ANTARCTICA

Weddell Sea
Bellingshausen Sea
South Orkney Is
Drake Passage
la Sea

SOUTHERN OCEAN

Iles de Kerguelen
Heard Is
Prince Edward Is
Iles Crozet

SOUTH ATLANTIC OCEAN
Bouvetoya

Cape Horn
Falkland Is

Dunedin
Chatham Is
Christchurch
Wellington
NEW ZEALAND
Auckland
North Island
Tasman Sea
Hobart
Tasmania

Ile St Paul
Ile d'Amsterdam

ARGENTINA
Montevideo
Buenos Aires
URUGUAY
Cordoba
Santiago
Porto Alegre
CHILE

Melbourne
Canberra
Adelaide
Sydney
Brisbane
AUSTRALIA
Great Australian Bight
Perth
Alice Springs

INDIAN OCEAN
Mauritius
Port Louis
REPUBLIC OF SOUTH AFRICA
Cape of Good Hope
Cape Town
Durban
LESOTHO
Maseru
Pretoria
SWAZILAND
Mbabane
Johannesburg
Windhoek
NAMIBIA
BOTSWANA

Asuncion
PARAGUAY
Sucre
BOLIVIA
Sao Paulo
Rio de Janeiro
Brasilia
BRAZIL
Lima
PERU
Fortaleza
Belem

FRENCH POLYNESIA
TONGA
Nuku'alofa
NEW CALEDONIA
Noumea
Suva
FIJI
VANUATU
Port-Vila
Apia
SAMOA

SOUTH PACIFIC OCEAN

Coral Sea
Cairns
Darwin
Timor Sea
Arafura Sea
EAST TIMOR
Dili
Bali
Java
Surabaya
Jakarta
INDONESIA
PAPUA NEW GUINEA
Port Moresby
Solomon Sea
Honiara
SOLOMON ISLANDS
Christmas Island
Cocos (Keeling) Is
Chagos Archipelago

MOZAMBIQUE
ZIMBABWE
Harare
ZAMBIA
Lusaka
ANGOLA
Luanda
MADAGASCAR
Mozambique
Moroni
COMOROS
TANZANIA
BURUNDI
RWANDA
Dar es Salaam
Nairobi
DEMOCRATIC REPUBLIC OF CONGO
CABINDA
CONGO
GABON
Kinshasa
Brazzaville
SAO TOME & PRINCIPE
EQUATORIAL GUINEA
Malabo
Gulf of Guinea
Ascension Is
St Helena

TUVALU
KIRIBATI
NAURU
Yaren
MICRONESIA
Kolonia
MARSHALL ISLANDS

SINGAPORE
MALAYSIA
BRUNEI
Bandar Seri Begawan
Kuala Lumpur
Medan
BORNEO
Celebes Sea
Maluku
Davao
Zamboanga

Hawaiian Islands
HAWAII
Honolulu

NORTHERN MARIANAS
PHILIPPINES
Manila
South China Sea

MALDIVES
Male
SRI LANKA
Jayewardenepura Kotte
Colombo
SEYCHELLES
Victoria
Mogadishu
SOMALIA
ETHIOPIA
Addis Ababa
KENYA
Kampala
UGANDA
CENTRAL AFRICAN REPUBLIC
CAMEROON
Bangui
NIGERIA
Abuja
BENIN
TOGO
GHANA
Accra
Lome
COTE D'IVOIRE
Yamoussoukro
SIERRA LEONE
GUINEA
Freetown
Conakry
GUINEA-BISSAU
Bissau
Banjul
GAMBIA
Dakar
SENEGAL

FRENCH GUIANA
Cayenne
Paramaribo
SURINAME
GUYANA
Georgetown
COLOMBIA
Bogota
Medellin
VENEZUELA
Caracas
Maracaibo
TRINIDAD & TOBAGO
Port of Spain
Guayaquil
ECUADOR
Quito
Galapagos Is
Cali
PANAMA
COSTA RICA
San Jose
NICARAGUA
Managua
EL SALVADOR
San Salvador
GUATEMALA
Guatemala
HONDURAS
Tegucigalpa
BELIZE
Belmopan

