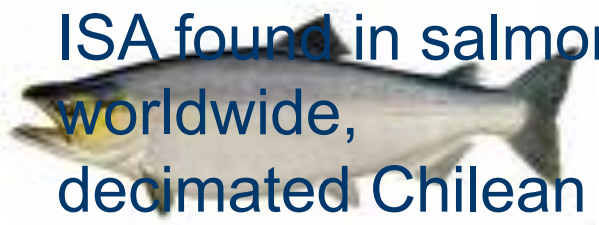


FMD resistant cattle

59 million human cases of H1N1 in U.S. in 2009

Influenza resistant pigs

ISA found in salmon worldwide, decimated Chilean industry for several years



Disease-resistant fish

Slide courtesy of CSIRO

Technology at a Crossroads

- Animal biotechnology developers are small
- No predictability in regulatory system
- Market based standards limiting technology use
- Public perception
- Trade questions
- Well funded opponents of technology

Regulatory Inaction

Year	Event
1989	Founder AquAdvantage® fish produced in Canada
1995	FDA review of AquAdvantage® salmon begins
2001	First regulatory study submitted by Aqua Bounty Technologies to U.S. FDA for a New Animal Drug Application
2009	FDA guidance on how GE animals will be regulated FDA approval of first GE animal pharmaceutical Final AquAdvantage® regulatory study submitted to FDA
2010	FDA VMAC meeting on AquAdvantage® salmon (9/20/10)-'as safe as food from conventional Atlantic salmon'
2011-2014	Political efforts to prevent FDA from regulating GE salmon, ban GE salmon, delay regulatory approval
2012	FDA released finding of no significant impact "FONSI" environmental assessment
2014	Still waiting for regulatory decision on AquAdvantage® salmon

