

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

- (2019). **Association of Primate Veterinarians' Socialization Guidelines for Nonhuman Primates in Biomedical Research.** In *Journal of The American Association For Laboratory Animal Science* (Vol. 58, Issue 6, pp. 753–754). Amer Assoc Laboratory Animal Science.
- Abney, D.M.; Moomaw, H.A. (2015). **Strategies for successfully social housing incompatible cynomolgus macaque trios.** *American journal of primatology* 77(Suppl. 1): 59-60.
- Abney, D.M. and J.L. Weed (2006). **Methods for successfully pair housing adult male rhesus macaques (*Macaca mulatta*).** *American Journal of Primatology* 68(Suppl. 1): 59.
Online: <https://dx.doi.org/10.1002/ajp.20270>
- Alexander, S. and M. Fontenot (2003). **Isosexual social group formation for environmental enrichment in adult male *Macaca mulatta*.** *Contemporary Topics in Laboratory Animal Science* 42(4): 122.
- Asvestas, C. and M. Reiniger (1999). **Forming a bachelor group of long-tailed macaques (*Macaca fascicularis*).** *Laboratory Primate Newsletter* 38(3): 14-15.
Online: <http://www.brown.edu/Research/Primate/lpn38-3.html#group>
- Augustsson, H. and J. Hau (1999). **A simple ethological monitoring system to assess social stress in group-housed laboratory rhesus macaques.** *Journal of Medical Primatology* 28 (2): 84-90.
- Bader, L. A., Janavaris, M., Houser, L., Prongay, K., Cullin, C., Sacha, J., Coleman, K., & Kievit, P. (2020). **LIFE IS Better With Friends: The Benefits of Group Housing Cynomolgus Macaques (*Macaca Fascicularis*) During Quarantine.** *American Journal of Primatology*, 82(1).
- Baker, K.C. (2016). **Survey of 2014 behavioral management programs for laboratory primates in the United States.** *American Journal of Primatology* 78(7): 780-796.
Online: <https://dx.doi.org/10.1002/ajp.22543>
- Baker, K.C., M.A. Bloomsmith, B. Oettinger, K. Neu, C. Griffis, and V.A. Schoof (2014). **Comparing options for pair housing rhesus macaques using behavioral welfare measures.** *American Journal of Primatology* 76(1): 30-42.
Online: <https://dx.doi.org/10.1002/ajp.22190>
- Baker, K.C., M. Bloomsmith, K. Neu, C. Griffis, B. Oettinger, V. Schoof, A. Clay, and M. Maloney (2008). **Benefits of isosexual pairing of rhesus macaques (*Macaca mulatta*) vary with sex and are limited by protected contact but not by frequent separation.** *American Journal of Primatology* 70(Suppl. 1): 44.
Online: <https://dx.doi.org/10.1002/ajp.20556>
- Baker, K.C., M.A. Bloomsmith, B. Oettinger, K. Neu, C. Griffis, V. Schoof, and M. Maloney (2012). **Benefits of pair housing are consistent across a diverse population of rhesus macaques.** *Applied Animal Behaviour Science* 137(3-4): 148-156.
Online: <https://dx.doi.org/10.1016/j.applanim.2011.09.010>