MYANMAR
Yangon (Rangoon)
LAOS
Phnom Penh
CAMBODIA
VIETNAM
THAILAND
Bangkok
Ho Chi Minh
Bay of Bengal
Chennai
Bangalore
Hyderabad
Mumbai
Kolkata (Calcutta)
INDIA
Arabian Sea
NEPAL
Kathmandu
BHUTAN
Thimphu
BANGLADESH
Dhaka

DJIBOUTI
Djibouti
ERITREA
Asmara
SUDAN
Khartoum
CHAD
NIGER
Niamey
MALI
Bamako
BURKINA FASO
Ouagadougou
MAURITANIA
Nouakchott

TAIWAN
Taipei
Kaohsiung
Hong Kong
Guangzhou
Fuzhou
Guiyang
Shanghai
Chengdu
CHINA
Lanzhou
Urumqi

East China Sea
JAPAN
Tokyo
Osaka
Kyushu
Honshu
Fukuoka
Sea of Japan (East Sea)
SOUTH KOREA
Seoul
NORTH KOREA
Pyongyang
Jinan
Beijing
Shenyang

UNITED STATES OF AMERICA
New Orleans
Houston
El Paso
Phoenix
Las Vegas
Los Angeles
San Diego
San Francisco
Salt Lake City
Denver
Dallas
Atlanta
Washington
Philadelphia
New York
Boston
Cleveland
Chicago
Minneapolis
Bismarck
Seattle
Portland
Vancouver
Victoria

MEXICO
Monterrey
Guadalajara
Acapulco
Mexico
Gulf of Mexico
CUBA
Havana
Nassau
THE BAHAMAS
DOMINICAN REPUBLIC
Santo Domingo
HAITI
Port-au-Prince
Kingston
JAMAICA
Caribbean Sea
BARBADOS
ST LUCIA
DOMINICA
ST VINCENT & THE GRENADINES
ST KITTS AND NEVIS
ANTIGUA & BARBUDA
PUERTO RICO

MONGOLIA
Ulan Bator
Ulan-Ude
Irkutsk
Chita
KAZAKHSTAN
Astana
Almaty
Bishkek
KYRGYZSTAN
Tashkent
UZBEKISTAN
TAJIKISTAN
TURKMENISTAN
Ashgabat
AFGHANISTAN
Kabul
Islamabad
PAKISTAN
Lahore
Karachi
New Delhi
IRAN
Tehran
Mashhad
IRAQ
Baghdad
Basra
SAUDI ARABIA
Riyadh
OMAN
Muscat
YEMEN
Sana'a
UNITED ARAB EMIRATES
QATAR
BAHRAIN
KUWAIT
Salalah
Al Dawhah

EGYPT
Cairo
LIBYA
Tripoli
ALGERIA
Algiers
MOROCCO
Rabat
Casablanca
Canary Is
Las Palmas

Khabarovsk
Vladivostok
Harbin
Sapporo
Hokkaido
Kuril Islands
Sakhalin
Novosibirsk
Omsk
Chelyabinsk
Ufa
Kazan
Perm
Yekaterinburg
Moscow
St Petersburg
Volgograd

RUSSIAN FEDERATION

Yakutsk
Magadan
Okhotsk
Sea of Okhotsk
Ust Penzhino
Ulan-Ude
Chita

UKRAINE
Kiev
BELARUS
Minsk
POLAND
Warsaw
GERMANY
Berlin
Rome
ITALY
Vienna
FRANCE
Paris
SPAIN
Madrid
PORTUGAL
Lisbon
ANDORRA
MONACO
Bay of Biscay
TURKEY
Ankara
Istanbul
GREECE
Athens
BULGARIA
Sofia
ROMANIA
Bucharest
CYPRUS
SYRIA
Damascus
LEBANON
Beirut
ISRAEL
Jerusalem
JORDAN
Amman
Mediterranean
Tunis
TUNISIA
AZERBAIJAN
ARMENIA
GEORGIA
Tbilisi
Baku
Yerevan
Black Sea

