Research and Innovation in Agriculture
About Innovation
- why, what, how and who
A hungrier world
Population growth will drive global demand for food and fibre

A bumpier ride
Globalisation, climate change and environmental change will reshape the risk profile for agriculture

A wealthier world
A new middle income class will increase food consumption, diversify diets and eat more protein

Transformative technologies
Advances in digital technology, genetic science and synthetics will change the way food and fiber products are made and transported

Choosy customers
Information empowered consumers of the future will have expectations for health, provenance, sustainability and ethics
The global innovation landscape

- Increasing globalisation of science and technology
  - Rising of Asia

- Adjusting the balance
  - From Invention to Innovation
  - Research excellence AND Impact

- Digital is disrupting every industry

- Challenges have no boundaries
  - Organisational, discipline, cultural, geographic
  - Complex & interconnected
  - Require global standing and scale
Snapshot of Australia’s Innovation Capability

AU$33.5 billion
Gross expenditure on R&D in FY 13/14, 2.1% of GDP

7
Australian universities rank top 100 in the world: QS rankings

No.2
UN human development index 2015 - country’s investment in its people

5,400+ collaboration agreements
our universities and top 10 research partner nations

No. 1
Global Creativity Index 2015
The Australian innovation landscape

- Growing Digital Powerhouse
- SMEs Ranked 5th by OECD
- Partner with leading R&D, financial & industry players outside Australia
- 19 industries high global market share
- Stable economy, policies, government
- Respect and competitiveness
- Growing Digital Powerhouse
- Strong domestic supply chains
- Close to Asian economies
- Over 3% of world’s academic papers
- Over 99.7% population outside Australia
- Global market share
- Globally respected and competitive
- 98% global R&D outside Australia
- Research and Innovation in Agriculture | Lynne McIntyre |
Australia’s innovation performance
Constraining productivity, prosperity, health and sustainability

10th Strong in terms of R&D inputs
22nd Middling in terms of outputs
81st Weak global rank for innovation efficiency (ratio of R&D inputs to outputs)

Global Innovation Index
What continues, and what is different?

What stays the same;

- Delivering positive economic, environmental and social impact
- Mission directed R&D delivering projects with customers in industry, government and community
- Standards of science excellence and trusted advice
- Commitments to;
  - Health, safety and environment
  - Inclusion, trust and respect
  - Deliver on commitments

Customer First – a decisive shift from science creation as an objective, to value creation for customers from science and technology

Collaboration Hub – sourcing more capability from our partners, and integrating more students

Global outlook, national benefit – developing offshore businesses in key R&D markets

Breakthrough innovation - develop entrepreneurial skills, foster new collaborations and provide new funding models for high potential, high tech ventures
bring it

AcceleratiON
MotivatiON
IgnitiON
CollaboratiON
ConnectiON
InnovatiON

www.csiro.au
About CSIRO

- who, what, how
Who we are

People  5,000+

Locations  55

Impact driven

Budget  $1.2B+

Top 1% of global research institutions in 14 of 22 research fields

Top 0.1% in 4 research fields

2000 doctorates

500 masters

With our university partners, we develop 650 postgraduate research students
CSIRO’s contribution to Australian Innovation

