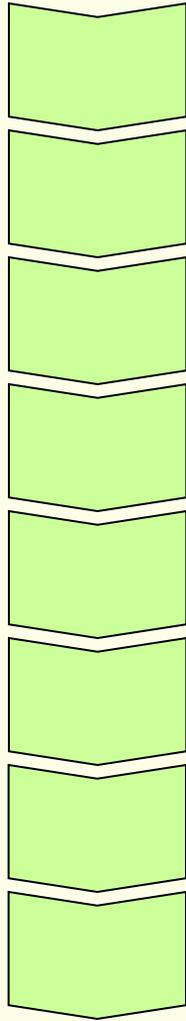


Challenges in the Livestock Value Chain

John Webb



Genetics

Feed

Producer

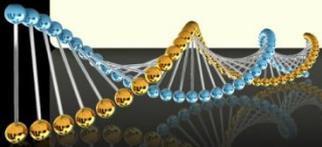
Primary processor

Further processor

Retail & Food Service

CONSUMER

Healthcare services



Consumers in Canada

55% 1-2 person meals

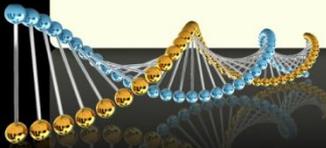
22% ethnic minorities by 2017

24% adults obese (8% children)

6% diabetic (2 million)

11% GDP on healthcare

16% over 65 years of age



**Mental
acuity**

**Neuro-
degenerative**

Osteoporosis

**Vitamins
& minerals**

Hypertension

**Type II
diabetes**

Obesity

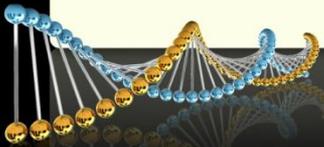
Cardiovascular

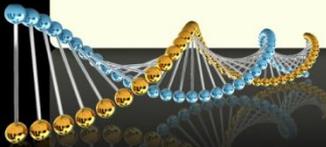
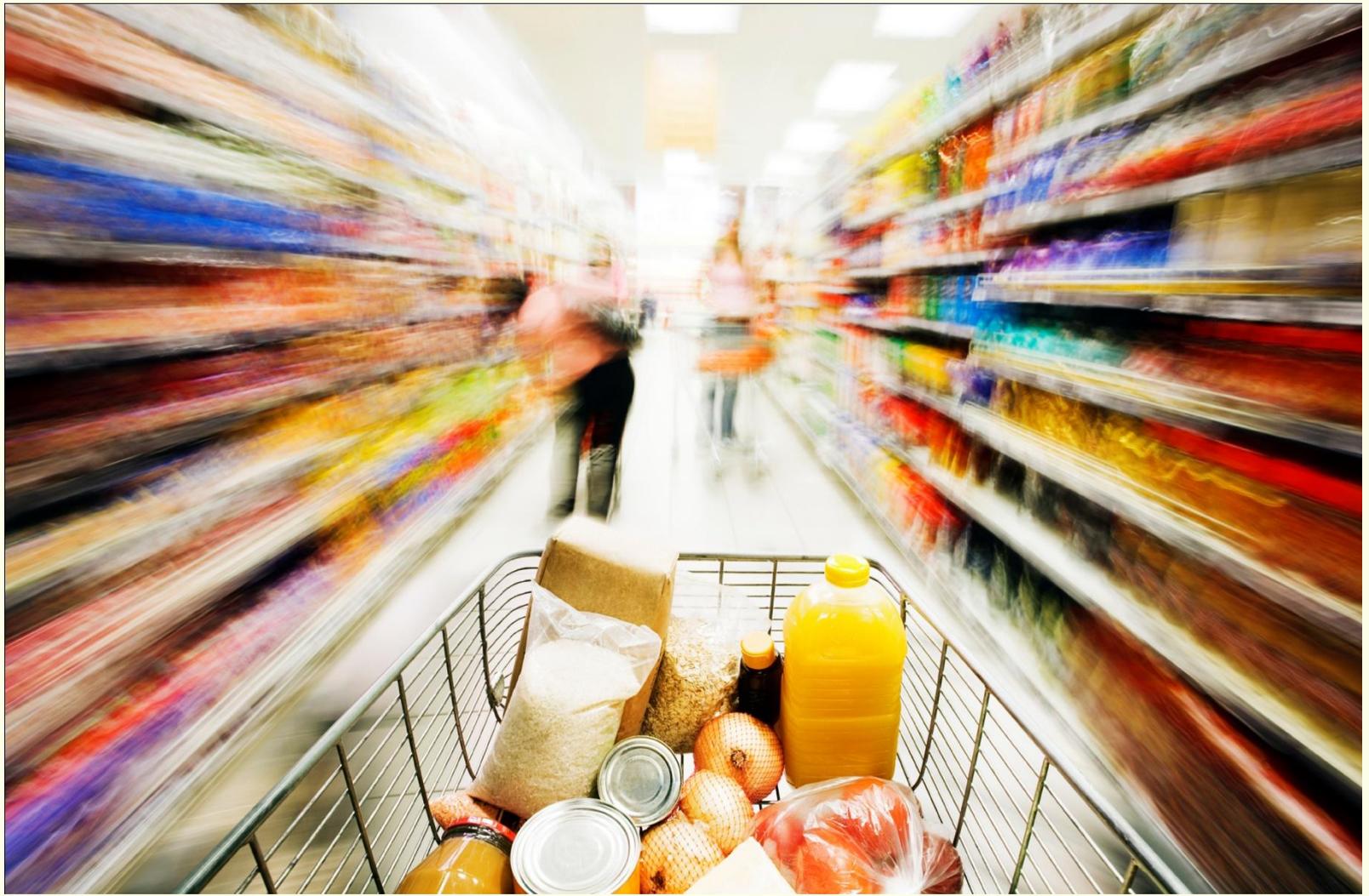
Inflammation