CANADA
Quebec
Montreal
Ottawa
Toronto
Winnipeg
Calgary
Edmonton
Regina
Churchill
Hudson Bay
Juneau
Whitehorse
Yellowknife
Anchorage
Fairbanks
Nome
Alaska U.S.A.
Gulf of Alaska
Bering Sea
Aleutian Islands
Halifax
St John's
BERMUDA
St Lawrence
Raleigh
Labrador Sea

Petropavlovsk-Kamchatskiy
Kamchatka
Providenlya
Chukchi Sea
Pevek
Chokurdakh
Tiksi
Olenek
Nordvik
Magadan
Ulan Penzhino

NORTH PACIFIC OCEAN

INTERNATIONAL DATE LINE

GREENLAND
Nuuk
Iqaluit
Devon Island
Melville Island
Victoria Island
Banks Island
Sachs Harbour
Baffin Island
Baffin Bay
Davis Strait
Queen Elizabeth Islands
Parry Islands
Prince of Wales Island
Resolute
Repulse Bay
M'Clure Strait
Beaufort Sea
Viscount Melville Sound

ARCTIC OCEAN

Svalbard (Norway)
Franz Josef Land
Novosibirskiye Ostrova
Laptev Sea
East Siberian Sea
Kara Sea
Barents Sea
Severnaya Zemlya
Vorkuta
Murmansk
Pechora Sea

FINLAND
Helsinki
SWEDEN
Stockholm
NORWAY
Oslo
Bergen
Norwegian Sea
ESTONIA
Tallinn
LATVIA
Riga
LITHUANIA
Vilnius
DENMARK
Copenhagen
NETHERLANDS
BELGIUM
UNITED KINGDOM
London
Dublin
IRELAND
Belfast
Glasgow
North Sea
ICELAND
North Atlantic

Tropic of Capricorn
Tropic of Cancer
Equator
Arctic Circle
Antarctic Circle

About me

- Grew up on a farm near Geraldine

- Studied Genetics and Business at Otago

- Did my OE to Europe

- Worked for Scottish red meat industry for 5 years, monitor farms, meat processing, animal health projects etc.

- PhD (Massey) project undertaken in Edinburgh

- **My own research interests are in how to maximize/capture value from carcasses**

- Joined AgR in Jan 2014 as a Science Impact leader in meat products and supply

beef+lamb new zealand GEN TICS

Content

- Why meat research?
- Changing Operating environment
- Consumer trends
  - Global context
  - Meat Quality
- Emerging Research Trends
  - Food safety and Provenance
  - Phenomics
- Future Opportunities for the meat industry
  - Data

Why Research meat?

- Improved efficiency of production and processing
- Improved returns from whole of carcass
- Better value capture and retention
- We farm animals for meat, milk and fibre.
- Meat is human food

- Try and produce food **for a market** –
  Not produce meat and try and find a market.
- Move from Commodity to food!
- Increase $$$

beef+lamb new zealand GEN⊗TICS

Model of changing nature of New Zealand's food & beverage exports and export marketing system
2014

	1950's		2050's
Target market	- British wholesaler - British shopkeeper, butcher, cheesemonger or greengrocer		- Asian bar or restaurant manager - Middle-class Asian consumer
Nature of food & beverages exported	- Traditional foods of England - Ingredients for further processing - Almost no consumer-ready packaged/ processed foods - Almost no beverages		- Premium luxuries of Asia - Finished goods - Almost totally shelf-ready - Targeted at consumer or foodservice - Predominantly processed foods and beverages
Product form	- Bulk - Dry bag or frozen - Predominantly un-branded		- Ready-to-use in bar or restaurant - Ready-to-eat/ready-to-drink by consumer - Chilled, shelf-stable retort or frozen
Marketing	- Targeted at middle-man (wholesaler) through trade press - Unsophisticated, awareness/availability-driven functional message - Very limited consumer-direct communication or messaging - Conducted by quasi-government agencies run by New Zealand farmers		- Targeted at consumer through non-traditional channels (e.g. sponsorship) - Sophisticated, abstract, brand-building message - Conducted by global multinationals with New Zealand operations

Currently in-transition

Global context

- Emerging markets predicted to grow fastest over next 5 years – likely to see boom in eating out.

- Implications for meat industry:
    - Growing emphasis on eating good quality food as a definition of luxury, a belief that paying more = higher quality
    - Strong interest in authenticity when purchasing food. Provenance is important for emerging markets.

beef+lamb new zealand GENETICS

So what is quality?

