Article

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# Let's Stay Together: Implications of Social Housing for Laboratory Pig Welfare and Management

The pig has become an increasingly popular test subject in biomedical research, due in large part to its physiological and anatomical similarities to humans. However, surprisingly little has been published on the general welfare needs of pigs used for laboratory research, and even fewer studies have focused on social housing of pigs used for such purposes.

Appropriately accommodating the pig's normal social behavior is an essential step in protecting its well-being in managed environments. Doing so is particularly important in laboratory settings in which distress due to social isolation and other factors can introduce unnecessary variability and induce physiological and behavioral coping mechanisms that can undermine the validity of research results. Further, addressing the social needs of pigs is a critical component of meeting our ethical obligation to provide the best possible quality of life for research animals.

Unfortunately, the housing of laboratory pigs often works against, rather than with, the ethology of the pig. Pigs are highly social animals prone to living in stable groupings of sows and their piglets or young bachelor boars. Only older boars tend to live alone in the wild (Ellegaard et al, 2010). Yet many pigs are routinely isolated for research purposes. While mixing of unfamiliar pigs typically leads to fighting, aggression is relatively rare once hierarchies are established, which usually occurs within 24-48 hours after introduction (Newberry and Wood-Gush, 1986; Stolba and Wood-gush, 1989; Ellegaard et al, 2010). Affiliative behaviors are prevalent in the pig's ethogram, with pigs frequently being seen grouping together when possible, nuzzling, and lying together. In fact, pigs are so highly motivated for social contact that they will perform operant tasks to gain access to each other (Mathews and Ladewig, 1994), and have been shown to choose social contact over access to bedding (Hemsworth et al., 2011). When singly housed, they often seek out conspecific contact, including lying against fencelines or pen sides that place them adjacent to each other.

Photo by Jill Davidson

Pigs appear to be fairly cognitively complex as well, which provides further impetus to ensure that all aspects of their well-being are addressed relative to their care. Memory, discrimination learning (conspecifics, odor, visual and location cues) and concept formation (Cerbulis, 1994; Mendl et al., 1997; Croney, 1999) have all been documented in the pig along with their capacity for social facilitation of learning (Stolba and Wood-Gush, 1989). Collectively, these data suggest that pigs are likely to need and benefit from social support; it probably is an important component of their behavioral and psychological well-being.

This theory is supported by the finding that isolated pigs show a chronic stress response compared to group housed pigs (Kanitz et al., 2004; Ruis et al., 2001). Social support may provide a stress "buffer" for animals that are having difficulty coping with the challenges of their environments, as may occur when they are socially isolated. For example, animals exposed to known stressors have been shown to have decreases in corticotropic-releasing hormone (CRH) (Bosch et al., 2009), adrenocorticotropic hormone (ACTH) (Hennesy et al., 2000) and glucocorticoid levels (Boissy et al., 1998; Ruis et al., 2001; Hennesy et al., 2009) when provided some form of social support. Moreover, providing familiar pen-mates as companions along with enrichment (a simulated udder) has been shown to decrease distress in piglets weaned early for experimental reasons (Jeppesen, 1982; Toscano and Lay, 2005; Widowski et al., 2005).

Determining what constitutes "social housing" in pigs, however, is not without controversy. For some, the definition extends to housing multiple pigs separately in a room where they may have only visual or olfactory access to each other. While this type of arrangement may serve to protect the pig from total isolation, it is unclear to what extent it adequately meets the pig's social needs.

For those considering housing pigs in pairs or larger groups, several factors must be considered. First, protecting wounds, surgical sites and sampling equipment, such as catheter lines can be complicated when pigs are housed together. There also can be risks associated with aggressive encounters which must be acknowledged. A plan should therefore be developed to introduce animals to each other so as to minimize aggression. Ensuring the stability of groups can help to facilitate harmonious interactions. The size of pen

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mates can also impact aggression and should be evaluated prior to introducing pigs to each other. Studies suggest that rather than housing pigs of similar weights together as is commonly done, disparate pair sizes may help to reduce both the severity and numbers of aggressive encounters when these occur (Arey et al., 1998; Anderson et al., 2000). Pigs that are asymmetrical in size or weight appear to establish relative social hierarchies more quickly than more evenly matched conspecifics (Arey et al.,1998), probably because they literally "size each other up" and elect not to engage in a battle they are unlikely to win if they perceive themselves to be physically outmatched.

In group housing, resource access and allocation must also be carefully scrutinized. Care must be taken to avoid inadvertently facilitating aggressive competition for resources (food, water, enrichment). Ensure that sufficient resources are provided for the number of animals housed together (consider, for example, the amount of feeder space or number of feeding stations allocated to the number of animals). All resources should be dispersed in such a manner that it is difficult for one or a few animals to commandeer them. If pigs are feed restricted, individual feeding may be necessary to avoid competitive aggression. When provided, the type of enrichment offered to group housed pigs should be well thought out. For example, bedding can be a very useful form of enrichment to pigs, affording them the opportunity to engage in behaviors they are highly motivated to perform, such as rooting, foraging and nest building. Given this, a relatively small amount of bedding may be perceived to be quite valuable to a pig, but depending on the type and amount provided, may be more difficult to commandeer than food or a toy. If toys are provided to pigs housed together, the extent to which cooperative use is possible should be considered.

