Animal Welfare Science and Bioethics Centre

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Collaborating Centre for Animal Welfare Science and Bioethical Analysis:

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Animal Welfare Science Centre
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Broadening Our Perspectives on Negative and Positive Animal Welfare Impacts

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Areas considered

- **Introduction**
- **A focus on *pain***
- **Giving more definition to *distress***
- **Sources of *negative* experiences or affects: *motivational urges and drives***
- ***Positive* subjective experiences or affects**
- **Concluding remarks**

Areas considered

- **Introduction**
  - **Source publications, animal welfare and lab-induced inpacts**
- **A focus on *pain***
- **Giving more definition to *distress***
- **Sources of *negative* experiences or affects: *motivational urges and drives***
- ***Positive* subjective experiences or affects**
- **Concluding remarks**

Introduction – source publications

- **Mellor, D.J. (2011).** Animal pain and World Organisation for Animal Health (OIE) guidelines. Session 5: Animal welfare. *In: Proceedings of the First OIE Global Conference on Evolving Veterinary Education for a Safer World*, Paris, France, 12-14 October, 2009, pp 175-180.
- **Green, T.C. & Mellor, D.J. (2011).** Extending ideas about animal welfare assessment to include 'quality of life' and related concepts. *New Zealand Veterinary Journal* 59, 263-271.
- **Mellor, D.J. (2012).** Animal emotions, behaviour and the promotion of positive welfare states. *New Zealand Veterinary Journal* 60, 1-8.
- **Mellor, D.J. (2012).** Affective states and the assessment of laboratory-induced animal welfare impacts. *Proceedings of the 8th World Congress on Alternatives and Animal Use in the Life Sciences*, Montreal, Canada, 21-25 August 2011: ALTEX (in press).
- **Beausoleil, N.J. & Mellor, D.J. (2012).** Complementary roles for systematic analytical evaluation and qualitative whole animal profiling in welfare assessment for Three Rs applications. *Proceedings of the 8th World Congress on Alternatives and Animal Use in the Life Sciences*, Montreal, Canada, 21-25 August 2011: ALTEX (in press).

Introduction – animal welfare

- **AW is a state within an animal**
- **It is what the animal *experiences***
- **It is the integrated outcome of:**
  - ***Internally generated* sensory inputs**
  - ***Externally generated* sensory inputs**
  - **Giving rise to *subjective, emotional or affective states***
  - ***Experienced consciously***
- **There has been a strong emphasis on *–ve states***
  - **Thirst, hunger, pain, anxiety, fear, loneliness, boredom**
- **Increasingly *+ve states* are being emphasised**

Introduction – lab-induced impacts

- **The Three Rs focus on minimising *–ve experiences***
- **Yet, in the past, the list was nonspecific and/or limited**
- **An expanded list would aid Three Rs applications**
- **Understanding sources of –ve experiences has increased the list which now would include *both*:**
  - **Undoubtedly negative experiences or affects**
  - **An absence of positive experiences or affects**
- **Increase in empathetic commitment to the Three Rs**

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A focus on *pain*

- **Early regulatory emphasis was on *pain* and *distress***
- **A focus on pain was and is worthwhile**
- **Helps address many factors that compromise welfare**
- **This is because pain has:**
  - **Many causes – injuries and disease-induced pathologies**
  - **Many manifestations – acute, chronic, localised, generalised, physical, emotional, adaptive, maladaptive**
  - **More than one type may be present at the same time**

Some Manifestations of pain

Aching	*Burning*	*Beating*
Throbbing	*Shooting*	*Bursting*
Boring	*Sharp*	*Smarting*
Drawing	*Hot iron*	*Electricity*
Pulling	*Soreness*	*Stinging*
Gripping	*Knife-like*	*Pricking*
Cramping	*Stabbing*	*Needle-like*
Nagging	*Toothache*	*Tingling*
Sense of pressure	*Tearing*	*Itching*
Gnawing	*Hot cords*	