- Means different things to different people

- Extremely difficult to define

- In meat we have come to a broad consensus of what defines "meat quality"
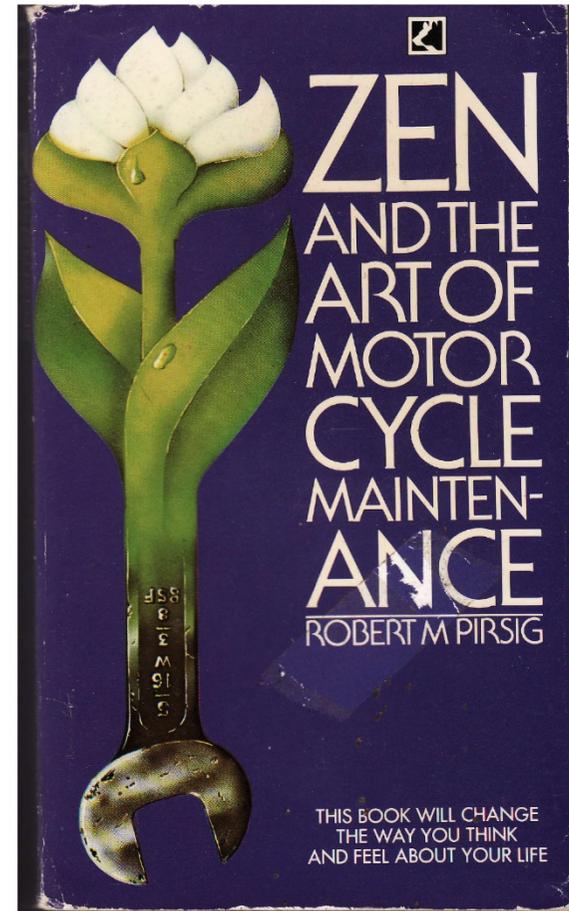
Consumer trends???

- NZ exports meat to >120 markets
- Each has their own preferences
    - Religious slaughter
    - Frozen vs. chilled
    - Eating quality
    - Functionality
    - Shelf life
    - Provenance and traceability
    - Production methods
    - etc. etc.

What impact does extrinsic factors have on intrinsic product quality?

beef+lamb new zealand GENETICS

AT A GLANCE

Established   Mainstreaming   Emerging

Artificial: Public Enemy No. 1

Eco is the New Reality

e-revolution: From Carts to Clicks

Good Enough to Tweet

From the Inside-Out

Alternatives Everywhere

Table for One

Diet by DNA

For Every Body

Based on a True Story

Fat Sheds Stigma

Eat with Your Eyes

MINTEL

Emerging meat research trends

Food Safety and Provenance

Integrated Food Safety System (across borders)

Legislation and regulatory changes (modernisation act)

Intensification of food production (increased risk)

Alternative food and feed source (biosecurity)

Consumer expectations (integrity)