Social compatibility of pigs sharing quarters is an essential consideration in ensuring their safety and well-being in groups. Pigs tend to form preferential social associations (Newberry and Wood-Gush, 1986; Stookey and Gonyou, 1998); thus housing them with incompatible companion(s) is potentially a stressor which could result in aggression and other undesirable behaviors. Purchasing and maintaining pigs in established groups with familiar and socially compatible peers may circumvent problems. The efficacy of social support provided by housing pigs together is also potentially impacted by the temperament of the pigs as well as their compatibility and familiarity with each other. In stress-susceptible strains, or those with a tendency toward high arousal or reactivity, both the previous experience and temperament of companions should be considerations for compatibility. In one study, familiar pigs were able to buffer each other's responses, but it was suggested that unfamiliar pigs might not be able to provide adequate social support, and might exacerbate stress responses (Dantzer, et al., 1980).

Age, gender and reproductive status are additional factors that must be accounted for in housing decisions. Social housing of boars can be particularly challenging in laboratory settings. Because older boars are solitary in the wild, they may be less tolerant of conspecifics than other pigs. Moreover, competition for resources in mature boars is far more likely to result in serious fights if group housed (Holtz, 2010). This can occur even when boars have been housed together harmoniously as juveniles. As alluded to previously, the genetic lines of pigs under consideration as pen-mates must be considered, as some strains, especially certain miniature swine, may have relatively low thresholds in regard to stimuli that trigger

aggression. If tusks are present, the risks of injury associated with fighting are obviously worsened. In addition, particularly in miniature pigs, sexually mature boars may mount each other (hierarchical rank is a factor). This behavior requires monitoring as low ranking pigs can be repeatedly mounted, potentially resulting in chronic stress and/or injury, which may require removing the lowest ranking animal(s) for safety reasons.

In those situations in which co-housing pigs presents risks to their well-being that are sufficient to require them to be housed singly, pigs should be kept in visual, olfactory and protected tactile contact with each other. In addition, the usefulness of alternatives to conspecific social housing may need to be considered. Some of these interventions include inter-specific social interactions and the provision of inanimate forms of enrichment that may provide an element of social support, such as mirrors.

Few studies appear to have examined the benefits and constraints of inter-species social support. Divincenti et al (2012) found that housing different species of macaques together provided appropriate social support without causing undue complications relative to managing aggression between animals or disrupting routine husbandry. Additional options for providing social support may include housing compatible animals of different genera within visual, olfactory, or tactile proximity to each other. For example, it is not uncommon in veterinary clinical settings to have sheep or goats housed in a room together or in adjacent pens. However, the potential benefits (and downsides) of doing so are often presumed, rather than documented. Further research is needed to examine these sorts of interactions as a form of social support for pigs kept for research purposes who may otherwise be isolated.

When single housing is necessary, the quantity and quality of caretaker interactions with pigs become even more important to their overall well-being. As a result, greater consideration is needed of the role human caretakers may play in providing social support for pigs kept in laboratory settings. Pigs often seek out positive social contact with caretakers and respond well to low stress handling. They are able to recognize, distinguish between and respond accordingly to familiar caretakers (Koba and Tanida, 2001). Their capacity to learn and remember negative as well as positive experiences, and to consequently suffer or cope, is evidenced by the alterations in their behavioral and physiological responses as a function of the quality of human-animal interactions they experience. Decrements in pig production, reproductive performance and willingness to approach humans after rough or inconsistent handling have been well documented (Hemsworth et al., 1987; 1989). For these reasons, aversive or inconsistent handling of pigs should be avoided. Although incorporating positive, low stress human-animal interactions as a matter of routine care requires time and planning, doing so is likely to pay off in regard to improved animal behavioral responses that facilitate data collection processes. In addition, minimizing handling distress and maximizing positive experiences with caretakers in laboratory pigs is a refinement that may remove a source of error and variability in their behavioral and physiological responses, which may consequently yield more robust data.

Inanimate forms of social support, such as televisions, audio and video-recordings and mirrors may also offer some benefits when social housing of pigs is not possible. Mirrors are often suggested to be useful forms of enrichment for isolated animals in research settings.

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Photo by Shelly DeBoer

Primates may use mirrors to view their reflections or activities outside pens (Lutz and Novak, 2005; Reinhardt, 2010) and at least one study suggests that the presence of a mirror attenuates stress responses in isolated sheep (Parrott et al., 1988). Pigs have been shown to be able to use mirrors to obtain environmental information (hidden food) (Broom et al., 2009). However, the extent to which mirrors offer useful social support for pigs is unclear. While mirrors may provide visual stimuli that may be somewhat enriching, they cannot provide auditory or tactile support, which are likely to be important to the pig given its natural history. The cognitive ability of a species for self-recognition would theoretically reduce the usefulness of a mirror as a form of social support. However, there is currently limited evidence that pigs have this capacity.

One recent experiment by DeBoer et al. (2013) evaluated pigs' preferences for different types of enrichment, including a mat, a mirror and another pig when alone and in the presence of a human. The mirror was chosen as often as a companion pig when a human approached the test pigs, suggesting that pigs may indeed perceive the mirror to provide some sort of social support. Further examination of the usefulness of mirrors as an alternative to conspecific social support for pigs is warranted given the need to protect the pig's overall well-being in laboratory settings.

Ultimately, it is the pig's perception of how well its needs are met that determines its level of well-being in biomedical and all other environments in which it may be kept. Therefore, any attempt to incorporate social support for the pig into its housing environment should include a holistic assessment of the chosen intervention on the pig's physical, behavioral and mental well-being outcomes.

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