Social deprivation as torture:
A bibliography of research about adult animals in social isolation

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May 2012

Humans are social mammals, of the primate order. Our biology, our behavior, and our pathologies are not unique to us. In a quest to understand, and reduce, solitary confinement, one source of information is the many reports of social isolation of other social mammals, especially primates.

The following is a bibliography of research reports on social isolation and social deprivation of adult animals can be informative about the consequences of solitary confinement on humans. This bibliography is a first attempt to create an exhaustive bibliography of such literature. If readers find errors or omission, we would be pleased to be informed. Contact: Floyd.Rudmin@UiT.No

Not all of the bibliography has been read and summarized yet. But a sample of 54 articles shows that social deprivation of animals has a many negative effects, including changes in behavior and in brain anatomy and brain physiology.

Studies show that socially isolated animals are more depressed and more anxious that animals that are grouped together (Berry, 2012; Garzon,1981; Suomi, 1975). Isolated rodents showed a significant increase in locomotor activity (Garzon, 1981), were more immobile in the forced swim test (Martin, 2010), and had increased emotionality and hypothalamic pituitary adrenal axis reactivity (Berry, 2012). Isolated primates showed several symptoms of depressive behavior, higher levels of stereotypy, less grooming, higher levels of self-clasping and more passivity to social stimuli long after the experiment was over (Suomi, 1975).

Social isolation has also been linked to more aggressive behavior (Malkesman, 2006; Miczek, 1978). Rats that were isolated when they were 2 months old, showed a constant aggressiveness in their first year of life (Garzon, 1981). Isolated male mice also show increased tendencies to fight after isolation (Crawley, 1975), and generally became more aggressive (Goldsmith, 1978).

Social isolation causes animals to consume alcohol and other drugs when available (Apter, 2006; McKenzie-Quirk, 2008; Parker, 1974; Wolffgramm, 1991). Isolated rats consumed 30% more ethanol than grouped housed rats (Wolffgramm, 1991). Similarly, isolated adult rats drank significantly more ethanol than paired-grouped rats (Parker, 1974). Squirrel monkeys experiencing prolonged social isolation increased alcohol drinking, but this was only true for male monkeys (McKenzie-Quirk, 2008).

Isolated animals have shown memory disorders (Hock, 1988; Huang, 2011; Voikar, 2005) and sleep disorders (Greco, 1989; Greco, 1990; Kaushal, 2012). They also have higher risk of developing diseases (Karelina, 2009; Lyons, 1999; Watson, 1998).

The social isolation of adult animals can also cause change in brain physiology and anatomy. In isolated animals, researchers have observed decreased opiate receptors in the frontal cortex, striatum, hippocampus, and periaqueductal grey matter (Petkov, 1985) and changed norepinephrine levels, compare to grouped housed animals (Stolk, 1974). Isolated rats have

shown less BDNF protein in the hippocampus (Scaccianoce, 2006). Isolated of rats also showed changes in the hypothalamic- pituitary adrenal axis (Serra, 2005).

There also seems to be different consequences of social isolation when it comes to strain and sex. For example, social isolation had more negative consequences for the "Wistar-kyoto" strain of rat, than the "Flinders sensitive line" strain (Malkesman, 2006). There also seems to be some sex differences (Brown, 1995).

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