Technical advances in analytics & big data (metagenomics)
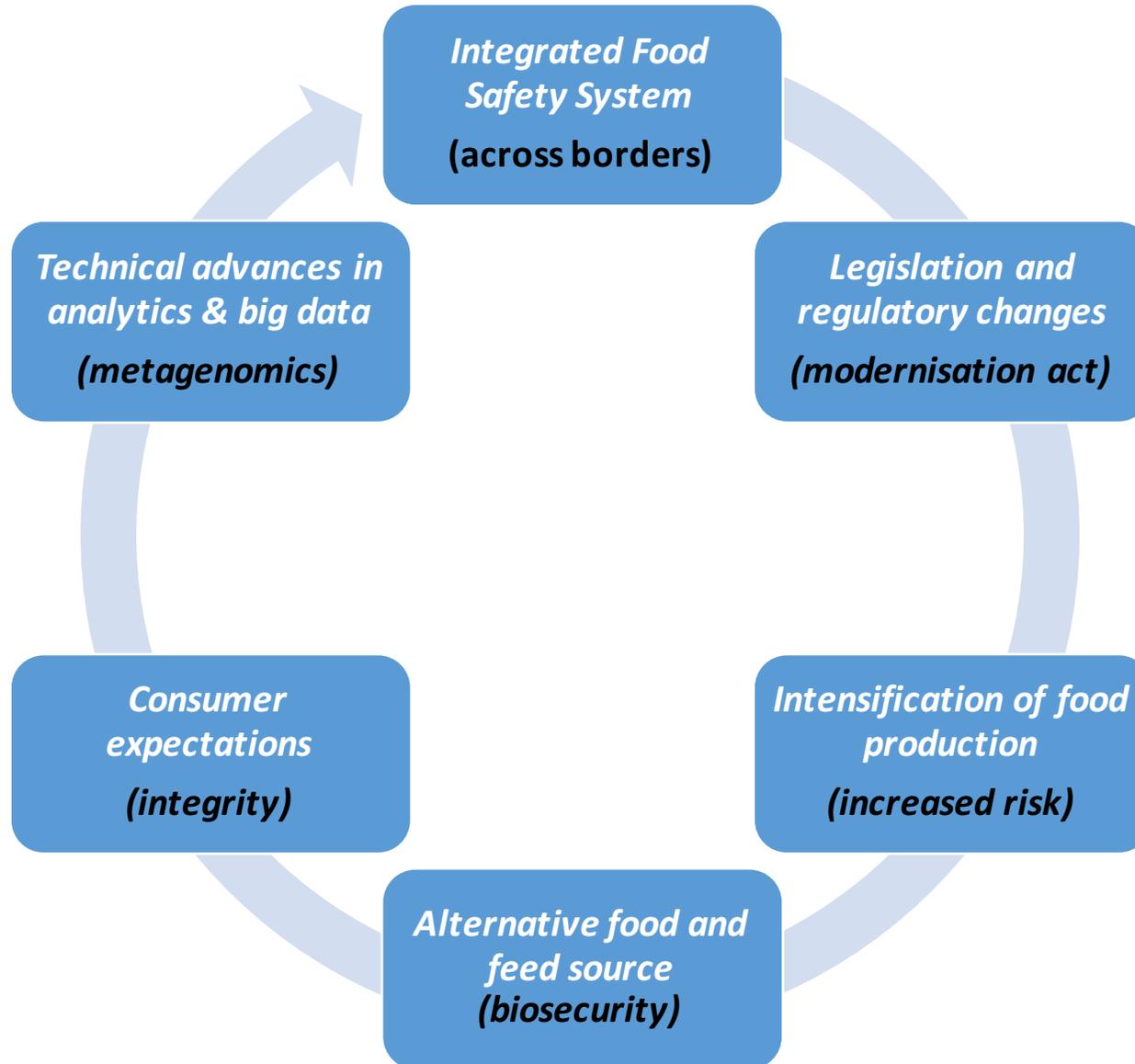
Food Safety consortium sequencing the supply chain