**Reproductive
cancer**

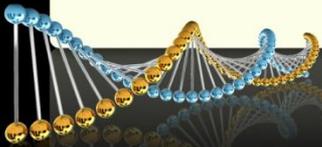
**Colon
cancer**

**Immune
function**

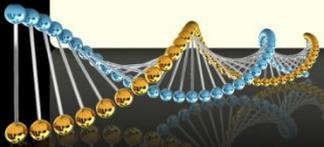
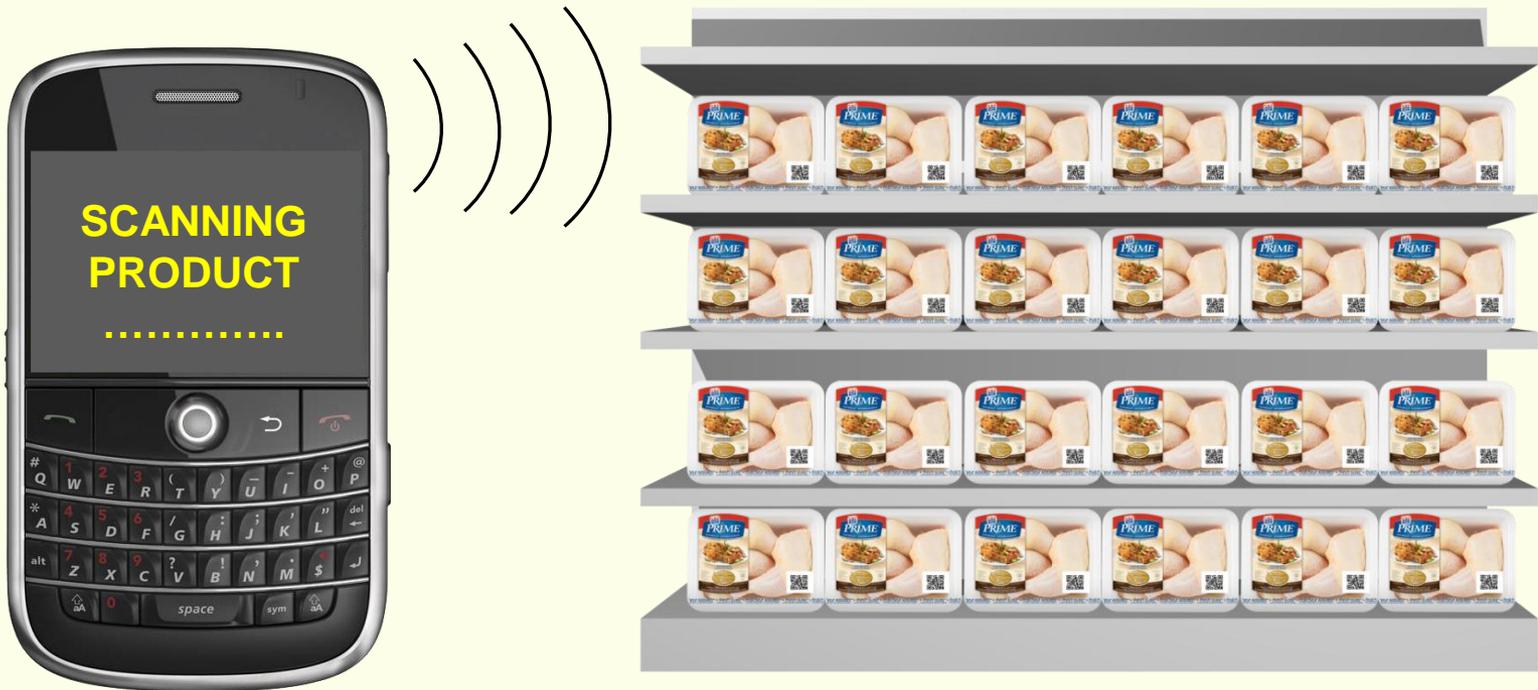




