Animal Welfare Science Centre

Who we are

Established in 1997, the AWSC comprises four collaborative partners

- **Department of Primary Industries, Victoria** (Future Farming Systems Research Division)
- **The University of Melbourne** (School of Land and Environment and Faculty of Veterinary Science)
- **Monash University** (School of Psychology and Psychiatry and School of Biomedical Sciences)
- **The Ohio State University** (Department of Animal Sciences and College of Veterinary Medicine)
What we do

The Centre conducts research in three program areas:
1. Welfare methodology where we develop and validate methods to measure animal welfare.
2. Housing and husbandry effects on animal welfare.
3. Attitudinal effects:
   a) The effects of the attitudes of stockpeople, animal handlers and animal owners on the welfare of their animals.
   b) The effects of attitudes to animal welfare on consumer and community behaviour.

These programs support the fourth program area:
• Tertiary, post-graduate and industry education and training.

Through these programs, the Centre aims to:

• Undertake research to inform government and industry in the development of animal welfare policy.

Our Vision
“Animal welfare and its constant improvement are societal and cultural norms”

Our Mission
“To contribute to improved animal welfare as a world leading provider of expert information, advice and education underpinned by rigorous research”
- The Animal Welfare Science Centre has built upon key discipline strengths of animal behaviour, stress physiology, veterinary science and psychology and their importance in studying human-animal interaction, animal housing and husbandry and community attitudes/behaviour.
- 19 post-graduate students across the 3 universities
- Relationship agreements with
  - DAgFWA
  - Massey Univ.
  - CSIRO
  - Univ. QLD

Project funding sources ‘02- ‘09 ($8.6m)
Scientific Advances in Animal Welfare

Housing and Husbandry Effects on Animal Welfare

Sows

Hens
Sow aggression and stress

- Design features of group pens that are likely to affect sow aggression and stress include:
  - Space
  - Group size?
  - Provision of feeding stalls
  - Time of mixing
  - Individual sow characteristics (and thus group composition)
    - Genetic & Experiential contributions?

Current APL-funded research

The effects of group housing during gestation on sow welfare and reproduction

Effects of aggressive characteristics of individual sows and mixing strategies on the productivity and welfare of group-housed gestating sows
Laying hen housing

- Design features of cages and pens that are likely to affect hen welfare include:
  - Space
  - Group size?
  - Nest boxes
  - Dust baths
  - Perches

Housing design – nest boxes

When a nest box is not available hens are

- more active,
- engage in locomotory behaviour for a longer duration before laying their eggs, and
- often perform what has been described as stereotyped pacing; behavioural differences that have been interpreted as signs of frustration.
Laying hen housing

- AECL project
  - rearing space allowance (450 and 1350 cm²/hen),
  - production space allowance (550 and 1,650 cm²/hen) and
  - nest box (cages with and without a nest box).

- Measurements on biological functioning:
  - behaviour (aggression, time budgets of behaviour, behaviour prior to oviposition and delayed oviposition)
  - physiology (plasma, egg yolk and albumen, and faecal corticosterone concentrations, corticosleterone concentrations in response to an ACTH challenge, differential white cell counts and extra-cuticular calcium).

- Preferences tests
  - Y-maze trials examining choice behaviour for either a nest box vs feed

Effects of deprivation of a preferred resource, feed or social contact, on the biological functioning of pigs.
The human-animal relationship

- Fear of humans in farm animals can limit their welfare and productivity
- This creates a sequential relationship

Understanding stress responses: can we develop strategies to reduce stress and improve welfare?
Stress!

What is Stress?

Claude Bernard (1813-1878)
Stable internal environment

Walter Cannon (1871-1945)
Homeostasis
Sympathoadrenal system
(fight or flight)
General Adaptation Syndrome

Hypothalamo-pituitary adrenal axis

Stress

A complicated physiological mechanism that embodies a range of integrative physiological and behavioural processes that occur when there is a real or perceived threat to homeostasis

Tilbrook (2007) Encyclopedia of Stress
Sympathoadrenal system
Sympathoadrenal system


ACUTE stress response: fight and flight!??
Hypothalamo-pituitary adrenal axis

[Diagram showing the hypothalamo-pituitary-adrenal axis with labeled parts such as stress, higher neural centers, hypothalamus (paraventricular nucleus), hypophysial portal blood system, anterior pituitary, ACTH, adrenal medulla, adrenal cortex, and cortisol.]
Hypothalamo-pituitary adrenal axis