It has been 1321 days since VMAC meeting

[1] Chart from Alison van Eenennaam, University of California-Davis

FDA Conclusions

VMAC September 2010

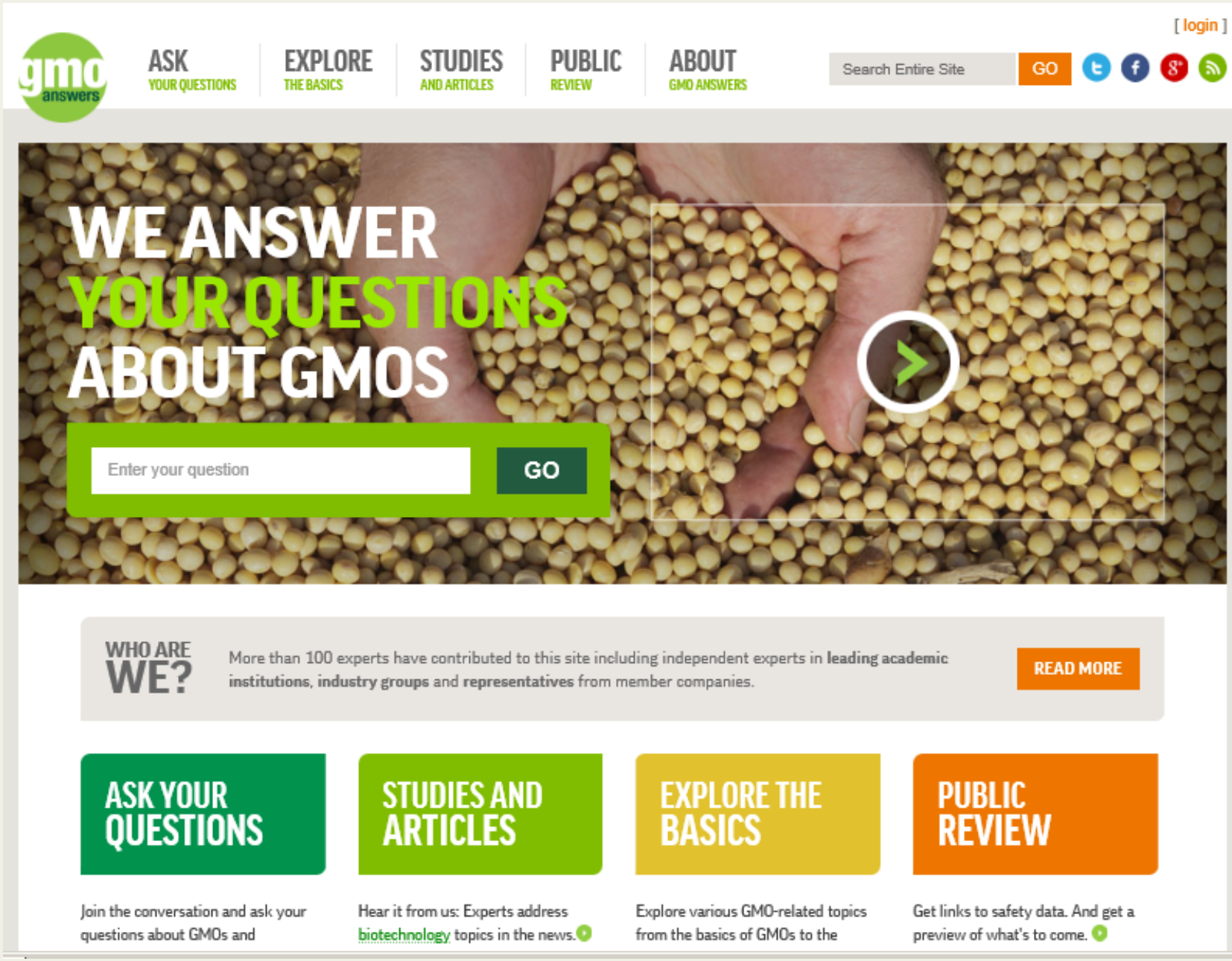
- AAS is an Atlantic salmon, and as safe to consume as food as any other Atlantic salmon
- AAS represents no significant risk to the environment under conditions of use in application an approval

Technology Moving Overseas

- China-investing $12 billion in agriculture biotechnology
  - Over 50 different animal lines developed
- Brazil-recruiting U.S. researchers
  - Supportive environment for development and deployment
- EU-biomedical research on livestock growing
  - Have put together a regulatory regime for GE animals

Acknowledge Current Business Climate/ Skepticism

- We have great stories that are not being heard because we are not believed
- Instead of repeating these messages, we committed to showing our audiences that we have nothing to hide
- Only when our audiences understand we are listening to them will they begin to listen to us



www.gmoanswers.com

Strong digital and social presence in which people hang out and engage

Website Traffic

- Facebook and Twitter top drivers

660 Questions Submitted	447 Questions Answered	137 Questions In-Progress

- More than **150,000 visits** and **600,000 page views**
- Currently **25,000 visitors /month**
- Average duration of visit is **5 minutes**
- **35% are returning** visitors

Conclusions

- **Innovations from biotechnology will positively impact the future of food production**

- **The biotechnology industry seeks to work in partnership with the value chain**
  - Providing timely and useful information
  - Working for public understanding and confidence
  - Overcome inaction from overabundance of precaution

"…We have recently advanced our knowledge of genetics to the point where we can manipulate life in a way never intended by nature.
We must proceed with utmost caution in the application of this new found ability."

1906, critic of the plant breeder Luther Burbank

"Not one person has suffered negative effects from innovations like GMOs, yet 25,000 people die every day from malnutrition."

- Dr. Norman Borlaug, 2009

Contact Information

- **Dave Edwards, PhD**
  - **Director, Animal Biotechnology**
  - **dedwards@bio.org**
  - **P: +1(202)962-9200**

http://www.bio.org/livestockbiotechsummit

BIO International Convention
The Global Event for Biotechnology

Livestock Biotech Summit
September 16-18, 2014 in Sioux Falls, SD

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