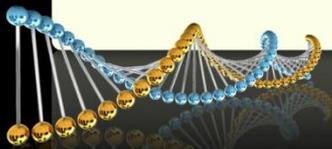
QR (Quick Response) Codes



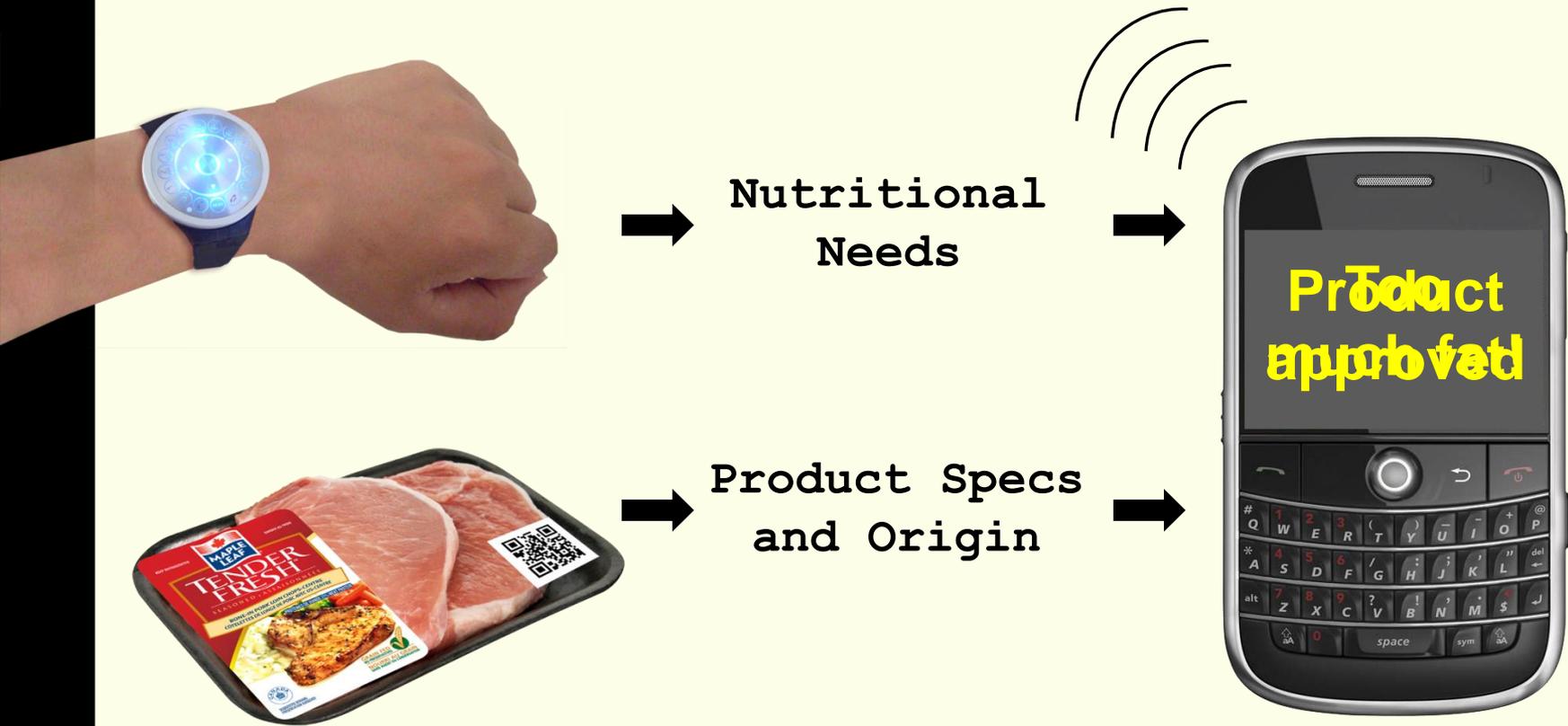
Scanning QR Codes



Blood Metabolites Monitor



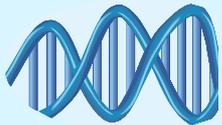
Match to Nutritional Status



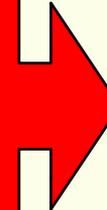
Ideal healthy fatty acids



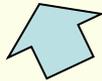
Human
genome



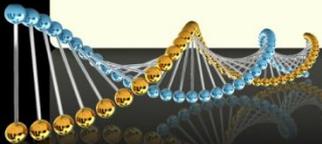
*Genomic
selection
technologies*



Animal
genome

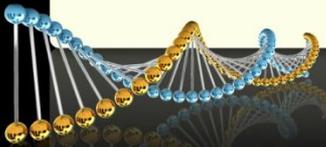


Change fatty acid profile

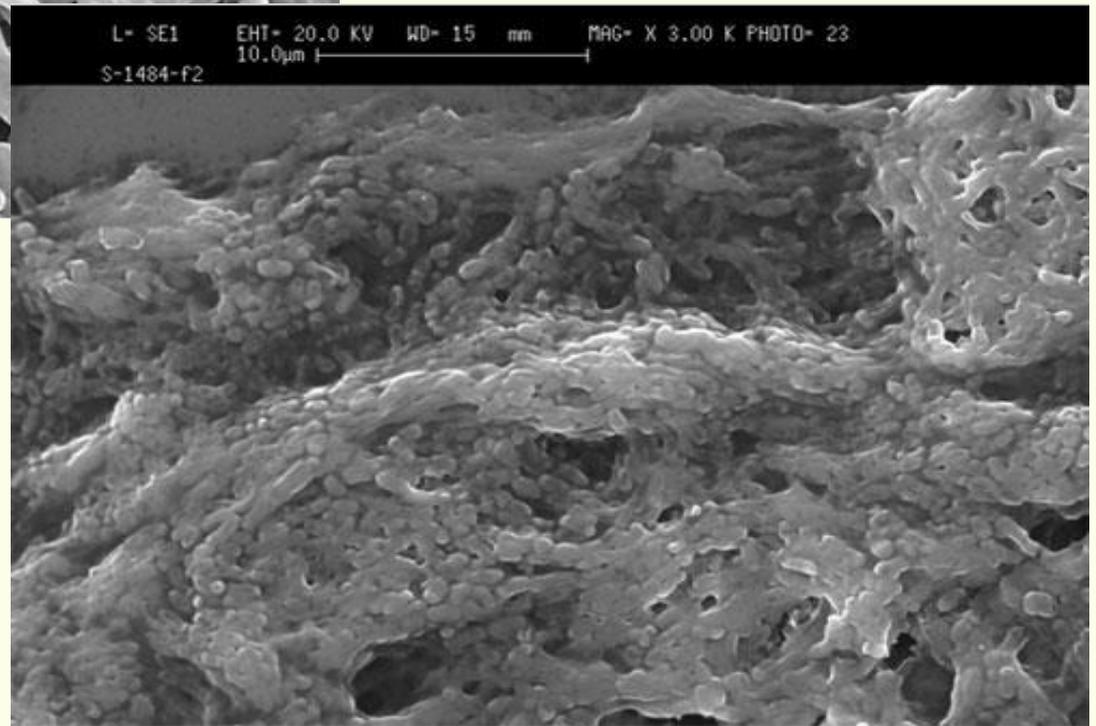
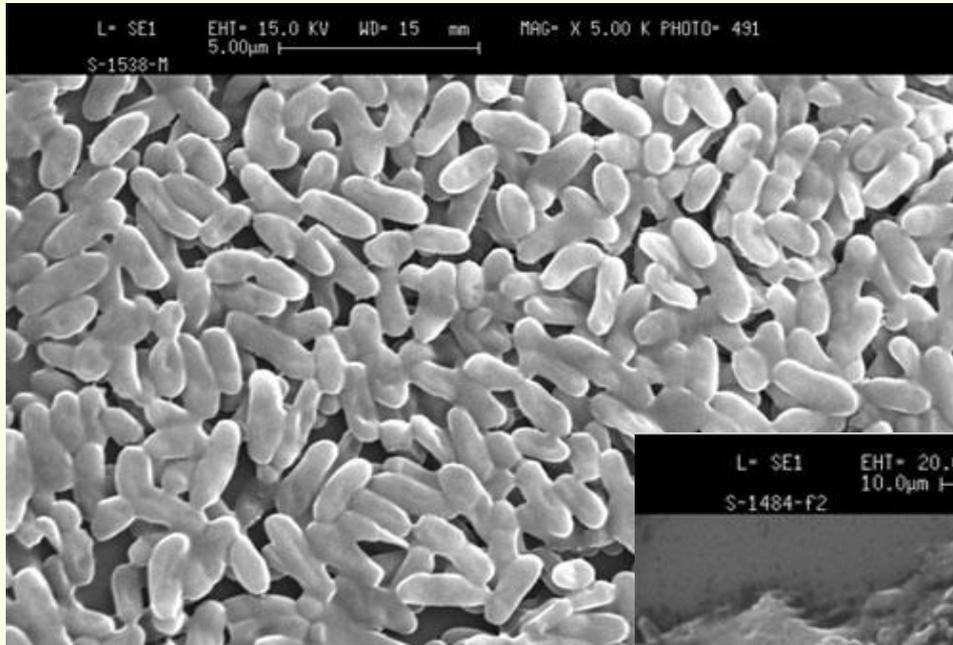


Meat Recalls in Canada

Year	2010	2011	2012
<i>Listeria mono</i>	28	255	6
<i>Salmonella</i>	10	122	6
<i>E.Coli 0157:H7</i>	5	10	37
Allergens	1	12	8

