Novel Biomarkers of Animal Welfare.

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Continuum of animal welfare

Positive

Negative

Need for novel biomarkers of animal welfare that can increase our power to assess the welfare state of the animal.

Positive affective states and negative affective states
Need biomarkers of the activity of key neurophysiological systems

Immune markers (cytokines)
- Tumor necrosis factor alpha (pro-inflammatory)
- C-reactive protein (pro-inflammatory)
- Interleukin 10 (anti-inflammatory)
- Interleukin 1 beta (anti-inflammatory)

Brain Derived Neurotrophic Factor (BDNF)

MiRNA

BDNF at 8 weeks of age

- 2 x 2 Factorial experiment
- Enriched or barren in the suckle phase
- Enriched or barren in the weaner phase
- Measured immune response 24 h before weaning, 24 h, 21 d and 65 d after weaning
Micro RNA

Potential biomarker of neural activity in the brain?

- 22-24 nucleotides
- Regulate gene expression
- Ubiquitous synthesis
- Brain activity
- Circulate in blood
- HIGHLY resistant to change

Measured in brain and blood

Micro RNA

- miRNA-34c up regulated after chronic social defeat and leads to anxiety and depression like behaviour
- miRNA-135 indicative of stress resilience, serotoninergic activity, depression
- miRNA-9 regulated by chronic unpredictable stress and maternal deprivation
- miRNA-21 up regulated by multiple types of peripheral pain
- miRNA-124 up regulated in key reward centres during rewarding experiences

Measured in brain and blood

Serotonin

Reward

↑ MiRNA 34c

Blood

↑ MiRNA 135a

REWARD

↑ MiRNA 135a

Information about multiple affective states in a single blood sample.
Amygdala

Periaqueductal grey
Blood: Control V Tail Dock

Amygdala: Control V Tail Dock

PAG: Control V Tail Dock

How is this practical?

Biomarkers of animal welfare

Advanced "biophotonics"
Point of care diagnostics

Real time sensing platform

Positive

Negative