Social Housing of Laboratory Animals

Selected Citations – updated April 2021

Compiled by USDA, NAL, Animal Welfare Information Center (AWIC)

This reference list is provided as a starting point from which to find relevant information on social housing of various animal species housed in laboratories. It is by no means a complete list. Contact the AWIC staff if you would like a more detailed search performed.

E-mail: awic@usda.gov
Phone: (301) 504-6212
Web site: https://www.nal.usda.gov/awic

Table of Contents
Nonhuman Primates........................................................................................................................................... 1
Dogs........................................................................................................................................................................11
Fish and Amphibians.......................................................................................................................................... 14
Pigs....................................................................................................................................................................... 18
Rabbits.............................................................................................................................................................. 26
Rodents.............................................................................................................................................................. 31
Ruminants.......................................................................................................................................................... 41
Nonhuman Primates


Online: https://dx.doi.org/10.1002/ajp.20270


Online: http://www.brown.edu/Research/Primate/lpn38-3.html#group


Online: https://dx.doi.org/10.1002/ajp.22543

Online: https://dx.doi.org/10.1002/ajp.22190

Online: https://dx.doi.org/10.1002/ajp.20556

Online: https://dx.doi.org/10.1016/j.applanim.2011.09.010


Online: https://dx.doi.org/10.1002/ajp.20556

Bray, J., C. Krupenye, and B. Hare (2013). Ring-tailed lemurs (*Lemur catta*) exploit information about what others can see but not what they can hear. *Animal Cognition* Epub.

Online: https://dx.doi.org/10.3389/fnbeh.2014.00047

Online: https://dx.doi.org/10.1002/ajp.22464


Online: https://dx.doi.org/10.1016/j.applanim.2012.06.008


Online: https://dx.doi.org/10.1002/ajp.22430


Janavaris, M., Bader, L., Coleman, K., & Kievit, P. (2020). Bedding as an enrichment strategy in group-housed mauritian cynomolgus macaques (Macaca fascicularis). American Journal of Primatology, 82.://WOS:000519103100122


Online: [https://dx.doi.org/10.1016/j.applanim.2007.02.009](https://dx.doi.org/10.1016/j.applanim.2007.02.009)


Pomerantz, O. and K.C. Baker (2017). Higher levels of submissive behaviors at the onset of the pairing process of rhesus macaques (Macaca mulatta) are associated with lower risk of wounding following introduction. *American journal of primatology* (Online version available). Online: [https://dx.doi.org/10.1002/ajp.22671](https://dx.doi.org/10.1002/ajp.22671)


Thompson, C.L. (2016). *To pair or not to pair: Sources of social variability with white-faced saki monkeys (Pithecia pithecia) as a case study.* *American Journal of Primatology* 78(5): 561-572. Online: [https://dx.doi.org/10.1002/ajp.22360](https://dx.doi.org/10.1002/ajp.22360)

Online: https://dx.doi.org/10.1002/ajp.22485

Online: http://www.brown.edu/Research/Primate/lpn41-2.html

Online: https://dx.doi.org/10.1002/ajp.20733


Online: https://dx.doi.org/10.1002/ajp.22521


Online: https://dx.doi.org/10.1002/ajp.22556

Online: https://dx.doi.org/10.1002/ajp.22285

Online: https://dx.doi.org/10.1016/j.vascn.2015.05.004

Dogs


metabolism studies allowing dogs to be pair housed. In LABORATORY ANIMALS. SAGE PUBLICATIONS INC. https://doi.org/10.1177/0023677220905330

Makszin, K., Bohle, D., & Seabrooke, L. (2018). The dog that didn’t bark; Social housing in European peripheries. BASE.

Online: https://dx.doi.org/10.1016/j.applanim.2013.12.002


Online: https://dx.doi.org/10.1016/j.beproc.2014.01.015


Online: https://dx.doi.org/10.1080/10888705.2013.741001


Online: http://www.nc3rs.org.uk/downloaddoc.asp?id=1365&page=51&skin=0


Fish and Amphibians


Kurtzman, MS; Craig, MP; Grizzle, BK; Hove, JR (2010). Sexually segregated housing results in improved early larval survival in zebrafish. Lab animal 39(6). 183-189.