Neville Gregory (2004). Physiology & Behaviour of Animal Suffering - Blackwell

A focus on *pain*

- Early regulatory emphasis on *pain* and *distress*
- The focus on pain was worthwhile
- Helps address many factors that compromise welfare
- This is because pain has:
  - Many causes – injuries and disease-induced pathologies
  - Many manifestations – acute, chronic, localised, generalised, physical, emotional, adaptive, maladaptive
  - More than one type may be present at the same time

Clearly a focus on pain and its alleviation has direct relevance to refinement in the laboratory context

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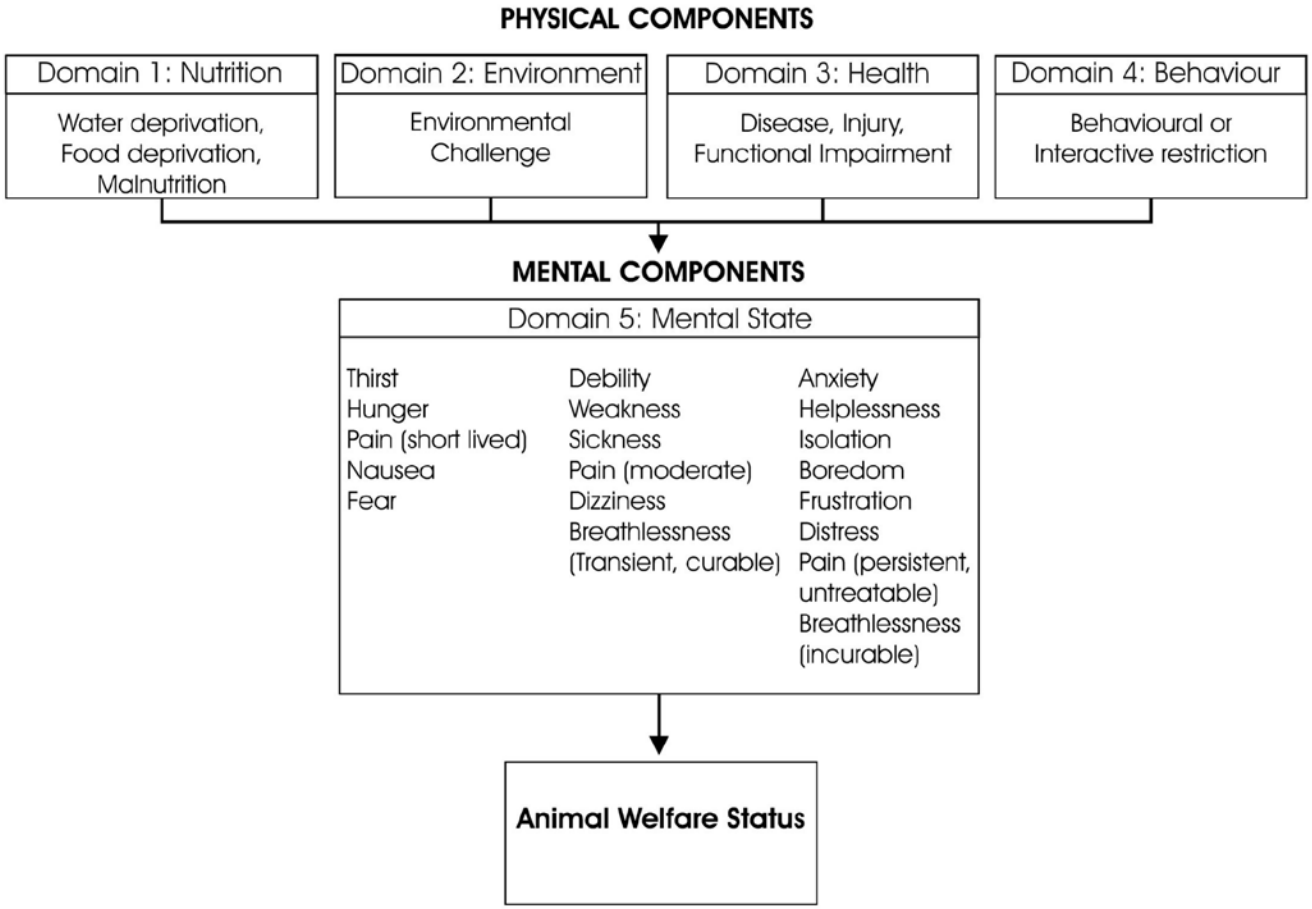
Giving more definition to *distress*