- Baker, K.C., C.M. Crockett, G.H. Lee, B.C. Oettinger, V. Schoof, and J.P. Thom (2012). **Pair housing for female longtailed and rhesus macaques in the laboratory: Behavior in protected contact versus full contact.** *Journal of Applied Animal Welfare Science* 15(2): 126-143.
Online: <https://dx.doi.org/10.1080/10888705.2012.658330>
- Baker, K. C., & Pomerantz, O. (2019). **Pair Housing In Pigtailed Macaques (Macaca Nemestrina) Following Transport To A New Facility: Effects of Timing.** *American Journal of Primatology*, 81(1, Si).
- Ballestaa, S., G. Reymond, M. Pozzobon, and J. Duhamel (2014). **A real-time 3D video tracking system for monitoring primate groups.** *Journal of Neuroscience Methods* 234(Sp. Iss. SI): 147-152.
Online: <https://dx.doi.org/10.1016/j.jneumeth.2014.05.022>
- Bayne, K. (2014). **A historical perspective on social housing.** *The Enrichment Record* 18: 8-11.
Online: <http://enrichmentrecord.com/wp-content/uploads/2014/01/HISTORICAL-PERSPECTIVE.pdf>
- Beisner, B. A., Wooddell, L. J., Hannibal, D. L., Nathman, A., & McCowan, B. (2019). **High rates of aggression do not predict rates of trauma in captive groups of macaques.** *Applied Animal Behaviour Science*, 212, 82–89. <https://doi.org/10.1016/j.applanim.2019.01.003>
- Bennett, B. T. (2016). **Association of Primate Veterinarians 2014 Nonhuman Primate Housing Survey.** *Journal of the American Association for Laboratory Animal Science: JAALAS* 55(2): 172-174.
Online: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC4783636/>
- Bernstein, I.S. (1991). **Social housing of monkeys and apes: group formations.** *Laboratory Animal Science* 41(4): 329-333.
- Berg, M. R., Heagerty, A., & Coleman, K. (2019). **Oxytocin and pair compatibility in adult male rhesus macaques (Macaca mulatta).** *American Journal of Primatology*. <https://doi.org/10.1002/ajp.23031>
- Bergman, Thore J.and M.J. Sheehan (2013). **Social knowledge and signals in primates.** *American Journal of Primatology* 75(7): 683-694.
Online: <https://dx.doi.org/10.1002/ajp.22103>
- Bliss-Moreau, E., G. Moadab, M.D. Bauman, and D.G. Amaral (2013). **The impact of early amygdala damage on juvenile rhesus macaque social behavior.** *Journal of Cognitive Neuroscience* 25(12): 2124.
Online: https://dx.doi.org/10.1162/jocn_a_00483
- Bloomsmith, M. A., & Jean, S. (2020). **Social Housing of Macaques on Studies of Simian Immunodeficiency Virus.** *American Journal Of Primatology*, 82(1).
- Bloomsmith, M. A., Clay, A. W., Lambeth, S. P., Lutz, C. K., Breaux, S. D., Lammey, M. L., Franklin, A. N., Neu, K. A., Perlman, J. E., Reamer, L. A., Marenco, M. C., Schapiro, S. J., Vazquez, M., & Bourgeois, S. R. (2019). **Survey of Behavioral Indices of Welfare in Research Chimpanzees (Pan troglodytes) in the United States.** *Journal of the American Association for Laboratory Animal Science : JAALAS*, 58(2), 160–177. MEDLINE. <https://doi.org/10.30802/AALAS-JAALAS-18-000034>

- Bloomsmith, M., K. Baker, C. Griffis, B. Oettinger, V. Schoof, A. Clay, and M. Maloney (2008). **Behavioral benefits of pair housing in adult rhesus macaques (*Macaca mulatta*) do not depend on age, previous duration of single housing, or naturalistic rearing.** *American Journal of Primatology* 70(Suppl. 1): 44.
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/10.1007/s10071-013-0705-0>
- Camus, S.M.J., C. Rochais, C. Blois-Heulin, Q. Li, M. Hausberger, and E. Bezard (2014). **Depressive-like behavioral profiles in captive-bred single- and socially-housed rhesus and cynomolgus macaques: A species comparison.** *Frontiers in Behavioral Neuroscience* 8(FEB): Article Number 47.
Online: <https://dx.doi.org/10.3389/fnbeh.2014.00047>
- Capitano, J.P., S.A. Blozis, J. Snarr, A. Steward, and B.J. McCowan (2017). **Do “birds of a feather flock together” or do “opposites attract”? Behavioral responses and temperament predict success in pairings of rhesus monkeys in a laboratory setting.** *American Journal of Primatology* 79(1): e22464.
Online: <https://dx.doi.org/10.1002/ajp.22464>
- Cassidy, L. C., Hannibal, D. L., Semple, S., & McCowan, B. (2020). **Improved behavioral indices of welfare in continuous compared to intermittent pair-housing in adult female rhesus macaques (*Macaca mulatta*).** *American Journal of Primatology*, 82(10). Scopus. <https://doi.org/10.1002/ajp.23189>
- Cassidy, L.; Semple, S.; Hannibal, D.; McCowan, B.(2015). **Behavioural and Physiological Effects of Housing Type on Laboratory Housed Female Rhesus Macaques (*Macaca mulatta*).** *Folia primatologica* 86(4): 259-260.
- Chelluri, G.I., S.R. Ross, and K.E. Wagner (2013). **Behavioral correlates and welfare implications of informal interactions between caretakers and zoo-housed chimpanzees and gorillas.** *Applied Animal Behaviour Science* 147(3-4): 306-315.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.06.008>
- Coleman, K., & Stull, C. (2020). **Pair Housing Mitigates Against Effects of Construction Noise In Caged Rhesus Macaques (*Macaca Mulatta*) In The Laboratory Environment.** *American JOURNAL OF PRIMATOLOGY*, 82(1).
- Crast, J.; Bloomsmith, M.A.; Jonesteller, T. (2015). **Effects of changing housing conditions on mangabey behavior (*Cercocebus atys*): Spatial density, housing quality, and novelty effects.** *American journal of primatology* 77(9): 1001-1014.
Online: <https://dx.doi.org/10.1002/ajp.22430>