Shams, S.; Chatterjee, D.; Gerlai, R. (2015). **Chronic social isolation affects thigmotaxis and whole-brain serotonin levels in adult zebrafish.** *Behavioural brain research* 292: 283-287. Online: [https://dx.doi.org/10.1016/j.bbr.2015.05.061](https://dx.doi.org/10.1016/j.bbr.2015.05.061)


Williams, TD; Readman, GD; Owen, SF. **Key issues concerning environmental enrichment for laboratory-held fish species.** *Laboratory animals* 43(2): 107-120. Online: [https://dx.doi.org/10.1258/la.2007.007023](https://dx.doi.org/10.1258/la.2007.007023)
Pigs


Bohnenkamp, A.-L., Traulsen, I., Meyer, C., Müller, K., & Krieter, J. (2013). *Comparison of growth performance and agonistic interaction in weaned piglets of different weight classes from farrowing systems with group or single housing*. *Animal, 7*(02), 309–315. [https://doi.org/10.1017/S1751731112001541](https://doi.org/10.1017/S1751731112001541)


Online: https://dx.doi.org/10.1016/j.jveb.2015.05.002


Online: https://dx.doi.org/10.1016/j.applanim.2004.11.019

Online: http://handle.nal.usda.gov/10113/56673

Desire, S; Turner, SP; D’Eath, RB; Doeschl-Wilson, AB; Lewis, CRG; Roehe, R (2015). Analysis of the phenotypic link between behavioural traits at mixing and increased long-term social stability in group-housed pigs. Applied animal behaviour science 166: 52-62.
Online: https://dx.doi.org/10.1016/j.applanim.2015.02.015

Online: https://dx.doi.org/10.1016/j.applanim.2004.05.003


Online: http://www.prairieswine.com/effects-of-temperament-and-floor-space-allowance-on-sows-at-grouping/


Online: [https://dx.doi.org/10.1016/j.physbeh.2014.02.059](https://dx.doi.org/10.1016/j.physbeh.2014.02.059)


Online: [https://dx.doi.org/10.1016/j.physbeh.2012.11.002](https://dx.doi.org/10.1016/j.physbeh.2012.11.002)


Online: [https://dx.doi.org/10.1016/j.applanim.2013.07.002](https://dx.doi.org/10.1016/j.applanim.2013.07.002)


Online: [https://dx.doi.org/10.1016/j.applanim.2009.08.006](https://dx.doi.org/10.1016/j.applanim.2009.08.006)


Online: [https://dx.doi.org/10.1016/j.applanim.2014.01.006](https://dx.doi.org/10.1016/j.applanim.2014.01.006)


Online: [https://dx.doi.org/10.1016/j.applanim.2012.02.010](https://dx.doi.org/10.1016/j.applanim.2012.02.010)


Thomsson, O; Bergqvist, AS; Sjunnesson, Y; Eliasson-Selling, L; Lundeheim, N; Magnusson, U (2015). Aggression and cortisol levels in three different group housing routines for lactating sows. *Acta veterinaria scandinavica* 57. Online: https://dx.doi.org/10.1186/s13028-015-0101-7


Rabbits


Online: https://dx.doi.org/10.1016/j.applanim.2003.09.011


Online: https://dx.doi.org/10.1016/j.applanim.2008.08.011

Online: https://dx.doi.org/10.1080/10888705.2016.1247352

Online: http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5113872/


Online: https://dx.doi.org/10.2376/0341-6593-116-97


Online: https://dx.doi.org/10.1017/S1751731114001244


Online: https://dx.doi.org/10.1016/j.applanim.2009.02.007

Online: https://dx.doi.org/10.1258/002367707782314247


Szendro, K; Szendro, Z; Matics, Z; Zotte, AD; Odermatt, M; Radnai, I; Gerencser, Z (2015). *Effect of genotype, housing system and hay supplementation on performance and ear lesions of growing rabbits*. Livestock science 174: 105-112. Online: https://dx.doi.org/10.1016/j.livsci.2015.01.008