- **30 years ago *distress* served as a catch-all term for –ve experiences (other than pain) *without specifying them***
- **An *underestimation* of –ve effects may have resulted**
- ***Specification* of particular types *focuses attention* for more effective *refinement* activity**
- **1979 Five Freedoms noted: *thirst, hunger, discomfort and fear,* in addition to *pain* and *distress***
- **Today, the list is much longer, and growing**

For example: The Five Domains



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Giving more definition to *distress*

- **This list remains *open-ended* by use of the phrase *'and other forms of distress'***
- **This *expanded list* has two advantages:**
  - **Being *explicit* it provides *guidance* about *possible targets* for refinements to mitigate –ve impacts in the lab and generally**
  - **Being *open-ended*, it highlights that additional forms of distress might be caused by our treatment of animals and should be evaluated as other possibilities for *refinement or mitigation***

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Specifying a wider range of –ve experiences requiring mitigation will enhance the overall effectiveness of refinement in laboratories and elsewhere

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Sources of *negative* experiences or affects:
motivational urges and drives

- **Health and survival depend on *homeostatic mechanisms***
- **Their critical role is *interactions* between the *internal and external environments* of the body**
- **These interactions are *active* not passive**

Sources of *negative* experiences or affects: *motivational urges and drives*

- Health and survival depend on *homeostatic mechanisms*
- Their critical role is *interactions* between the *internal and external environments* of the body
- These interactions are *active* not passive
- **They are focused on basic functions: e.g.**
  - **Respiratory gas exchange**
  - **Fluid (water/electrolyte) balance**
  - **Nutrient supply and utilisation**
  - **Thermal equilibrium**
  - **Responses to injury**

Sources of *negative* experiences or affects: *motivational urges and drives*

- These interactions involve *purposeful behaviours* at various levels of complexity
- These behaviours are *essential for survival*
- They involve various *motivational urges and drives*
- These urges and drives represent the *subjective elements* of these *instinctual behavioural patterns*

Sources of *negative* experiences or affects: *motivational urges and drives*

- **These *urges and drives* include:**
  - **Hunger for air (breathlessness)**
  - **Thirst**
  - **Hunger for specific minerals (i.e. salt hunger)**
  - **Hunger for energy-dense food (i.e. general hunger)**
  - **Pain**
  - **Sensations accompanying visceral functions such as micturition or defecation**
  - **Desire for sleep after severe deprivation**
  - **Avoidance of change in body core temperature**

Sources of *negative* experiences or affects: *motivational urges and drives*

- **Fresh insights into the neurological foundations of these urges and drives:**
  - **Onset**
  - **Intensity**
  - **Directedness**
  - **Disappearance**

***Full details* are available from:**

***Denton et al* (2009). *Consciousness and Cognition 18*, 500-514**

Here we are keeping it simple

Sources of *negative* experiences or affects: *motivational urges and drives*

- **These urges and drives have *two key characteristics*:**
  - **A *commanding specific sensation*:**
    - **They often make only *mild intrusions* into consciousness**
    - **BUT, when strong, they can *dominate consciousness***
    - **They are *subjectively distinct* – we do not mix them up**
  - **A *compelling specific intention*:**
    - ***Thirst* generates a compelling intention to *drink*, NOT eat or defecate**
    - ***Air hunger*, due to suffocation, generates a compelling intention to *fight for breath***