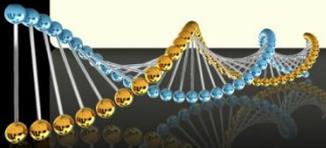


Biofilms



© **innovotech**

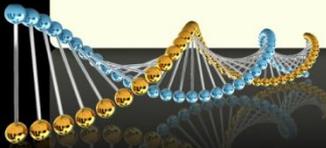
Edmonton AB

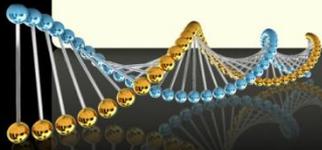
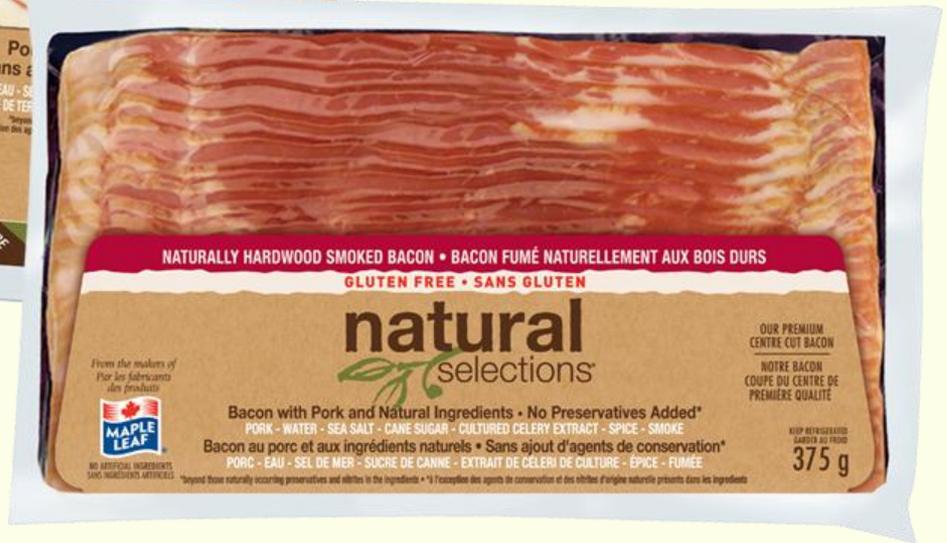


Processed and red meat

"Meta-analyses"

- **Colorectal Cancer**
 - *World Cancer Research Fund 2011*
- **Bladder Cancer**
 - *Ferrucci et al., Cancer 2010*
- **Cardiovascular disease**
 - *Micha et al., Circulation 2010*
- **Prostate Cancer**
 - *Joshi et al., Carcinogenesis 2012*

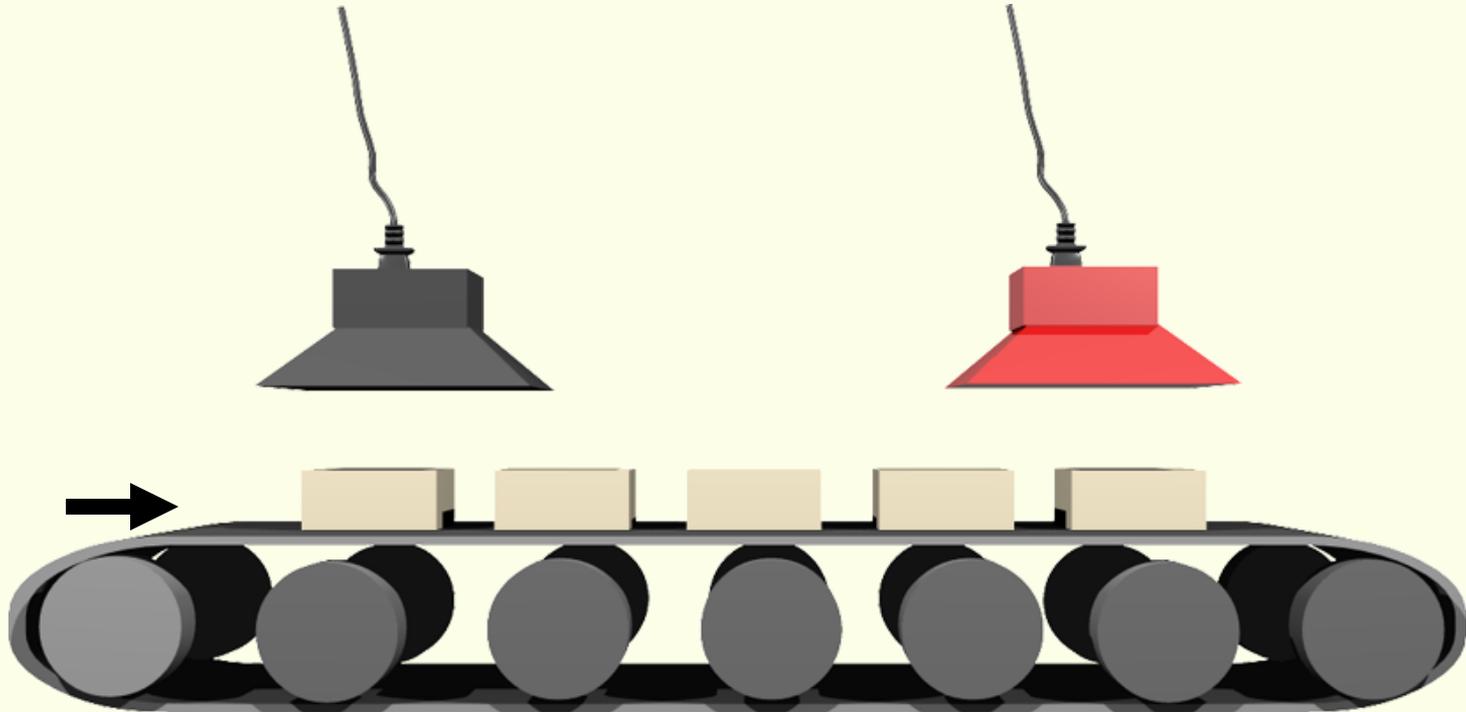




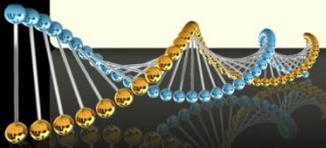
Next generation 'Aseptic Meat'

detector

terminator



Wet chemistry → Quantum genomics



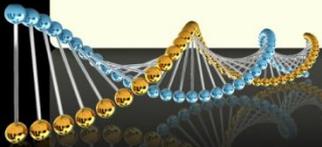
Horse meat scandal: Shoppers who buy 'cheapest food' at risk

British consumers face paying the price for the horse meat scandal, one of the country's leading retailers warns today.