1916
- CSIRO Formed

1926
- Prickly Pear Control

1930
- Black disease vaccine

1936
- CBPP vaccine

1938
- Aerogard

1942
- Radar

1944
- First Australian Soil Map

1949
- CSIRAC: Australia’s first computer

1951
- Myxomatosis Rabbit control

1952
- Atomic Absorption Spectrophotometer

1953
- Solar Hot Water

1957
- SIROset permanent crease wool clothing

1960
- Softly detergent

1961
- Self-twisting yarn

1971
- Flammability standards

1986
- Gene Shears

1991
- Buffalo fly trap

1991
- Extended wear contact lenses

1992
- Fast Wi-fi

1995
- Gene silencing

1996
- RAFT polymerisation

1999
- Relenza flu treatment

2005
- Total Wellbeing diet

2008
- BarleyMAX

2009
- UltraBattery

2011
- Zebedee

2012
- Light body armour

2012
- Hendra vaccine

2013
- OptiCOOL energy control
# Value to the Australian economy

Seven CSIRO technologies alone annually contribute $1 billion*  

<table>
<thead>
<tr>
<th>Technology</th>
<th>Value (M pa)</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cotton</td>
<td>≈ $431</td>
<td>Foot and mouth disease insurance value</td>
</tr>
<tr>
<td>Cotton Varieties</td>
<td>$632.4</td>
<td>Based on historical impact</td>
</tr>
<tr>
<td>Longwall Automated Mining</td>
<td>≈ $785.6</td>
<td>CSIRO-delivered benefits (2001/02–2024/25)</td>
</tr>
<tr>
<td>Prawn Breeding and Novel Feed</td>
<td>$882.2</td>
<td>Total benefits (to 2023/24)</td>
</tr>
<tr>
<td>Textor Technologies</td>
<td></td>
<td>Doubling of Textor’s turnover</td>
</tr>
<tr>
<td>Water Resource Assessment (WRA)</td>
<td>$685–795</td>
<td>Delivered benefits to date</td>
</tr>
</tbody>
</table>

*$Source: 2014 ACIL Allen Report*

The annual value delivered by CSIRO to Australian economy is estimated to be at least $5B.
Big ideas start here

1854 patents
Biggest patent holder in Australia
30% involve collaboration

300 licenses
Most with Australian companies

65% of our staff hold university degrees

150+ spin-out companies
worth $1bn in market capitalisation

Globally our publications are Top 1% in 14 of 22 research fields

1,200+ schools benefit from our scientists in schools program

200K+ people visit our facilities and visitor centres

120M in annual sales and over 300 jobs
Innovation is a team sport

<table>
<thead>
<tr>
<th>8.2/10</th>
<th>3000</th>
<th>1200</th>
<th>150</th>
<th>$140m</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% of ASX 200</td>
<td>Customers</td>
<td>SMEs with 50+ researchers in business projects</td>
<td>international partners from 80+ countries</td>
<td>from offshore sources</td>
</tr>
<tr>
<td>Willingness of customers to recommend CSIRO</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEDERAL STATE &amp; LOCAL GOV'Ts</td>
<td>We work with 90% of Research and Development Corporations</td>
<td>We've worked with 139 of 200 Cooperative Research Centres</td>
<td>ALL AUSTRALIAN UNIVERSITIES</td>
<td></td>
</tr>
</tbody>
</table>
About CSIRO Agriculture
- who, what, how
CSIRO Agriculture

FTE 721 + 118

People 1078

Budget $220 m

Top 10 in Agricultural Science, 12th in Plant & Animal Sciences

Connecting CSIRO’s science capabilities to agriculture
Our difference – Integrated Agricultural Research

Genome  Phenome  Breeding & Selection  Farming Systems  Landscapes & Environment  Markets  Society & Economy
Key impact areas

- Transforming yield
- Closing yield gaps
- Transforming value
- Transformative digital agriculture
- Sustaining the base
- Informing policy and practice
<table>
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<tr>
<th><strong>Gluten-free food and beverage</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Coeliac disease requires a life-long gluten-free diet for 70 million people globally, with increasing diagnosis in China</td>
</tr>
<tr>
<td>The gluten free market is 5-10X larger</td>
</tr>
<tr>
<td>Worldwide market for gluten-free products is predicted to grow by US$1.2 billion over the next five years, to a total of US $4.3 billion.</td>
</tr>
<tr>
<td>Growing recognition that gluten-free foods are poor in B vitamins, Fe and fibre</td>
</tr>
</tbody>
</table>
Development of Ultra Low Gluten Barley

ULG 2.0
June 2006
~1,600 ppm
Grain 33 mg

ULG 3.0
June 2009
~4 ppm
Grain 42 mg

ULG 3.2
June 2012
<4 ppm
Grain 48 mg

Sloop
~50,000 ppm
Grain 53 mg
ULG beer - German brewing conference
Opportunities - Food

Opportunity to use for gluten-free whole-grain cereal foods

- Malt – drink and food flavour
- Fillers and thickeners
- Flour, whole grain, flake

Advantage over current gluten-free substitutes

- High fibre
- High iron and zinc
- High B vitamins
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Thank you