



'Animal Farm'

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Overview:

What can we learn from the behaviour of farmyard animals about human behaviour and health? This was the topic for a small seminar led by Professor Alistair Lawrence of the Scottish Agricultural College.

Key ideas:

- Animal modelling can be used to study the likely effects of changing environments on behaviour.
- Control and predictability are important factors that influence health outcomes.
- Obesity can be thought of as the result of the interaction between evolved controls and an artificial environment.
- Social behaviour has a genetic component.
- Stress causes cells to age faster and pre-natal stress may give rise to a general susceptibility to higher stress reactivity in offspring.

Summary

Animal models may allow biological questions to be addressed more readily than is possible with human populations. And although animal and human behaviour are not directly comparable, animal modelling can be used to look at the likely effects of changing environments on behaviour. The domestication of farm animals involves an attenuation of animals' responses to the environment at all levels of organisation (in the brain, in their physiology and in their behaviour), similar to the experience of humans in intensified environments. Domestication of animals brings them into artificial environments, often providing no opportunity for them to display species-typical behaviour. However, behavioural adaptations follow and significant degrees of 'coping' are evident.

Control and predictability were identified as important factors that influence health outcomes - exemplified by the 'executive rat' experiment. Rats were housed in a situation where they received electric shocks, the 'executive rats' having the ability to control the interval between shocks by turning a treadle. The results showed that the health outcomes of the rats were dependent on the level of control they had over their environment. All rats in the study exhibited some stomach ulceration, suggesting that just housing the rats in these conditions was not without impact. However, the 'executive rats' had a significantly lower level of stomach ulceration than those without control, suggesting that control over environment leads to better health outcomes, and vice versa. Similar results were found for predictability – a light warning the animals when the shock was about to be delivered.

Prof Lawrence discussed four areas of research, as follows.

1. Food intake and the trend for us to put on weight

Obesity is an issue in animals as well as humans. At a basic level, weight gain can be thought to be the result of energy imbalance (i.e. energy intake being met with inadequate energy expenditure, leading to fat deposition). Give animals the same sort of choices that we now have in terms of food quality and they show a similar response – their intake increases. Animals (and humans) evolved under conditions of great fluctuations in food quality, and it made evolutionary sense to jump up from

low to high benefit foods whenever they were on offer. We now have high benefit foods constantly on offer, and constantly triggering the evolved response of consumption with little cost in terms of expended energy.

2. Genetics of social behaviour

We have significant problems with social behaviour in the human population, and non-human species similarly spend a lot of time establishing their relationship to others (both through aggressive and non-aggressive behaviours). There is much evidence to suggest that many behaviours have a significant genetic component. Particular traits have been selected for in the breeding of different species, and other experiments have shown direct behavioural consequences from changes to DNA sequences. Additionally, in looking at early life factors, it has been shown that aggressive pigs tend to have been born in a poor pre-natal and post-natal environment, interacting with the genetic background of these animals and leading to greater expression of aggression.

3. Stress

It is believed that the more stress we experience the faster our cells age. Pre-natal stress gives rise to a general susceptibility to higher stress reactivity. There is a lot of evidence from animal studies that the nutritional conditions around the point of ovulation can have long term effects on health outcomes. For example, when pregnant pigs are kept in stressful conditions, corticotrophin releasing hormone (CRH) is expressed to significantly high levels in the foetuses. In addition it has been found that when these daughter pigs come to give birth themselves, they show significantly higher levels of maladapted maternal behaviour. It is surmised that they are more stress-sensitive with stress triggering a breakdown in maternal response. Thus there is a possibility that these early environments - both pre and post-natal - have profound influence on later development, including behaviour.

4. The emotional life of animals

Darwin wrote about the emotional life of animals but it was considered at this time to be anthropomorphic, and unemotional descriptions of animals' behaviours were preferred. Recent developments involving 'holistic assessment of behaviour' are being used now to look at the *quality* of animal behaviour. Observers from different backgrounds make spontaneous and qualitative assessments of animal behaviour, and are found to describe what they see in a highly consistent way. There is ongoing debate about whether these behaviours represent a subjective state in the animals, but Lawrence argued that an animal's behaviour certainly tells an observer something valid about its state.

Prof Lawrence concluded by reviewing the usefulness of animal models in terms of health improvement. Animal models have potential impacts in terms of:

- biological input into policies, such as the work on foods and diets that satisfy by imposing energetic costs;
- behavioural development, and the need to target health messages at important periods of development; and
- family culture, as poor pre-natal conditions could lead to a particular type of sensitivity which gives rise to yet more for the next generation, and so on.

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Finally, two slogans were proposed as take-home messages. “*Consider the animal within*”, reminds us of our biological and evolutionary heritage; and “*from which we came to which we belong*” reminds us of the dangers of spending all our time considering the human race without an associated interest in the wider environment.

The views expressed in this paper are those of the speaker and do not necessarily reflect the views of the Glasgow Centre for Population Health.

Summary prepared by the Glasgow Centre for Population Health.