Sources of *negative* experiences or affects: *motivational urges and drives*

A striking feature* of *each urge and drive

- **Once the *motivated behaviour* achieves its *objective* there is a *precipitous decline* in both the *sensation* and the *intention*:**
  - **Air hunger is extinguished rapidly with a few deep breaths**
  - **Thirst with drinking of water**
  - **Salt hunger with ingestion of salt**
  - **General hunger with the speedy consumption of food**
- ***Brain imaging studies* show neural correlates with the changes in these urges or drives**

Sources of *negative* experiences or affects: *motivational urges and drives*

Brain imaging studies:

- ***Intense activation*** **in particular cortical regions:**
  - **When marked *air hunger is* at its height**
  - **When marked *thirst* is at its height**
- ***Deactivation*** **in these cortical regions accompanies:**
  - ***Rapid extinction*** **of air hunger with *restoration of breathing***
  - ***Rapid extinction*** **of thirst with *drinking to satiation***
- **The *cortical activation* and *deactivation, respectively,* are linked to the *onset* and *rapid loss* of *conscious awareness* of these urges and drives**

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Sources of *negative* experiences or affects: *motivational urges and drives*

A reminder:

- **These *urges and drives* are derived from sensory 'scanning' of the *internal conditions* of the body**

Animal welfare implication

- **This pattern of *cortical activation/deactivation* supports the view that *minimisation of such urges and drives* (which are –ve mental states) merely moves the associated welfare state from *–ve to neutral*, NOT beyond neutral to +ve**

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Positive subjective experiences or affects

- **Long proposed, now widely accepted that animals can also have +ve experiences**
- **Thus, it is likely that AW compromise may result from factors that *prevent +ve experiences***
- **Promoting good AW thus requires BOTH the *minimisation of –ve* and the *promotion of +ve* experiences**
- **Such experiences are *subjective, emotional and/or affective* in character**

Positive subjective experiences or affects

- ***Positive* experiences include: *satiety, vitality, reward, contentment, curiosity* and *playfulness***
- **Absence of such affects may be a form of *welfare compromise***
- **Their presence may thus constitute a *need* in the *mental domain***
- **In these terms, good welfare results both from an *absence of –ve states* and *the presence of +ve states***

Positive subjective experiences or affects

- **Jaak Panksepp's *neuropsychological thinking and research* provide strong support for this view:**
  - **To date, it has *not* been imported into *animal welfare science* thinking to any great extent**
  - **In part because of the *discursive character of his writing***
    - **High quality, a delight to read, but lengthy and hard work**
  - **In part because of its *neurophysiological complexities***
  - **In part because *he attributes intentionality and emotional contents to behaviour* – ideas that are only now regaining credibility**

Positive subjective experiences or affects

- **Thus, Panksepp's *neuropsychological thinking and research* are not well known in animal welfare circles:**
  - **Recently I have made an attempt to correct this omission –**
  - ***Mellor DJ (2012).* Animal emotions, behaviour and the promotion of positive welfare states. *New Zealand Veterinary Journal* 60, 1-8.**

Positive subjective experiences or affects

- **Panksepp and colleagues have conceived of seven *emotional action-orientated systems* and outlined their *cogent neuropsychological foundations*:**
  - **SEEKING** +
  - **FEAR** -
  - **RAGE-ASSERTIVENESS*** -/+ **(RAGE)**
  - **BONDING*** +/- **(PANIC)**
  - **CARE** +
  - **PLAY** +
  - **LUST** +

Positive subjective experiences or affects

- **SEEKING system:**
  - **Its *embedded emotional content* includes –**
    - **Compelling *exploratory urges***
    - **Involving *wanting* and *expectancy***
    - **Leading to *engaged aliveness* and *excitement***
  - ***Behaviourally* expressed as *goal-directed, energised exploration of* or *interaction with the environment***
  - ***Neural circuits* associated with +ve affect or *reward***