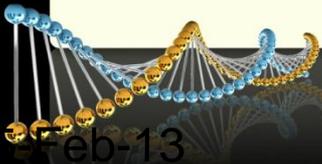
The Telegraph

February 17th 2013

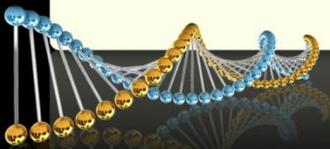
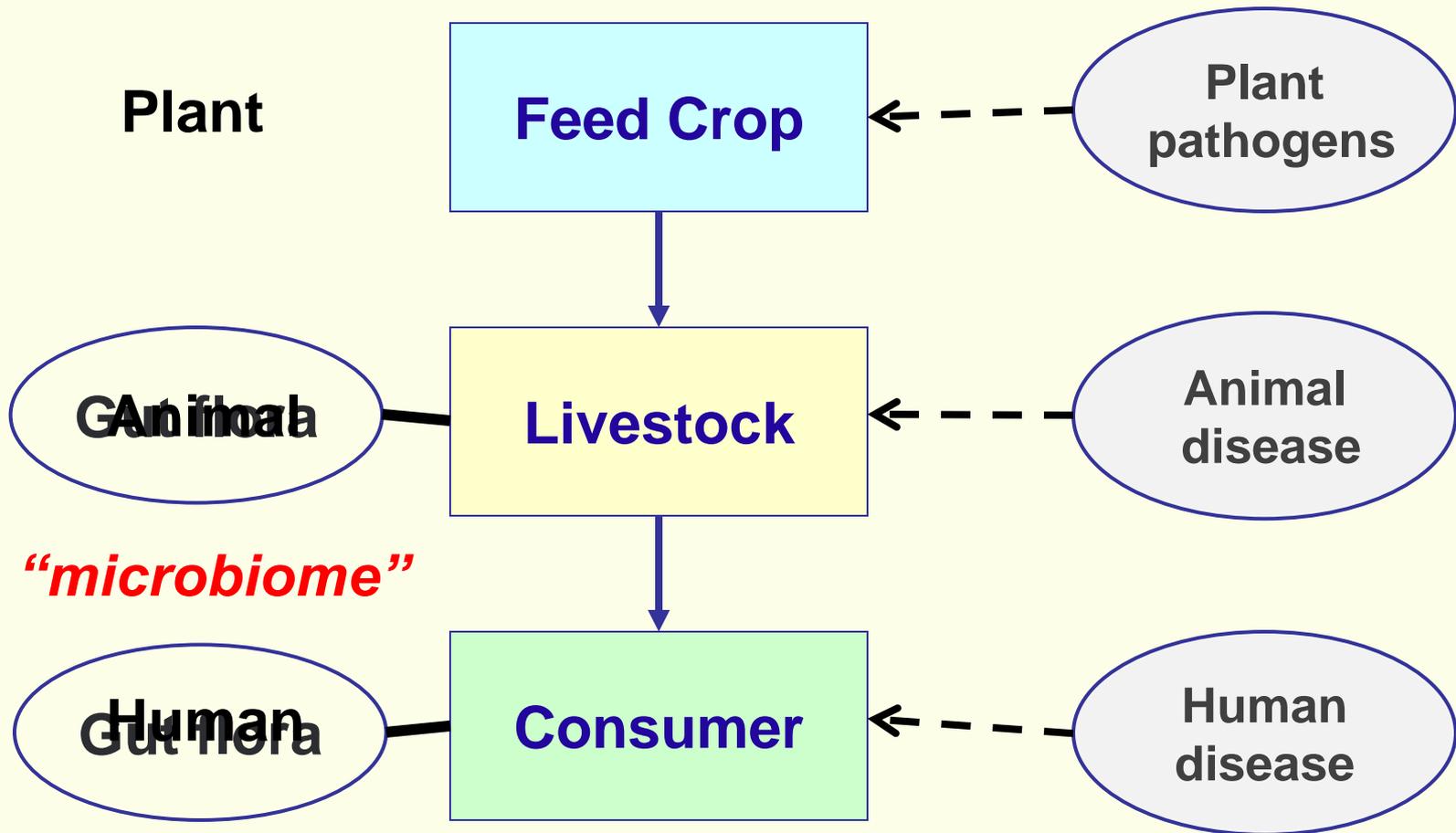


Food Quality and Safety

- **Animal immunity**
- **Protein quality**
- **Fat quantity & quality**
- **Integrity/origin**
- **Antimicrobial peptides**
- **Carcinogen precursors**



Whose Genotype?



Livestock Production

Growth rate

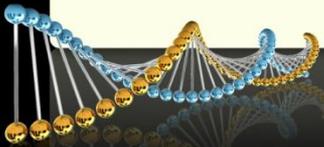
Feed efficiency

Carcass composition

Saleable yield

Product quality

Reproduction

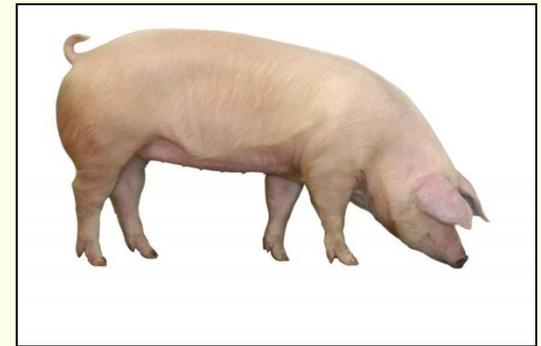
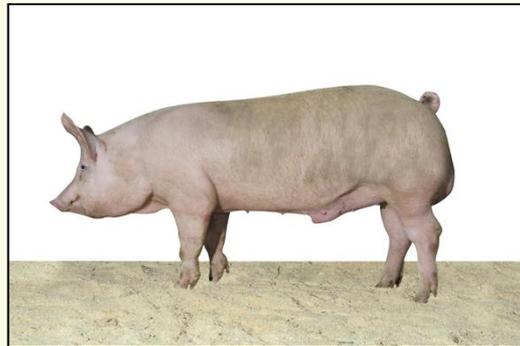
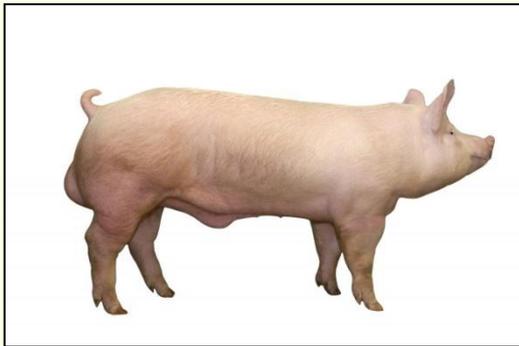


Nucleus Populations

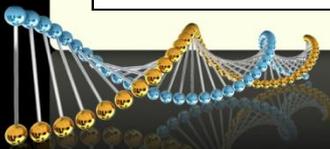
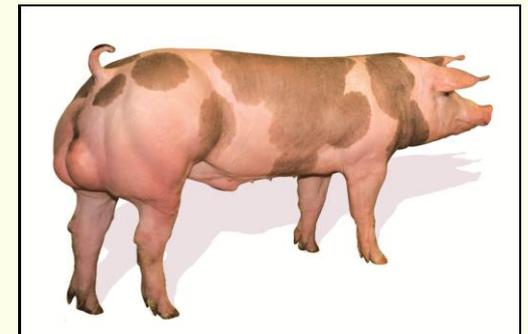
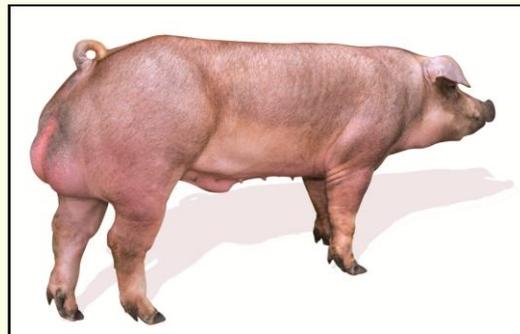
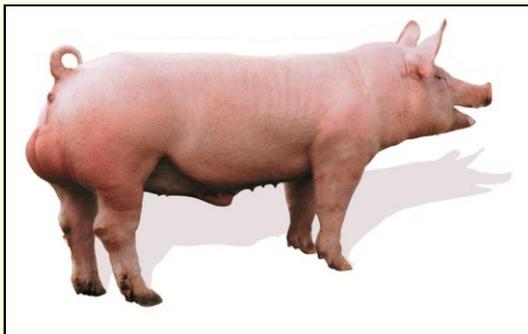
© Topigs Canada Inc. 2013



