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Neurological Development and the Potential for
Conscious Perception after Birth
Comparison between Species and Implications for Animal
Welfare

A Thesis Presented in Partial

Fulfilment of the Requirements for the Degree of

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Widmung

Ich widme diese Dissertation meiner Familie. Im Besonderen meinem Mann Cedric Priest, meiner Tochter Mackenzie, meinen Eltern Heidrun und Peter Diesch und meinen Grosseltern Liesbeth und Oskar Schienbein, Gertrud Kopp-Diesch und Josef Kesenheimer.

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Dedication

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Ethical Affirmation

As I embark on my career as a scientist I willingly pledge that I will conduct my research and my professional life in a manner that is always above reproach and I will seek to incorporate the body of ethics and moral principles that constitute scientific integrity into all that I do.

I will always strive to ensure that the results of my research and other scientific activities are ultimately beneficial – for animals and humans alike- and that they do not cause any harm.

With this affirmation I pledge to acknowledge and honour the contributions of ethical scientists who have preceded me, to seek the truth and the advancement of knowledge in all my work.

Adapted from

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Abstract

In order for animals to experience pain and to suffer from it, they have to be capable of conscious perception. Recent evidence suggests that the fetus is maintained in a sleep-like unconscious state and that conscious perception therefore only occurs after birth. The timing of the onset of conscious perception depends on the maturation of underlying neurological processes and is anticipated to be species dependent. Pain-specific electroencephalographic (EEG) responses of lightly anaesthetised young of three species born at different levels of neurological development were investigated. The results of the present thesis are in agreement with published data on general neurological, EEG and behavioural development. This information, in addition to the present results, has been used to estimate the approximate time of the onset of conscious perception in tammar wallaby joeys, rat pups and newborn lambs.

In wallaby joeys (extremely immature at birth), the EEG remained isoelectric until about 100-120 days of in-pouch age and became continuous by about 150-160 days, with electroencephalographic and behavioural signs of conscious perception apparent by about 160-180 days. In rat pups (immature at birth), the absence of a differentiated EEG suggests that the ability for conscious perception in pups younger than 10-12 days is doubtful. The marginal EEG responses to noxious stimulation in 12-14 day-old pups and the pronounced EEG responses in pups 18-20 days suggest that rats may be capable of conscious perception from 12-14 days onwards. In lambs (mature at birth), full conscious perception is probably not apparent before 5 minutes after birth and may take up to several hours or days to become fully established. Its modulation by the residual neuroinhibitor allopregnanolone, if that occurs, would be highest over the first 12 hours after birth.

Overall, the onset of conscious perception does not seem to follow an “on-off phenomenon”, but seems to develop gradually, even in species born neurologically mature. Although conscious perception, and hence pain experience, may be qualitatively different in younger animals, on the basis of the precautionary principle, when significantly invasive procedures are planned, pain relief should be provided from those postnatal ages when pain may first be perceived – i.e. from about 120 days in the tammar wallaby joey, about 10 days in the rat pup and from soon after birth in the lamb.

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