Positive subjective experiences or affects

- **FEAR system:**
  - ***Generates*** **–ve affects of –**
    - **Anxiety**
    - **A sense of threat**
    - **Fear**
  - ***Behaviourally*** **expressed as *nervous vigilance, freezing or flight***
  - ***Neural circuits*** **for *threat recognition* and others for *behavioural evasion of threat.***

Positive subjective experiences or affects

- **RAGE-ASSERTIVENESS system (*two elements*):**

  1. RAGE

  - ***Generates*** **strongly –ve affects of –**
    - ***Anger, rage*** **and** ***highly aroused urges*** **to** ***defeat, dominate*** **or** ***defend***
  - ***Behaviourally*** **expressed as** ***species-typical offensive or defensive enraged attack behaviours***

  - ***Neural circuits*** **for** ***rage expression, threat recognition*** **and some involvement of the** ***FEAR circuits***

Positive subjective experiences or affects

- **RAGE-ASSERTIVENESS system (*two elements*):**

  2. ASSERTIVENESS

  - ***Generates*** **+ve affects of *energised, goal-directed wanting and expectancy* driven by *appetitive* and *consummatory urges***
  - ***Behaviourally*** **expressed as highly focused *predatory stalking and attack*, or *focused and engaged foraging***
  - ***Neural circuits*** **involved are merged with those of the SEEKING system that engender a sense of reward**

Positive subjective experiences or affects

- **BONDING system (two facets):**

  1. Drive *to experience* +ve affects

  - ***Generates*** **a strong drive to attain and retain the *comfortable* and *comforting* +ve affects of *affectionate companionship* or *protection***

  - ***Behaviourally*** **expressed through initiation of and responsiveness to species-typical *prosocial or affiliative interactions***

  - ***The circuits*** **involve *neuroactive agents* such as endogenous *opioids*, *oxytocin*, *vasopressin* and *noradrenaline*, as well as circuits for detecting *thermotactile and odour cues*.**

Positive subjective experiences or affects

- **BONDING system (two facets):**
  2. **Drive *to avoid* –ve affects**
     - ***Generates*** **a strong drive to avoid *separation-induced anxiety* or *panic*, or *isolation-induced loneliness***
     - ***Behaviourally*** **expressed through attempts to *reunite with bonded others*, or as *depressive inactivity***
     - ***The circuits*** **involve *neuroactive agents* such as endogenous *opioids*, *oxytocin*, *vasopressin* and *noradrenaline*, as well as circuits for detecting *thermotactile and odour cues*.**

Positive subjective experiences or affects

- **CARE, PLAY and LUST systems:**

  Manifest +ve affects via:

  - ***Protective* and *empathetic* maternal care**
  - **The *joyfulness* of play**
  - **The *appetitive eroticism* and *orgasmic pleasures* of lust**
  - ***Behaviourally* expressed in *system-specific* and *species-typical ways***
  - ***Neural circuits* involving specific *neurochemicals* and *neuroactive hormones* that generate these particular *prosocial and affiliative emotions and behaviours*.**

Positive subjective experiences or affects

- ***Promotion*** **of +ve affective states:**
  - **To date, the primary rationale has been:**
    - ***Behaviour-based*** **assessments of *motivation* to satisfy perceived *needs, wants* or *preferences***
    - **A key example is *environmental enrichment* initiatives**
    - ***Panksepp's concepts* and their *neuropsychological support* may *strongly reinforce* the largely behavioural basis for most such initiatives taken to date.**

Positive subjective experiences or affects

- ***Replacement* of –ve states with +ve states:**
  - **Manipulation of the FEAR system:**
    - ***Anxiety*, *fear* and *nervous vigilance* may be *replaced* by *calmness* and *harmonious interactions* with other animals and human beings**
    - **By minimising *visual*, *auditory*, *olfactory*, *environmental*, *handling* and other cues that may engender a *sense of threat***
    - ***Otherwise fearful animals* may thereby enjoy the *enlivening rewards* of exploratory and appetitive behaviour generated by the SEEKING system**