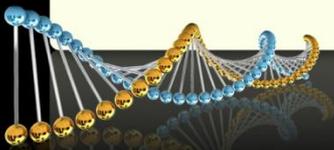
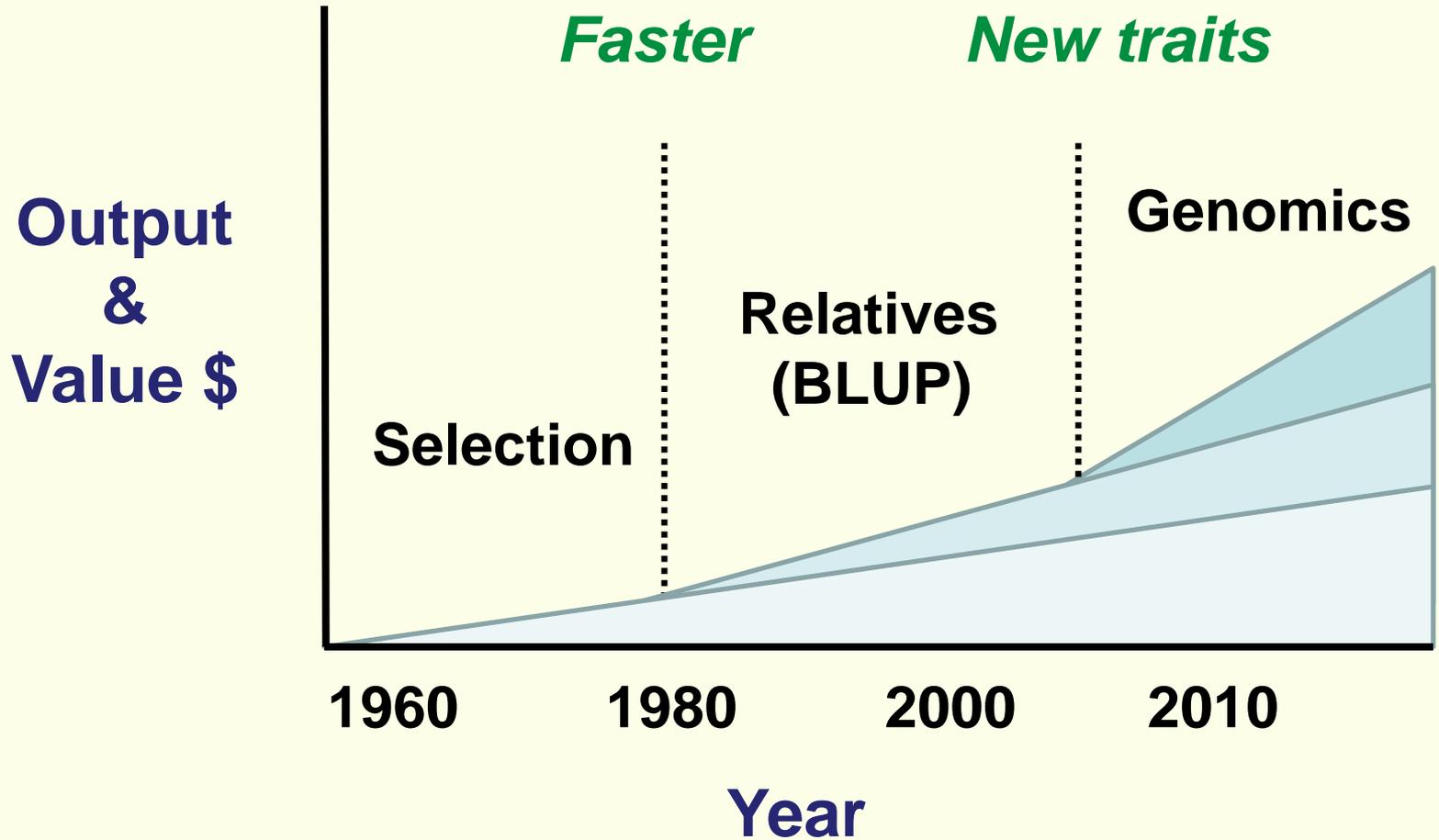
Dam lines