- Díaz, S., Sánchez, S., & Fidalgo, A. (2020). **Coping Style and Early Life Vocalizations in the Common Marmoset (*Callithrix jacchus*)**. *International Journal of Primatology*, 41(3), 497–510. Scopus.
<https://doi.org/10.1007/s10764-020-00153-8>
- Dinklo, T., Garces, P., Chatham, C., Pouliot, M., & Authier, S. (2019). **Non-human primate neuropharmacology refinement: Polysomnography and regional qEEG with social housing in ETS 123 compliant cages**. *Journal of Pharmacological and Toxicological Methods*, 99.
<https://doi.org/10.1016/j.vascn.2019.05.069>
- DiVincenti Jr, L. and J.D. Wyatt (2011). **Pair housing of macaques in research facilities: A science-based review of benefits and risks**. *Journal of the American Association for Laboratory Animal Science* 50(6): 856-863.
Online: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3228921/>
- DiVincenti, L., A. Rehrig, and J. Wyatt (2012). **Interspecies pair housing of macaques in a research facility**. *Laboratory Animals*: 1-3.
Online: <https://dx.doi.org/10.1258/la.2011.011134>
- Doyle, L.A., K.C. Baker, and L.D. Cox (2008). **Physiological and behavioral effects of social introduction on adult male rhesus macaques**. *American Journal of Primatology* 70(6): 542-550.
Online: <https://dx.doi.org/10.1002/ajp.20526>
- Ekanayake-Alper, D. K., Wilson, S. R., & Scholz, J. A. (2018). **Retrospective Review of Surgical Outcomes and Pair-housing Success in Vasectomized Rhesus Macaques (*Macaca mulatta*)**. *Comparative Medicine*, 68(2), 168–176.
- Gilbert, M.H. and K.C. Baker (2011). **Social buffering in adult male rhesus macaques (*Macaca mulatta*): Effects of stressful events in single vs. pair housing**. *Journal of Medical Primatology* 40(2): 71-78.
Online: <https://dx.doi.org/10.1111/j.1600-0684.2010.00447.x>
- Gazes, R.P., E.K. Brown, B.M. Basile, and R.R. Hampton (2013). **Automated cognitive testing of monkeys in social groups yields results comparable to individual laboratory-based testing**. *Animal Cognition* 16(3): 445-458.
Online: <https://dx.doi.org/10.1007/s10071-012-0585-8>
- Gottlieb, D.H.; Maier, A.; Coleman, K. (2015). **Evaluation of environmental and intrinsic factors that contribute to stereotypic behavior in captive rhesus macaques (*Macaca mulatta*)**. *Applied animal behaviour science* 171: 184-191.
Online: <https://dx.doi.org/10.1016/j.applanim.2015.08.005>
- Gulledge, J.P.; Fernandez-Carriba, S.; Rumbaugh, D.M.; Washburn, D.A (2015). **Judgments of Monkey's (*Macaca mulatta*) Facial Expressions by Humans: Does Housing Condition "Affect" Countenance?** *Psychological record* 65(1): 203-207.
Online: <https://dx.doi.org/10.1007/s40732-014-0069-0>