Positive subjective experiences or affects

- ***Replacement*** **of –ve states with +ve states:**
  - **Manipulation of the SEEKING system:**
    - ***Boredom*** **may be** ***replaced*** **by the** ***enlivening rewards*** **of exploratory and appetitive behaviour**
    - **By improving the levels of** ***environmental complexity*** **and** ***variety*** **available for the animals**

Positive subjective experiences or affects

- ***Replacement*** **of –ve states with +ve states:**
  - **Manipulation of the BONDING system:**
    - ***Loneliness, isolation, helplessness, separation distress*** **and feelings of** ***abandonment*** **may be** ***replaced*** **with feelings of** ***affectionate companionability*** **and of being** ***secure*** **and** ***protected***
    - **By promoting** ***affiliative interactions*** **with compatible animals and** ***minimising the separation*** **of bonded animals**

Positive subjective experiences or affects

- ***Replacement*** **of –ve states with +ve states:**
  - **Manipulation of the CARE, PLAY and LUST systems:**
    - **+ve *prosocial* and *affiliative emotions* could be *reinforced* if management practices were to be directed towards the CARE and PLAY systems and, probably limited to breeding animals, the LUST system**

Positive subjective experiences or affects

- ***Replacement*** **of –ve states with +ve states:**
  - **Manipulation of the RAGE-ASSERTIVENESS system:**
    - ***Frustration*** **and** ***anger*** **may be minimised by the above initiatives**
    - **Also by continuing existing** ***breeding*** **and** ***culling*** **programmes that** ***target temperament***
    - **As well as by keeping only** ***mutually compatible animals*** **together in** ***groups***

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Concluding remarks

- **Targeting *different types of pain* caused by laboratory procedures and generally covers a *wide range of potential –ve effects* that merit direct attention.**
- **Defining *different types of distress* focused on *specific additional –ve effects* that also merit mitigation.**
- **Many of these relate to motivational *urges or drives* generated by the internal conditions of the body.**
- **BUT *acceptable or good animal welfare* is more than the *mere absence* of –ve subjective, emotional or affective states**
- **It also includes the *presence (and promotion) of +ve states*.**

Concluding remarks

- **Such +ve experiences may include feelings of *satiety*, *vitality*, *reward*, *contentment*, *curiosity* and *playfulness*.**
- **Panksepp's concepts extend understanding of the *neuropsychological foundations* of the *intentionality and emotional contents of particular behaviours*.**
- **They thereby also provide a *functional rationale*, reinforcing the *behavioural one*, for the *replacement* of –ve with +ve affective states.**

Concluding remarks

- **Finally, let us review the list of subjective, emotional or affective experiences we now need to consider when evaluating the potential impacts of laboratory procedures and other management approaches on animals:**
  - ***Negative states*, which our actions may *cause*, include:**
    - **Many types of pain, thirst, hunger, weakness, debility, breathlessness, nausea, sickness, anxiety, fear, nervous vigilance, boredom, loneliness, isolation, helplessness, frustration and anger, and other unspecified forms of distress**
  - ***Positive states* that our actions may *compromise*, include:**
    - **satiety, appetitive and consummatory satisfaction, reward, goal-directed engagement, curiosity, vitality, playfulness, calmness, contentment, affectionate companionability, and feelings of security**

Concluding remarks

This much longer list might reasonably be *expected* to:

- **Engender a more comprehensive awareness of *mitigation possibilities* and to enhance *caring and empathetic attitudes* towards animals**
- **Among RTT personnel, members of Animal Ethics Committees or Animal Care and Use Committees, farmers, veterinarian and others.**

Thank you

Q & A

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