Sire lines



Genetic improvement



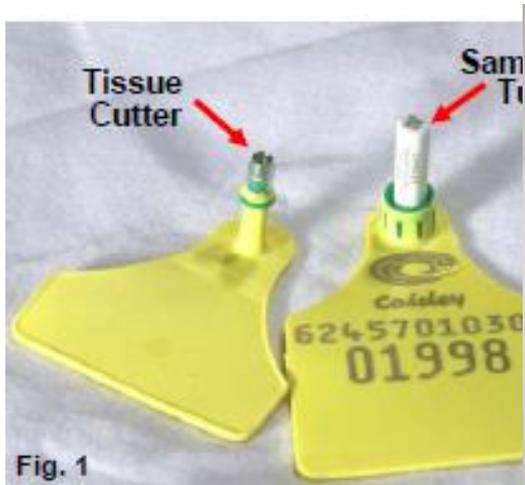


Fig. 1

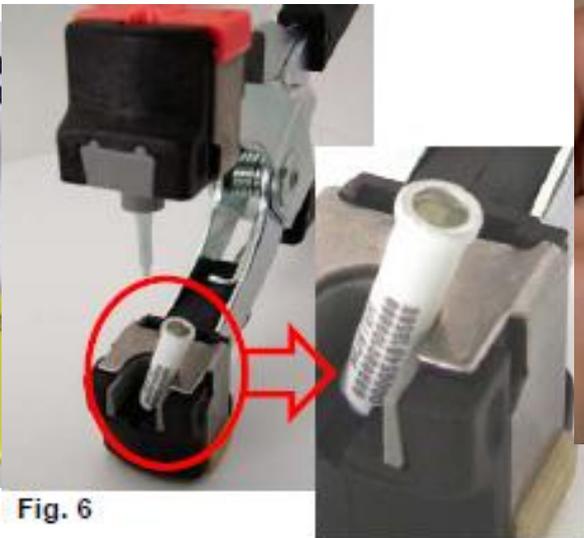
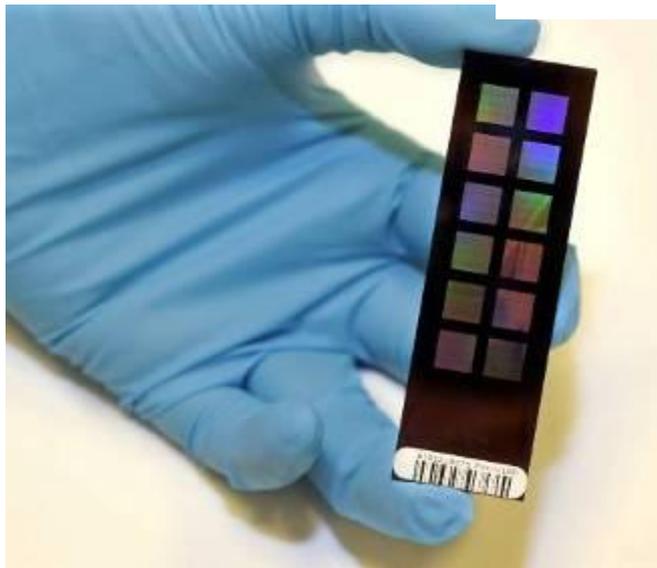


Fig. 6



Courtesy: Topigs 2013

Market Hogs



Nutrigenomics

**Genetic marker
for protein accretion**

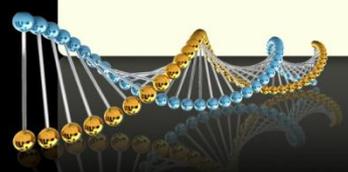


**High
responders**

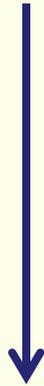
**Low
responders**

**High protein diet
(Expensive)**

**Low protein diet
(Cheap)**



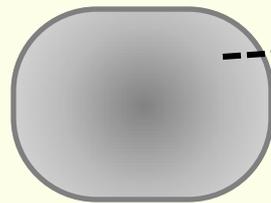
Genotype



← **Many environments**

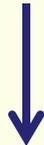
← **Gene expression**

cell

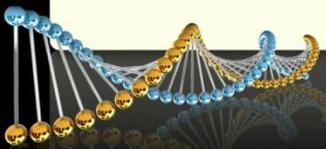


metabolites

“metabolome”



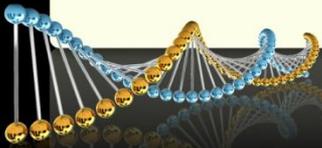
Phenotype



Ontarian catches H1N1 variant after close contact with pigs

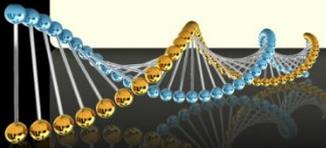


Reuters September 25, 2012



The fundamental threat

- Bacteria
- Viruses
- Plasmids and phages
- Misfolded proteins
- Immune competence
- Antibiotic resistance



Hog castration

2010

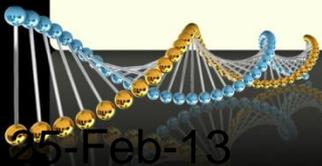
*Belgian supermarket
bans surgical castration*



Improvest (Pfizer) accepted
in over 50 countries

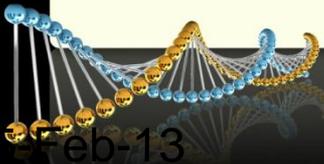
- GnRF vaccine
- semen sexing
- genetic selection against taint

Dr Jim Squires (Guelph)



Production, Health, Welfare

- Immune competence
- Hard-to-measure traits
- Alternative feedstuffs
- Boar taint
- Gut microbes
- Metabolomics



Sustainability

Air

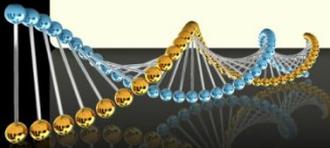
GHG's, CO₂, CH₄, VOC's

Water

Pollution: N, P

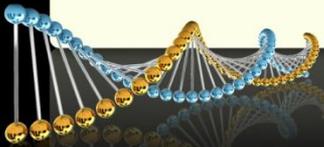
Earth

*Energy, soil depletion, microbes
Biodegradeable, locovore*



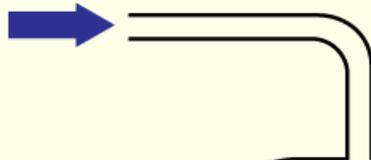
**“One cow produces
100 to 500 litres
methane per day”**