IBM Research and MARS tracking the microbiome of foods across the supply chain (http://www.research.ibm.com/client-programs/foodsafety/).
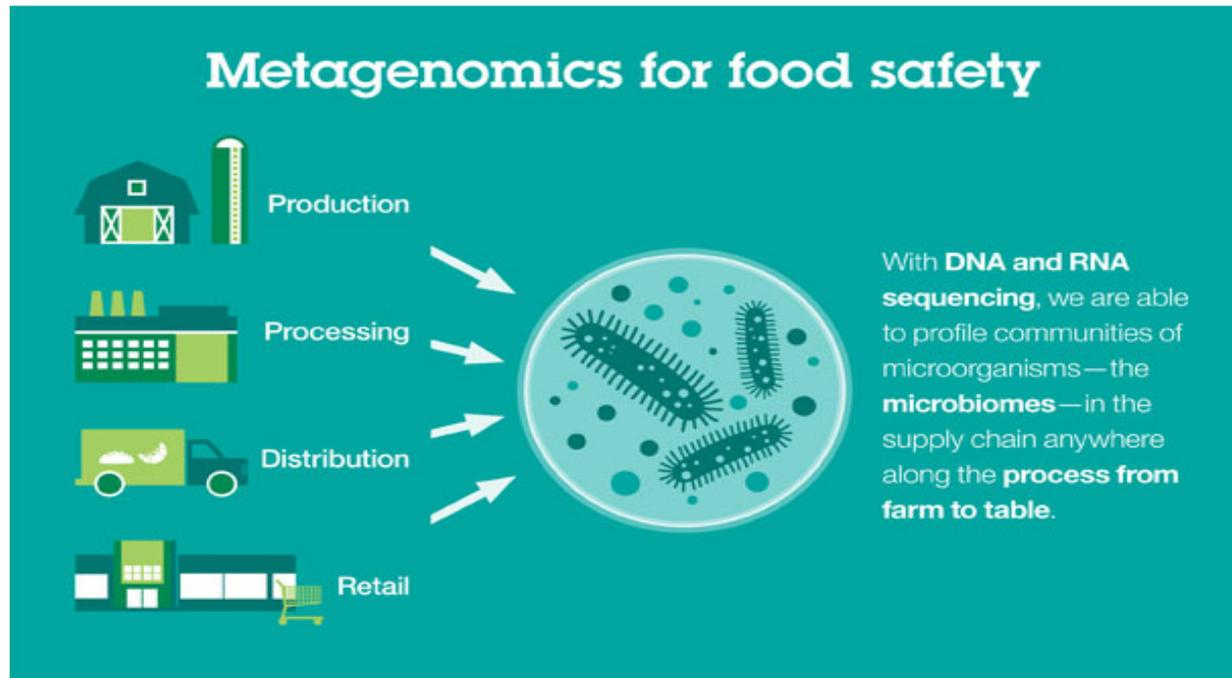
Phenomics

- Animal phenomics is a relatively new term that describes the next generation of animal trait measurement, including methodologies and equipment used to acquire data on traits, and computational approaches required to turn data into phenotypic information.

- Objective measures of traits

beef+lamb new zealand GEN(E)TICS

Phenomics - meat

- Real-time lamb meat quality measurement (more in the workshop)

- New traits from CT scanning

  - Spine characteristics (SRUC)

  - Intramuscular fat (SRUC)

- In-plant measurements for meat yield:

- DEXA – sees through the carcass, differentiates, lean, fat and Bone.