Rodents

Online: https://dx.doi.org/10.1016/0376-6357(77)90030-4

Online: https://dx.doi.org/10.1016/j.physbeh.2009.03.008


Online: https://dx.doi.org/10.1080/10253890701265362


Online: https://dx.doi.org/10.7554/eLife.01385.001

Online: https://dx.doi.org/10.1016/j.yfrne.2007.02.001

Online: https://dx.doi.org/10.1016/S0306-4530(02)00039-2

Online: https://dx.doi.org/10.1016/S0031-9384(00)00411-X

Online: https://dx.doi.org/10.1016/j.physbeh.2013.10.019


Online: https://dx.doi.org/10.1016/j.applanim.2008.02.007


Online: https://dx.doi.org/10.1016/j.neubiorev.2010.10.004


Online: https://dx.doi.org/10.1016/j.applanim.2012.10.006


Online: https://dx.doi.org/10.1016/j.applanim.2012.06.001


Online: https://dx.doi.org/10.1016/j.bbr.2013.01.015


Online: https://dx.doi.org/10.1016/j.physbeh.2014.04.008

Online: [https://dx.doi.org/10.1177/0023677216660740](https://dx.doi.org/10.1177/0023677216660740)


Online: [https://dx.doi.org/10.1258/la.2012.012027](https://dx.doi.org/10.1258/la.2012.012027)


Online: [https://dx.doi.org/10.1371/journal.pone.0169705](https://dx.doi.org/10.1371/journal.pone.0169705)

Online: [https://dx.doi.org/10.1016/j.bbr.2015.09.028](https://dx.doi.org/10.1016/j.bbr.2015.09.028)

Online: [https://dx.doi.org/10.1016/j.physbeh.2016.02.040](https://dx.doi.org/10.1016/j.physbeh.2016.02.040)


Maher, RL; Barbash, SM; Lynch, DV; Swoap, SJ (2015). *Group housing and nest building only slightly ameliorate the cold stress of typical housing in female C57BL/6J mice.* *American journal of...*


Stickney, J. D., & Morgan, M. M. (2021). **Social housing promotes recovery of wheel running depressed by**

Taylor, K. (2010). *Reporting the implementation of the Three Rs in European primate and mouse research papers: Are we making progress?* Atla *Alternatives to Laboratory Animals* 38(6): 495-517.


**Ruminants**


Online: https://dx.doi.org/10.1016/j.applanim.2009.04.005


Online: https://dx.doi.org/10.1016/S0168-1591(02)00217-4


Online: https://dx.doi.org/10.1017/S0022029908003683


Online: https://dx.doi.org/10.3168/jds.2013-7823


Online: https://dx.doi.org/10.1016/j.applanim.2005.10.012


Online: https://dx.doi.org/10.1371/journal.pone.0090205


Guesdon, V; Meurisse, M; Chesneau, D; Picard, S; Levy, F; Chaillou, E (2015). *Behavioral and endocrine evaluation of the stressfulness of single-pen housing compared to group-housing and social isolation conditions*. *Physiology & behavior* 147: 63-70.
Online: https://dx.doi.org/10.1016/j.physbeh.2015.04.013

Online: https://dx.doi.org/10.1016/j.applanim.2004.10.003


Online: https://dx.doi.org/10.1016/j.livsci.2006.04.033

Online: https://dx.doi.org/10.2527/jas.2005-346

Online: https://dx.doi.org/10.3168/jds.2013-7311


Nordmann, E; Barth, K; Futschik, A; Palme, R; Waiblinger, S (2015). Head partitions at the feed barrier affect behaviour of goats. *Applied animal behaviour science* 167: 9-19. Online: https://dx.doi.org/10.1079/9781780642161.0169


Vogeli, S; Wolf, M; Wechsler, B; Gygax, L (2015). **Housing conditions influence cortical and behavioural reactions of sheep to videos showing social interactions of different valence.** *Behavioural brain research* 284: 69-76. Online: [https://dx.doi.org/10.1016/j.bbr.2015.02.007](https://dx.doi.org/10.1016/j.bbr.2015.02.007)

Voegeli, S., J. Lutz, M. Wolf, B. Wechsler, and L. Gygax (2014). **Valence of physical stimuli, not housing conditions, affects behaviour and frontal cortical brain activity in sheep.** *Behavioural Brain Research* 267: 144-155. Online: [https://dx.doi.org/10.1016/j.bbr.2014.03.036](https://dx.doi.org/10.1016/j.bbr.2014.03.036)


Zipp, K. A., & Knierim, U. (2020). **Physical development, ease of integration into the dairy herd and performance of primiparous dairy cows reared with full whole-day, half-day or no mother-contact as calves.** *Journal of Dairy Research,* 87(S1), 154–156. Scopus. [https://doi.org/10.1017/S002202992000059X](https://doi.org/10.1017/S002202992000059X)