**Modify the Rumen Bacteria
(Bruce German, 2012)**



Designer bacteria

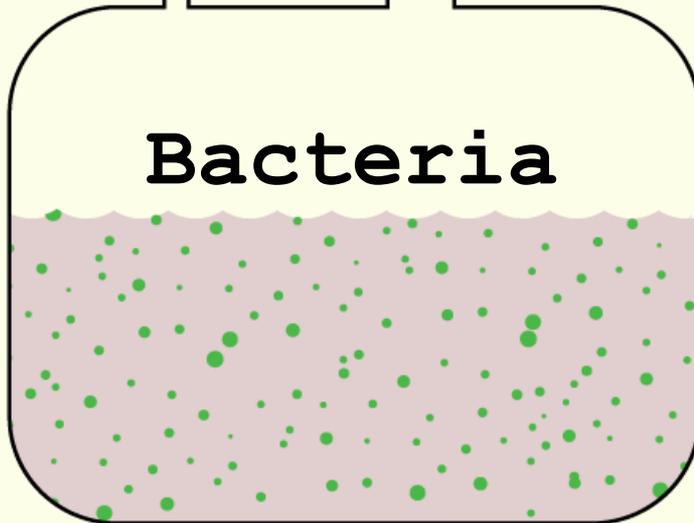
Nutrients



CO₂

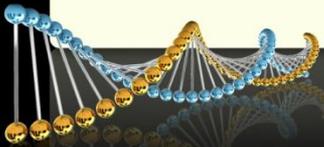


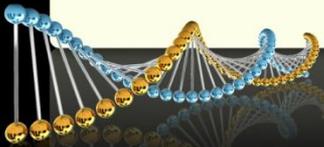
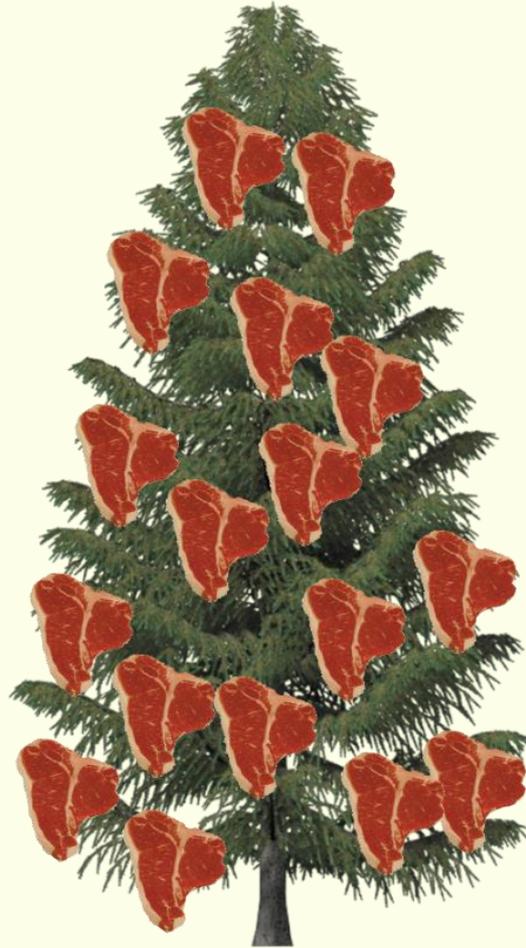
Bacteria

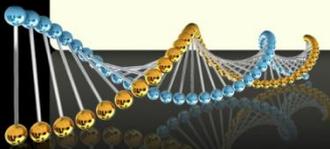
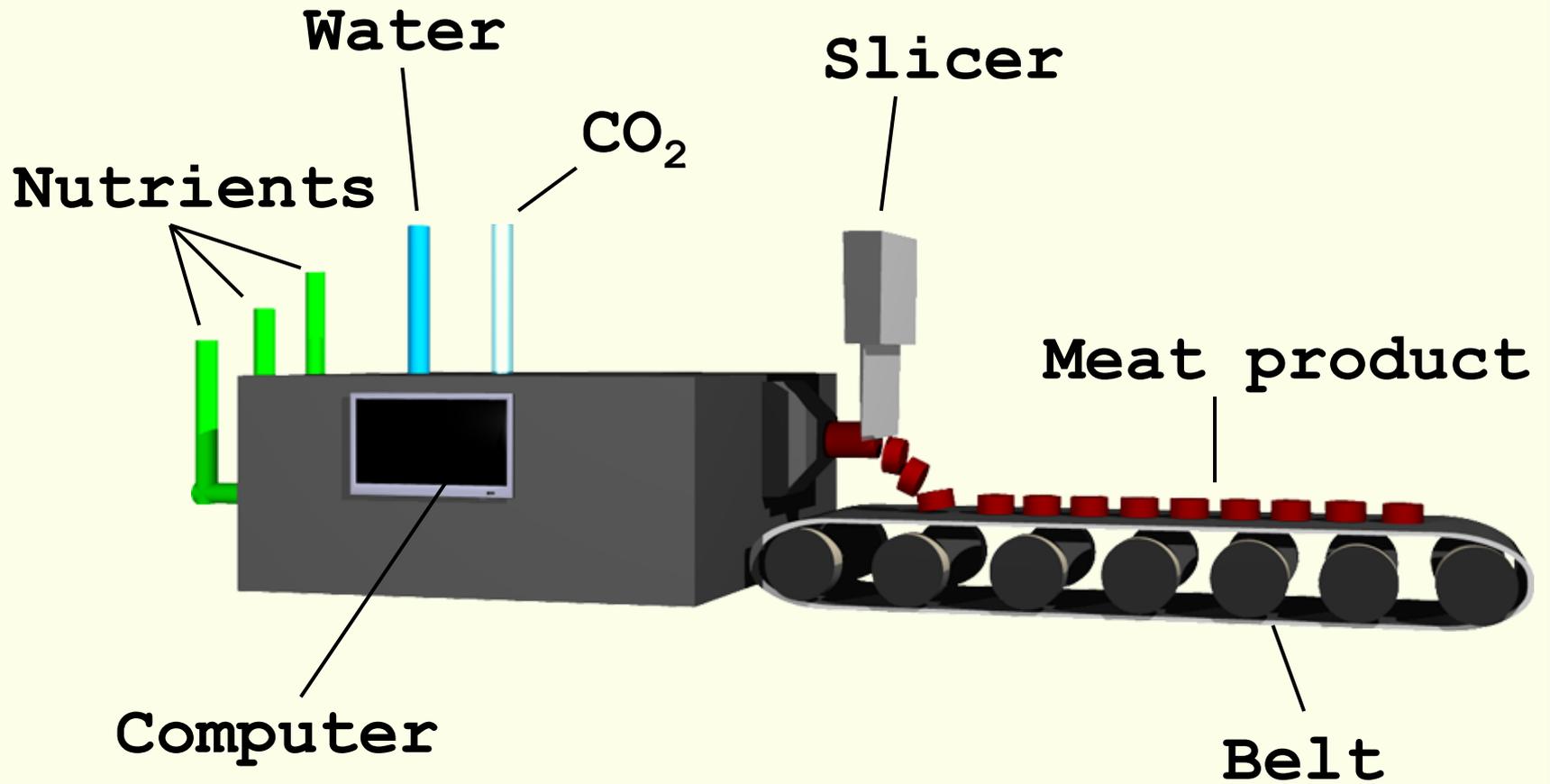


From:
Craig Venter
(2010)

Designer
carbohydrate



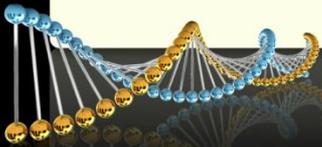






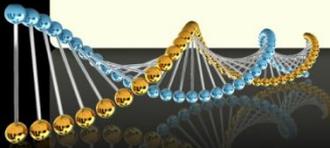
**9 Billion
2050**

Feed the World?



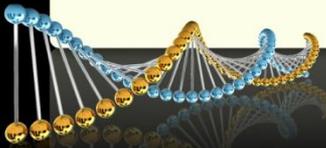
Success

- **Healthy consumers**
- **High quality food**
- **Safe food**
- **Profitable agriculture**
- **Protein export markets**
- **Sustainability**
- **Animal health & welfare**



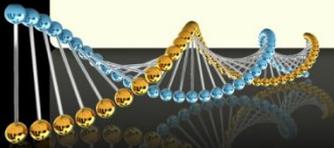
Top Research Priorities

- Pathogens, immune function
- Anti-microbial properties
- Consumer health
- Taste and eating quality
- Alternative feeds
- Harmful emissions
- Nanotech, quantum biology



Genomics is the key
to ...

“Re-balancing”
the ecology
of our planet.



john.webb@mapleleaf.com
Thank You