Changes in hormone secretion
- Catecholamines
- CRH and AVP
- ACTH
- Glucocorticoids

Target cell responses
- Catecholamines
- CRH and AVP
- ACTH
- Glucocorticoids
- Gonadotrophins
- Gonadal steroids

Sympathoadrenal system
- Hypothalamo-pituitary adrenal axis
- Reproductive axis

Tilbrook et al., (2006) Endocrinology

Adapted from Sapolsky et al., (2000) Endocrine Reviews
### Immediate physiological consequences

- Increased cardiovascular tone
  - Immune activation
  - Energy mobilization
    - Increased cerebral blood flow and cerebral glucose utilization
    - Altered appetite
    - Enhanced memory consolidation
- Water retention and vasoconstriction

<table>
<thead>
<tr>
<th>When is welfare compromised?</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Decreased reproductive function</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>&lt; 1 min.</th>
<th>&lt; 10 min.</th>
<th>&lt; 1 hour</th>
<th>Hours/days</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Adapted from Sapolsky et al., (2000) Endocrine Reviews
Welfare may be compromised if animals are stressed frequently or all the time

Studying stress responses in sheep
Responses to stress differ

• Females and males

• Physiological state of females
  – Low level of visceral adipose tissue
  – Lactation

  Natural states of reduced responses to stress
Isolation and restraint

Group

Isolation/restraint

Isolation and restraint

Predator stress

Barking dog

Females and males differ in responses to stress

Responses to stress vary with the type of stressor
Is there a cure for stress?

**PROFESSOR BROWN SEQUARD'S METHOD.**

**EXTRACTS OF ANIMAL ORGANS.**

Testicle Extract, Grey Matter Extract, Thyroid Gland Extract, &c., &c.

Concentrated Solutions at 30%.

These preparations, completely sterile, are mailed to any distance on receipt of a money order. Directions sent with the flasks.

Price for 25 Injections, $2.50.

Syringe Specially Gauged, (3 cubic c.c.) $2.60.

Used in the Hospitals of Paris, New York, Boston, &c.

Circular Sent on Application.

**New York Biological and Vaccinal Institute,**

Laboratory of Externe Vaccine and of Biological Products.

3 East 43rd Street, Chemist and Bacteriologist, Superintendent.

PASTEUR INSTITUTE BUILDING, NEW YORK CITY.

---

*Advertisement, New York Therapeutic Review, 1893.*

---

Natural states of stress hyporesponsiveness
Low visceral adiposity

Lactation
The importance of suckling?
Stressor salience: protecting the offspring?
Attenuated stress responses in

lean females
lactating females

Natural states of stress attenuation: a key to ameliorating stress responses?
Mechanisms for altered stress responsiveness

Mechanisms of alterations in stress responsiveness

- Stress
  - Higher neural centres
    - Hypothalamus (paraventricular nucleus)
      - CRH and AVP release
      - Changes in central regulation?
  - Hypophyseal portal blood system
  - Anterior Pituitary
    - ACTH
      - Adrenal medulla
      - Adrenal cortex
      - Altered pituitary responsiveness?
  - Altered negative feedback?
  - Cortisol
    - Disrupted diurnal activity?
Changes in central regulation: oxytocin


Changes in central regulation: oxytocin

Adapted from Windle et al., (1997) Endocrinology
Changes in central regulation: oxytocin

Rivalland and Tilbrook, unpublished data

Adapted from Tilbrook & Clarke (2006) Frontiers in Neuroendocrinology

Sex differences in response to stress

Type of stressor

Attenuated stress responses
low levels of adipose tissue
lactation

Development of treatments to reduce stress?
Our Team

Animal Welfare Science Centre

Paul Hemsworth  
John Barnett  
Alan Tilbrook  
Jeremy Skuse  
Lauren Edwards  
Bronwyn Stevens  
Joanna Engle  
Anne Turner  
Melissa Papargiris  
Adam Morrissey  
Cameron Ralph  
Astrid Rivalland  
Maxine Rice  
Sarah Spencer  
Sara Drew  
Iain Clarke

University of Michigan

Fred Karsch  
Kellie Breen  
Amy Oakley  
Beth Wagenmaker  
Doug Doop  
Vasantha Padmanabhan  
Elizabeth Young

APL  
AECL  
RIRDC  
DIRDC  
ARC  
NHMRC (Australia)  
NIH-HD30773  
NSF-IOB0520597