- Hannibal, D. L., Nathman, A. C., Beisner, B. A., Lin, N. S., & McCowan, B. (2019). **Increased produce enrichment reduces trauma in socially-housed captive rhesus macaques (*Macaca mulatta*)**. *American Journal of Primatology*, 81. [://WOS:000506231200106](https://doi.org/10.1002/ajp.22528)
- Hannibal, D.L., E. Bliss-Moreau, J. Vandeleest, B. McCowan, and J. Capitanio (2017). **Laboratory rhesus macaque social housing and social changes: Implications for research**. *Journal of pharmacological and toxicological methods* 79(1): e22528.
Online: <https://dx.doi.org/10.1002/ajp.22528>
- Hannibal, D. L., Cassidy, L. C., Vandeleest, J., Semple, S., Barnard, A., Chun, K., Winkler, S., & McCowan, B. (2018). **Intermittent pair-housing, pair relationship qualities, and HPA activity in adult female rhesus macaques**. *American Journal of Primatology*, 80(5), e22762.
<https://doi.org/10.1002/ajp.22762>
- Hartner, M., J. Hall, J. Penderghest, and L.P. Clark (2001). **Group housing subadult male cynomolgus macaques in a pharmaceutical environment**. *Lab Animal* 30(8): 53-57
- Heagerty, A., Johnson, C., & Coleman, K. (2019). **Use of regression tree modeling to predict pair success in rhesus macaques (*Macaca mulatta*)**. *American Journal of Primatology*, 81. [://WOS:000506231200015](https://doi.org/10.1002/ajp.22762)
- Hoff, M., Powell, D., Lukas, K., & Maple, T. (1997). **Individual and social behavior of lowland gorillas in outdoor exhibits compared with indoor holding areas**. *Applied Animal Behaviour Science*, 54(4), 359–370.
- Hotchkiss, C.E. and M.G. Paule (2003). **Effect of pair-housing on operant behavior task performance by rhesus monkeys**. *Contemporary Topics in Laboratory Animal Science* 42(4): 38-41.
- 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](https://doi.org/10.1002/ajp.22501)
- Jorgensen, M.J., K.R. Lambert, S.D. Breaux, K.C. Baker, B.M. Snively, and J.L. Weed (2017). **Pair housing of Vervets/African Green Monkeys for biomedical research**. *Journal of pharmacological and toxicological methods* 79(1): e22501.
Online: <https://dx.doi.org/10.1002/ajp.22501>
- Kaiser, R.A., S.D. Tichenor, D.E. Regalia, K. York, and H.H. Holzgrefe (2015). **Telemetric assessment of social and single housing: Evaluation of electrocardiographic intervals in jacketed cynomolgus monkeys**. *Journal of pharmacological and toxicological methods* 75: 38-43.
Online: <https://dx.doi.org/10.1016/j.vascn.2015.05.001>
- Kaumanns Werner, Singh Mewa, and M. Schwibbe (2013). **Environmental change and housing conditions result in disappearance and return of reproductive seasonality in rhesus macaques (*Macaca mulatta*)**. *Current Science* 105(4): 517-521.

- Koyama, H., Tachibana, Y., Takaura, K., Takemoto, S., Morii, K., Wada, S., Kaneko, H., Kimura, M., & Toyoda, A. (2019). **Effects of housing conditions on behaviors and biochemical parameters in juvenile cynomolgus monkeys (*Macaca fascicularis*)**. In EXPERIMENTAL ANIMALS (Vol. 68, Issue 2, Pp. 195–211). Int Press Editing Centre Inc. <https://doi.org/10.1538/Expanim.18-0114>
- Kutsukake, N., Teramoto, M., Honma, S., Mori, Y., Ikeda, K., Yamamoto, R., Ishida, T., & Hasegawa, T. (2019). **Behavioural and hormonal changes during group formation by male chimpanzees**. *Behaviour*, 156(2), 109–129. Environment Complete.
- Lee, G.H., J.P. Thom, K.L. Chu, and C.M. Crockett (2012). **Comparing the relative benefits of grooming-contact and full-contact pairing for laboratory-housed adult female *Macaca fascicularis***. *Applied Animal Behaviour Science* 137(3-4): 157-165.
Online: <https://dx.doi.org/10.1016/j.applanim.2011.08.013>
- Leonardi, R., Buchanan-Smith, H. M., Dufour, V., MacDonald, C., & Whiten, A. (2010). **Living together: behavior and welfare in single and mixed species groups of capuchin (*Cebus apella*) and squirrel monkeys (*Saimiri sciureus*)**. *American Journal of Primatology: Official Journal of the American Society of Primatologists*, 72(1), 33–47.
- Luetjens, C. M., Grossmann, H., & Weinbauer, G. F. (2019). **Social Housing And Pregnancy Success In The Nonhuman Primate (NHP): An Appraisal**. INTERNATIONAL JOURNAL OF TOXICOLOGY, 38(1), 47.
- 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](https://dx.doi.org/10.1016/S0031-9384(00)00347-4)
- MacAllister, R. P., Heagerty, A., & Coleman, K. (2020a). **Behavioral predictors of pairing success in rhesus macaques (*Macaca mulatta*)**. *American Journal of Primatology*, 82(1).
<https://doi.org/10.1002/ajp.23081>
- MacAllister, R. P., Heagerty, A., & Coleman, K. (2020b). **Behavioral predictors of pairing success in rhesus macaques (*Macaca mulatta*)**. In AMERICAN JOURNAL OF PRIMATOLOGY (Vol. 82, Issue 1). WILEY.
<https://doi.org/10.1002/ajp.23081>
- Majolo, B., Buchanan-Smith, H.M., and K. Morris (2003). **Factors affecting the successful pairing of unfamiliar common marmoset (*Callithrix Jacchus*) females: Preliminary results**. *Animal Welfare* 12 (3): 327-337.
- McCowan, B., K. Anderson, A. Heagerty, and A. Cameron (2008). **Utility of social network analysis for primate behavioral management and well-being**. *Applied Animal Behaviour Science* 109(2): 396-405.
Online: <https://dx.doi.org/10.1016/j.applanim.2007.02.009>

