Environmental Enrichment: a need, desirable, feasible?

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What is environmental enrichment?
Environmental Enrichment:

Any modification in the environment of the captive animal that seeks to enhance its psychological and physiological well being by providing stimuli, meeting the animal’s species specific needs.

Newberry 1995, Baumans 2000
Needs

- Needs can be defined as requirements, fundamental in the biology of the animal, to obtain a particular resource or respond to a particular environmental or bodily stimulus

Broom and Johnson 1993
Behavioural Needs

- Psychological needs: Requirements to enable the animal to acquire experience
  - collect information
  - analyze information

- Ethological needs: Requirements to enable the animal to perform certain behaviour patterns

Poole 1992
Fulfilling animal’s needs ≠ back to nature!
Environmental Enrichment

- Bringing crucial features of the wild environment into the lab, not bringing natural behaviours into the lab

Blanchard and Blanchard 2003
Animal needs

- **Social**
  - Conspecifics
  - Caretakers

- **Physical**
  - rest
  - explore
  - groom
  - dig
  - nest/hide

- **Microclimate**
  - T, RH, etc.

- **Excretion**
  - urine/faeces/markings

- **Feeding**
  - eat, drink
  - forage
Minimal needs

- **Mice**
  - nesting material
  - social housing

- **Guinea pigs**
  - shelter
  - roughage
  - social housing

Animal Welfare Expert Workshop, Copenhagen, June 2000
Danish Animal Welfare Society Novo Nordisk A/S

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Conclusions (mice, rats, guinea pigs, rabbits, dogs)

- Social contacts
- Sufficient freedom of movement
- Structured and complex environment
- Controllability
- Security
- Safety
Needs are no luxury!!
Environmental Enrichment

- Desirable ?

- Feasible ?
Intended and unintended effects of procedures on experimental results

Experimental procedure → 'intended' effect → Experimental results

'Disturbance of homeostatic balance' → 'non-intended' effects

Changes
- endocrinology
- immunology
- blood circulation
- food intake
- clinical disease
- etc.

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Environmental factors affecting the laboratory animal

- cage
- cage size
- cage mates
- contra-specifics
- man
- food/water
- air/ventilation
- bedding
- NH₃, CO₂
- pathogens
- odours
- noise
- light
- RH
- T
- structure/enrichment

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All confounding variables!!!!

- Despite conditions being rigorously equated among sites, different inbred mouse strains tested simultaneously at three well-recommended labs revealed large effects of site for nearly all variables examined.

Crabbe et al. (1999) and Wahlsten et al. (2003)
Why is the environment important?

- Throughout life time
- Stimulating environment
- Species specific behavioural repertoire
- Control of environment
- Reduction of stress
- Better experimental results
Environmental Enrichment, a Confounding Variable?
Environmental Enrichment in the lab should:

- Meet the animal’s needs
- Be practical
- Be inexpensive
- No risk to humans (bites, sharp)
- No risk to animals (sharp, entangling, toxic, aggression)
- No risk to experiment (interference, statistical power)
Which type of environmental enrichment?
Types of environmental enrichment

- Social Enrichment
  - Social Contact Enrichment
  - Social Noncontact Enrichment

- Physical Enrichment
  - Complexity
  - Nesting material
  - Sensory Enrichment (visual, auditory, olfactory, tactile, taste)
  - Nutritional Enrichment
How evaluate environmental enrichment?
Environmental enrichment

- Behavioural repertoire $\uparrow$
- Controllable environment
- Stress $\downarrow$
- Less fearful
- Easier to handle
- Faster habituation
- Experimental results $\uparrow$?
Important:

- Knowledge on normal animal behaviour
- Evaluation of the enrichment used
  - Animal behaviour
  - Experimental results
  - Practicality
- Previous enrichment
  - Breeder
  - Other animal unit
Evaluate enrichment: methods

- Behavioural observations (home cage, test situation)
- Preference tests
- Physiological parameters
Preference tests

- “Ask” animals what they prefer
- Strength of preference
- Combine with behavioural observation
Preference tests Utrecht University
Preference tests

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Two popular nest-boxes for mice

- Tecniplast Mouse House (TMH)
- Shepherd Shack or Des Res (SS/DR)

- Tecniplast, Milan, Italy
- Shepherd Specialty Papers, Michigan USA
- Lillico, Surrey, England

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Preference for nest boxes

11 out of 15 groups dragged tissues from the TMH inside the SS/DR

Van Loo et al 2005
Improving Animal Welfare

- March 2001
- Bioethics Management

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Enriched animals are better able to cope

better animal models?
Enriched animals show more variability

worse animal models?
Variation in experimental results

- Type of enrichment
- Parameter
- Strain
- Statistical method used
Enrichment in Neuroscience: Induce changes in brain and behaviour
Enrichment: meeting the animal’s needs
Variation in experimental results

- Unchanged, increased or decreased variation found (e.g. Janus et al. 1995; Kuhnen et al. 1998-1999; Eskola et al. 1999; Gartner 1999; Zimmerman et al. 2001; van de Weerd et al. 2002; Augustsson et al, 2003; Tsai et al, 2002, 2003)

  - Parameter
  - Strain
  - Type of enrichment
  - Statistical method used
Conclusions

- The effect of environmental enrichment on the variation in results should not be generalised or overstated at the cost of animal well-being
- EE not more confounding than other environmental variables (e.g. animal staff, cages, bedding......)
- Type of EE in M&M of scientific papers
- Data on EE and enrichment programs documented (use, variation...
Thank you!
Latency to enter lit compartment. Comparison between strains, housing and pharmacological treatments.

Results

- Strain effect (anxiolytic effect Diazepam more clear in BALB/c)
- Enriched more weight gain
- No difference in variability (3 statistical methods)
LABORAS (Laboratory Animal Behaviour Observation Registration Analysis System)

- Movements of animal translated into behaviour
  - Locomotion
  - Immobility
  - Grooming
  - Eating
  - Drinking
  - Rearing (rat)
  - Climbing (mouse)