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


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/10.1007/s10071-013-0705-0](https://dx.doi.org/10.1007/s10071-013-0705-0)


Lopak, V. and R. Eikelboom (2000). Pair housing induced feeding suppression: Individual housing not novelty. Physiology and Behavior; 2000; 71 (3-4); 329-333. Online: https://dx.doi.org/10.1016/S0031-9384(00)00347-4


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


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)


Dogs


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


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.


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
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](https://dx.doi.org/10.1016/j.jveb.2015.05.002)


Online: [https://dx.doi.org/10.1016/j.applanim.2004.11.019](https://dx.doi.org/10.1016/j.applanim.2004.11.019)

Online: [http://handle.nal.usda.gov/10113/56673](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](https://dx.doi.org/10.1016/j.applanim.2015.02.015)

Online: [https://dx.doi.org/10.1016/j.applanim.2004.05.003](https://dx.doi.org/10.1016/j.applanim.2004.05.003)


Rault, J.L. (2017). **Social interaction patterns according to stocking density and time post-mixing in group-housed gestating sows.** *Animal Production Science* 57(5): 896-902. Online: [https://dx.doi.org/10.1071/AN15415](https://dx.doi.org/10.1071/AN15415)

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: [http://ilarjournal.oxfordjournals.org/content/47/4/358.full.pdf](http://ilarjournal.oxfordjournals.org/content/47/4/358.full.pdf)

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

Online: [https://dx.doi.org/10.1016/j.applanim.2013.03.001](https://dx.doi.org/10.1016/j.applanim.2013.03.001)

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](https://dx.doi.org/10.1186/s13028-015-0101-7)

Online: [https://dx.doi.org/10.1016/j.applanim.2012.05.002](https://dx.doi.org/10.1016/j.applanim.2012.05.002)

Online: [https://dx.doi.org/10.1016/j.applanim.2013.03.012](https://dx.doi.org/10.1016/j.applanim.2013.03.012)


Online: [https://dx.doi.org/10.1258/0023677053739701](https://dx.doi.org/10.1258/0023677053739701)

Online: [https://dx.doi.org/10.2527/jas.2014-8742](https://dx.doi.org/10.2527/jas.2014-8742)

Online: [https://dx.doi.org/10.1258/0023677053739701](https://dx.doi.org/10.1258/0023677053739701)


Rabbits


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


Online: https://doi.org/10.1016/j.rvsc.2018.11.016

Online: https://doi.org/10.1017/S1751731112002029

Online: https://dx.doi.org/10.1016/j.applanim.2013.10.002

Online: https://dx.doi.org/10.1016/j.applanim.2008.12.004


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.2005.06.014

Online: https://dx.doi.org/10.1016/j.neulet.2014.02.051

Online: https://dx.doi.org/10.1371/journal.pone.0086237

Online: https://dx.doi.org/10.1097/PSY.0000000000000052

Online: https://dx.doi.org/10.1093/ilar.53.3-4.279


Online: https://dx.doi.org/10.1016/j.yfrne.2009.06.001

Online: https://dx.doi.org/10.1002/dev.20045


Online: https://doi.org/10.1007/978-1-4939-8994-2_7

Online: https://dx.doi.org/10.1007/s00204-014-1203-0


Online: https://dx.doi.org/10.1016/j.physbeh.2006.07.010


Online: https://dx.doi.org/10.1177/0023677213505085


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
physiology-regulatory integrative and comparative physiology 308(12): R1070-R1079.
Online: https://dx.doi.org/10.1152/ajpregu.00407.2014


**Online:** https://dx.doi.org/10.1098/rspb.2013.2535


**Online:** https://dx.doi.org/10.1258/002367704323133600

**Online:** https://dx.doi.org/10.1016/j.physbeh.2017.05.015


**Online:** https://doi.org/10.1016/j.vascn.2019.02.005


**Online:** https://dx.doi.org/10.1016/j.applanim.2005.02.004

**Online:** https://dx.doi.org/10.1258/002367703762226692

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


Woodard, C. L., Nasrallah, W. B., Samiei, B. V., Murphy, T. H., & Raymond, L. A. (2020). *PiDose: An open-source system for accurate and automated oral drug administration to group-housed mice*. Scientific Reports, 10(1). Scopus. [https://doi.org/10.1038/s41598-020-68477-2](https://doi.org/10.1038/s41598-020-68477-2)

Online: https://doi.org/10.3390/ani9121010
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


University of Life Sciences, Department of Animal and Aquacultural Sciences, 120 pages.


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


Jensen, MB; Herskin, MS; Thomsen, PT; Forkman, B; Houe, H (2015). **Preferences of lame cows for type of surface and level of social contact in hospital pens.** *Journal of dairy science* 98(7): 4552-4559. Online: https://dx.doi.org/10.3168/jds.2014-9203


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](https://dx.doi.org/10.1079/9781780642161.0169)

https://doi.org/10.3390/ani10040565

Online: https://dx.doi.org/10.1016/j.applanim.2012.11.009


https://doi.org/10.3168/jds.2019-17727


Online: https://dx.doi.org/10.1016/j.applanim.2004.12.001

Online: https://dx.doi.org/10.1016/S0168-1591(02)00213-7

https://doi.org/10.3168/jds.2020-19689

https://doi.org/10.1017/S1751731119001733


https://doi.org/10.3390/ani10010040


Vogeli, S; Wolf, M; Wechsler, B; Gygax, L (2015). **Housing conditions influence cortical and behavioural reactions of sheep in response 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


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**