- McCowan, B., Beisner, B., & Hannibal, D. (2018a). **Social management of laboratory rhesus macaques housed in large groups using a network approach: A review.** *Behavioural Processes*, 156, 77–82. <https://doi.org/10.1016/j.beproc.2017.11.014>
- McCowan, B., Beisner, B., & Hannibal, D. (2018b). **Social management of laboratory rhesus macaques housed in large groups using a network approach: A review.** In *Behavioural Processes* (Vol. 156, Issue Si, Pp. 77–82). Elsevier. <https://doi.org/10.1016/j.beproc.2017.11.014>
- McGrew, K. (2014). **The importance of data collection to social housing.** *The Enrichment Record* 19: 20-21. Online: <http://enrichmentrecord.com/wp-content/uploads/2014/04/ER-0414.pdf>
- Meguerditchian, A., Marie, D., Margiotoudi, K., Roth, M., Nazarian, B., Anton, J.-L., & Claidière, N. (2021). **Baboons (*Papio anubis*) living in larger social groups have bigger brains.** *Evolution and Human Behavior*, 42(1), 30–34. Scopus. <https://doi.org/10.1016/j.evolhumbehav.2020.06.010>
- Moomaw, H., Abney, D., Duffy, A., & Atherton, S. (2018). **A Successful Strategy For Social Housing Adult Male *Cynomolgus* Macaques In Triads.** *American Journal Of Primatology*, 80(1, Si).
- Morgan, D., K.A. Grant, O.A. Prioleau, S.H. Nader, J.R. Kaplan, M.A. Nader (2000). **Predictors of social status in *Cynomolgus* monkeys (*Macaca fascicularis*) after group formation.** *American journal of primatology* 52(3): 115-131. Online: [https://dx.doi.org/10.1002/1098-2345\(200011\)52:3<115::AID-AJP1>3.0.CO;2-Z](https://dx.doi.org/10.1002/1098-2345(200011)52:3<115::AID-AJP1>3.0.CO;2-Z)
- Neal Webb, S. J., Hau, J., & Schapiro, S. J. (2019). **Does group size matter? Captive chimpanzee (*Pan troglodytes*) behavior as a function of group size and composition.** *American Journal of Primatology*, 81(1), e22947. MEDLINE. <https://doi.org/10.1002/ajp.22947>
- Niehoff, M., Bartko, T., Kremer, J., & Nichols, J. (2020). **Evaluation of PhysioTel (TM) digital M11 cardiovascular telemetry implant in socially housed *Cynomolgus* monkeys using etilefrine and moxifloxacin.** *Journal of Pharmacological and Toxicological Methods*, 105. <https://doi.org/10.1016/j.vascn.2020.106761>
- Novak, M. A. (2020). **Self-Injurious behavior in rhesus macaques: Issues and challenges.** *American Journal of Primatology*. Scopus. <https://doi.org/10.1002/ajp.23222>
- Pahar, B., Baker, K. C., Jay, A. N., Russell-Lodrigue, K. E., Srivastav, S. K., Aye, P. P., Blanchard, J. L., & Bohm, R. P. (2020). **Effects of Social Housing Changes on Immunity and Vaccine-Specific Immune Responses in Adolescent Male Rhesus Macaques.** *Frontiers in Immunology*, 11. Scopus. <https://doi.org/10.3389/fimmu.2020.565746>
- Pate, K. M., Guerrero-Martin, S., Mcgee, K., & Rubin, L. (2019). **Social Housing of Simian Immunodeficiency Virus Infected Macaques.** *American Journal of Primatology*, 81(1, Si).