- Video Image Analysis –external carcass view only

- DATA CAPTURE > CONVERT TO INFO

Drill deeper

What we see often is only a fractional part of what it really is.
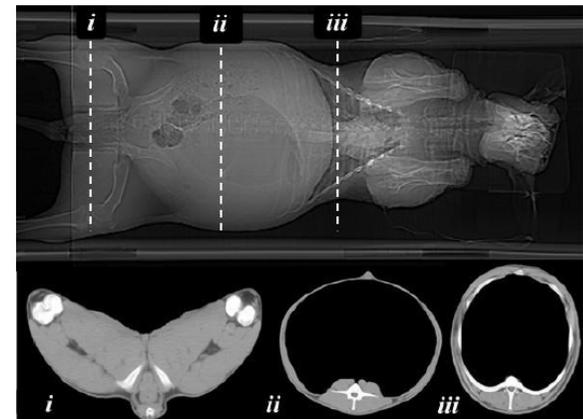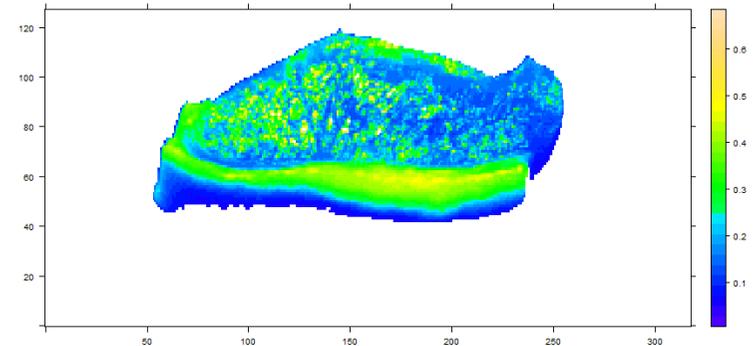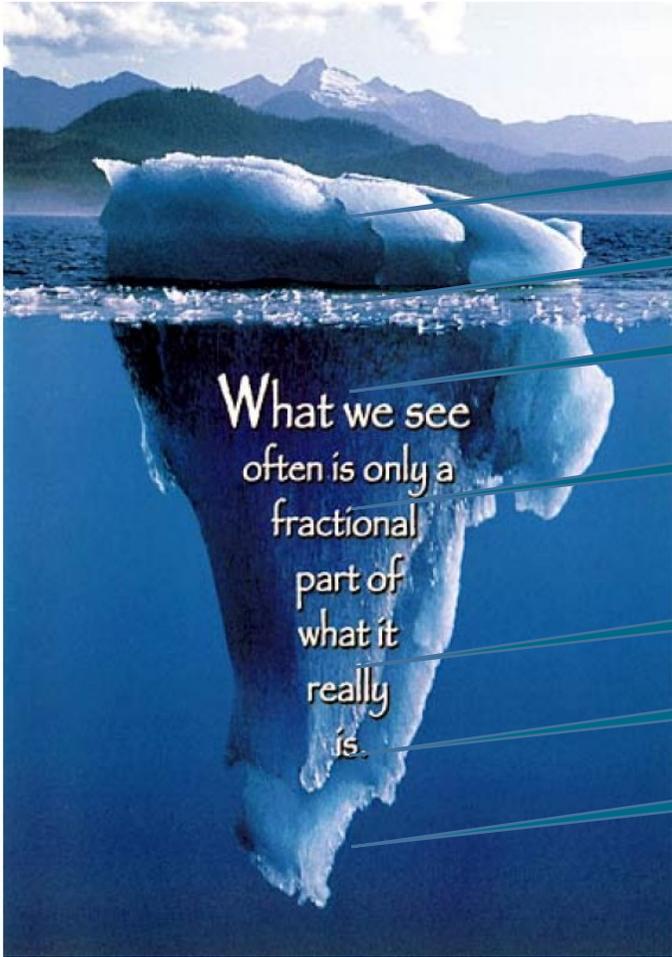
Appearance, Shelflife, Convenience

Provenance, Production System

Eating quality

Favourable Fat content

Increased Functionality

Beneficial Metabolites

Beneficial protein modifications

$???

beef+lamb new zealand GENETICS

Usage of Existing and New Data

- Increased uptake of information feedback mechanisms (already exist)

- Simplicity and intuitive

- Recognition of data value "in-market"

- Capture of data in NZ value chains

- Understanding of "levers" influencing product quality

- Enable farmers, processors to quantify impacts of production and processing on meat product quality:

- e.g. If I do X what impact will it have on Tenderness, taste, shelf life etc.?
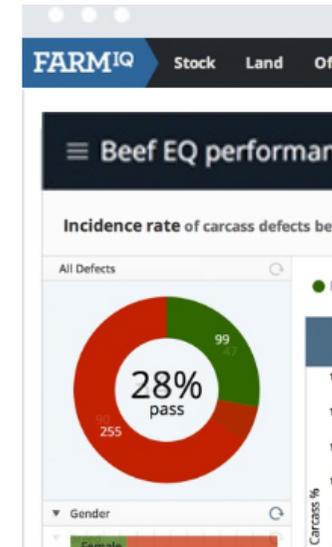
Emerging Data Issues

- *Interpretation -* As analytics and meat testing methodologies become more advanced, big data could be open to misinterpretation, and the challenge is to draw the right conclusions from these data sets.

- *Lack of capability and infrastructure -* Urgent need to train future animal scientists to use and analyze big data sets and interact successfully with data scientists across disciplines.

- *Lack of trust and accountability-* Sharing data across value chains and jurisdictions: Urgent need to standardize data, legal and privacy restrictions

beef+lamb new zealand GENETICS

Summary Messages

- Move as far from commodities as possible by differentiating products on credence and demonstrable intrinsic quality parameters – Drill deeper.

- Leverage brand NZ, but embrace new opportunities for quantifying variation in meat product quality, because they will enable differentiation in market.

- Meat consumers will have higher expectations – it's a given.

- Phenomics is here to stay, and integration of data from multiple sources will be increasingly necessary.

- NZ is ahead of the curve, and we need to stay there!

beef+lamb new zealand GENETICS

THANK YOU