- Pearson, BL; Reeder, DM; Judge, PG (2015). **Crowding Increases Salivary Cortisol But Not Self-Directed Behavior in Captive Baboons.** *American journal of primatology* 77(4): 462-467.
Online: <https://dx.doi.org/10.1002/ajp.22363>
- 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>
- Prescott, M. J., Clark, C., Dowling, W. E., & Shurtleff, A. C. (2021). **Opportunities for refinement of non-human primate vaccine studies.** *Vaccines*, 9(3). Scopus. <https://doi.org/10.3390/vaccines9030284>
- Price, E. E., & Stoinski, T. S. (2007). **Group size: Determinants in the wild and implications for the captive housing of wild mammals in zoos.** *Applied Animal Behaviour Science*, 103(3–4), 255–264.
<https://doi.org/10.1016/j.applanim.2006.05.021>
- Reinhardt, V. (1999). **Pair-housing overcomes self-biting behavior in macaques.** *Laboratory Primate Newsletter* 38(1): 4-5.
Online: <http://www.brown.edu/Research/Primate/lpn38-1.html#pair>
- Reinhardt, V. and A. Reinhardt (2000). **Social Enhancement for Adult Nonhuman Primates in Research Laboratories: A Review.** *Lab Animal* 29(1); 34-41.
- Roberts, S.J. and M.L. Platt (2005). **Effects of isosexual pair-housing on biomedical implants and study participation in male macaques.** *Contemporary Topics in Laboratory Animal Science* 44(5): 13-18.
- Rox, A., van Vliet, A. H., Langermans, J. A. M., Sterck, E. H. M., & Louwse, A. L. (2021). **A Stepwise Male Introduction Procedure to Prevent Inbreeding in Naturalistic Macaque Breeding Groups.** *Animals*, 11(2). <https://doi.org/10.3390/ani11020545>
- Schapiro, S.J. and B.J. Bernacky (2011). **Socialization strategies and disease transmission in captive colonies of nonhuman primates.** *American Journal of Primatology* 74(6): 518-527.
Online: <https://dx.doi.org/10.1002/ajp.21001>
- Schapiro, S.J., M.A. Bloomsmith, L.M. Porter, and S.A. Suarez (1996). **Enrichment effects on rhesus monkeys successively housed singly, in pairs, and in groups.** *Applied Animal Behaviour Science* 48(3-4): 159-172. Online: [https://dx.doi.org/10.1016/0168-1591\(96\)01038-6](https://dx.doi.org/10.1016/0168-1591(96)01038-6)
- Schapiro, S.J., M.A. Bloomsmith, S.A. Suarez, and L.M. Porter (1996). **Effects of social and inanimate enrichment on the behavior of yearling rhesus monkeys.** *American Journal of Primatology* 40(3): 247-260.
Online: [https://dx.doi.org/10.1002/\(SICI\)1098-2345\(1996\)40:3<247::AID-AJP3>3.0.CO;2-Y](https://dx.doi.org/10.1002/(SICI)1098-2345(1996)40:3<247::AID-AJP3>3.0.CO;2-Y)

- Schapiro, S.J., P.N. Nehete, J.E. Perlman, and K.J. Sastry (2000). **A comparison of cell-mediated immune responses in rhesus macaques housed singly, in pairs, or in groups.** *Applied Animal Behaviour Science* 68(1): 67-84.
Online: [https://dx.doi.org/10.1016/S0168-1591\(00\)00090-3](https://dx.doi.org/10.1016/S0168-1591(00)00090-3)
- Schrock, A. E., Leard, C., Lutz, M. C., Meyer, J. S., & Gazes, R. P. (2019). **Aggression and social support predict long-term cortisol levels in captive tufted capuchin monkeys (Cebus Sapajus apella).** *American Journal of Primatology*, 81(7), e23001–e23001.
- Seelig, D. (2007). **A tail of two monkeys: Social housing for nonhuman primates in the research laboratory setting.** *Journal of Applied Animal Welfare Science* 10(1): 21-30.
- Singh, P., El Amrani, A. I., Loriot, S., El Amrani-Callens, F., Duclos, M. E., & Forster, R. (2019). **Comparison of single, paired and group housing effects on cardiovascular parameters and body temperature in telemetered cynomolgus monkeys.** *Toxicology Letters*, 314, S257–S257.
- Smith, A.S., A.K. Birnie, and J.A. French (2011). **Social isolation affects partner-directed social behavior and cortisol during pair formation in marmosets, Callithrix geoffroyi.** *Physiology & Behavior* 104(5): 955-961.
Online: <https://dx.doi.org/10.1016/j.physbeh.2011.06.014>
- Sterck, E. H. M., Zijlmans, D. G. M., de Vries, H., van den Berg, L. M., van Schaik, C. P., & Langermans, J. A. M. (2019). **Determining overweight and underweight with a new weight-for-height index in captive group-housed macaques.** *American Journal of Primatology*, 81(6), e22996. MEDLINE.
<https://doi.org/10.1002/ajp.22996>
- Stoinski, T. S., Lukas, K. E., & Kuhar, C. W. (2013). **Effects of age and group type on social behaviour of male western gorillas (Gorilla gorilla gorilla) in North American zoos.** *Applied Animal Behaviour Science*, 147(3–4), 316–323. <https://doi.org/10.1016/j.applanim.2013.07.003>
- Stow, R., Kendrick, J., Ibbotson, N., Adjin-tettey, G., Murphy, B., Trojca, R., Miller, J., Konradsen, G., Øvlisen, K., Helleberg, H., & Hansen, J. J. (2021). **A new group housing approach for non-human primate metabolism studies.** *Journal of Pharmacological and Toxicological Methods*, 107. Scopus.
<https://doi.org/10.1016/j.vascn.2020.106947>
- Sullivan, J., K. Schultz, N. Goecks, M. Rosga, and C. Cruzen (2009). **Comparison of introduction strategies: gradual vs. protected contact in macaques.** *American Journal of Primatology* 71(Suppl. 1): 33.
Online: <https://dx.doi.org/10.1002/ajp.20733>
- 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>
- Truelove, M.A., A.L. Martin, J.E. Perlman, J.S. Wood, and M.A. Bloomsmith (2017). **Pair housing of Macaques: A review of partner selection, introduction techniques, monitoring for compatibility,**

- and methods for long-term maintenance of pairs.** *American Journal of Primatology* 79(1): e22485.
Online: <https://dx.doi.org/10.1002/ajp.22485>
- Watson, L. (2002). **A successful program for same-and cross-age pair-housing adult and subadult male *Macaca fascicularis*.** *Laboratory Primate Newsletter* 41(2): 6-9.
Online: <http://www.brown.edu/Research/Primate/lpn41-2.html>
- West, A., S. Leland, M. Collins, T. Welty, W. Wagner, and J. Erwin (2009). **Pair-formation in laboratory rhesus macaques (*Macaca mulatta*): a retrospective assessment in a compatibility testing procedure.** *American Journal of Primatology* 71(Suppl 1): 41.
Online: <https://dx.doi.org/10.1002/ajp.20733>
- Westergaard, G.C., M.K. Izard, J.H. Drake, S.J. Suomi, and J.D. Higley (1999). **Rhesus macaque (*Macaca mulatta*) group formation and housing: wounding and reproduction in a specific pathogen free (SPF) colony.** *American Journal of Primatology* 49(4): 339-347.
- Williams, L.E., C.S. Coke, and J.L. Weed (2017). **Socialization of adult owl monkeys (*Aotus* sp.) in captivity.** *American Journal of Primatology* 79(1): e22521.
Online: <https://dx.doi.org/10.1002/ajp.22521>
- Wolfensohn, S. (2004). **Social housing of large primates: Methodology for refinement of husbandry and management.** *Alternatives to Laboratory Animals* 32(Suppl. 1A): 149-151.
- Worlein, J.M., R. Kroeker, G.H. Lee, J.P. Thom, R.U. Bellanca, and C.M. Crockett (2017). **Socialization in pigtailed macaques (*Macaca nemestrina*).** *American Journal of Primatology* 79(1): e22556.
Online: <https://dx.doi.org/10.1002/ajp.22556>
- Xie, L., Q. Zhou, S. Liu, F. Xu, C.A. Shively, Q. Wu, W. Gong, Y. Ji, L. Fang, L. Li, N.D. Melgiri, and P. Xie (2014). **Effect of living conditions on biochemical and hematological parameters of the cynomolgus monkey.** *American Journal of Primatology* 76(100): 1011-1024.
Online: <https://dx.doi.org/10.1002/ajp.22285>
- Xing, G.; Lu, J.; Hu, M.; Wang, S.; Zhao, L.; Zheng, W.; Schofield, J.; Oldman, K.; Adkins, D.; Yu, H.; Platz, S.; Ren, J.; Skinner, M. (2015). **Effects of group housing on ECG assessment in conscious cynomolgus monkeys.** *Journal of pharmacological and toxicological methods* 75: 44-51.
Online: <https://dx.doi.org/10.1016/j.vascn.2015.05.004>
- Yamanashi, Y., Nemoto, K., & Alejandro, J. (2021). **Social relationships among captive male pygmy slow lorises (*Nycticebus pygmaeus*): Is forming male same-sex pairs a feasible management strategy?** *American Journal of Primatology*, 83(2), e23233. <https://doi.org/10.1002/ajp.23233>

Dogs

- Arena, L., Wemelsfelder, F., Messori, S., Ferri, N., & Barnard, S. (2017). **Application of Free Choice Profiling to assess the emotional state of dogs housed in shelter environments.** In *APPLIED ANIMAL BEHAVIOUR SCIENCE* (Vol. 195, pp. 72–79). ELSEVIER SCIENCE BV. <https://doi.org/10.1016/j.applanim.2017.06.005>
- Bayne, K. (2003). **Environmental enrichment of nonhuman primates, dogs and rabbits used in toxicology studies.** *Toxicologic Pathology* Suppl 31: 132-137.
Online: <https://dx.doi.org/10.1080/01926230390175020>
- Beerda, B., M.B.H. Schilder, J.A. van Hooff, H. W.de Vries, and J.A. Mol (2000). **Behavioural and hormonal indicators of enduring environmental stress in dogs.** *Animal Welfare* 9(1): 49-62.
- Coban, Ö. (2013). **Housing conditions and dog welfare.** *Atatürk Üniversitesi Veteriner Bilimleri Dergisi* 8(2): 166-173.
Online: <http://e-dergi.atauni.edu.tr/index.php/VBD/>
- Dalla Villa, P., Barnard, S., Di Fede, E., Podaliri, M., Candeloro, L., Di Nardo, A., Serpell, J. A. (2013). **Behavioural and physiological responses of shelter dogs to long-term confinement.** *Veterinaria Italiana*, 49(2), 231–241.
- Epstein, J., Dowling-Guyer, S., McCobb, E., Glotzer, C., & Dodman, N. H. (2021). **Addressing stress in dogs in shelters through a novel visual and auditory enrichment device.** *Applied Animal Behaviour Science*, 236, 105215. <https://doi.org/10.1016/j.applanim.2021.105215>
- Gfrerer, N., Taborsky, M., & Würbel, H. (2018). **Benefits of intraspecific social exposure in adult Swiss military dogs.** *Applied Animal Behaviour Science*, 201, 54–60.
- Graham, L., D.L. Wells, and P.G. Hepper (2005). **The influence of visual stimulation on the behaviour of dogs housed in a rescue shelter.** *Animal Welfare* 14(2):143-148.
- Grigg, E. K., Nibblett, B. M., Robinson, J. Q., & Smits, J. E. (2017). **Evaluating pair versus solitary housing in kennelled domestic dogs (*Canis familiaris*) using behaviour and hair cortisol: a pilot study.** *Veterinary Record Open*, 4(1), e000193. <https://doi.org/10.1136/vetreco-2016-000193>
- Kendrick, J., Stow, R., Ibbotson, N., Adjin-Tettey, G., Murphy, B., Bailey, G., Miller, J., Helleberg, H., FINDERUP GROVE, M., ØVLISEN, K., & HANSEN, J. J. (2020). **A novel welfare and scientific approach to conducting dog metabolism studies allowing dogs to be pair housed.** *Laboratory Animals*, 54(6), 588–598.
Scopus: <https://doi.org/10.1177/0023677220905330>
- Jongman, E. C., Butler, K. L., & Hemsworth, P. H. (2018). **The effects of kennel size and exercise on the behaviour and stress physiology of individually-housed greyhounds.** *Applied Animal Behaviour Science*, 199, 29–34.
- Kendrick, J., Stow, R., Ibbotson, N., Adjin-Tettey, G., Murphy, B., Bailey, G., Miller, J., Helleberg, H., FINDERUP GROVE, M., ØVLISEN, K., & HANSEN, J. J. (n.d.). **A novel welfare and scientific approach to conducting dog**

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.

<http://search.ebscohost.com/login.aspx?direct=true&db=edsbas&AN=edsbas.C5388E71&site=eds-live>

Mariti, C., B. Carlone, E. Ricci, C. Sighieri, and A. Gazzano (2014). **Intraspecific attachment in adult domestic dogs (*Canis familiaris*): Preliminary results.** *Applied Animal Behaviour Science* 152: 64-72.

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

Mertens, P. A., & Unshelm, J. (1996). **Effects of group and individual housing on the behavior of kennelled dogs in animal shelters.** *Anthrozoös*, 9(1), 40–51.

Normando, S., B. Contiero, G. Marchesini, and R. Ricci (2014). **Effects of space allowance on the behaviour of long-term housed shelter dogs.** *Behavioural Processes* 103: 306-314.

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

Pathak, A. **The Welfare of Shelter Dogs: Recommended Modifications to Current Federal Standards Based on Research Findings.** (2018). BASE.

<http://search.ebscohost.com/login.aspx?direct=true&db=edsbas&AN=edsbas.D3ECDE61&site=eds-live>

Prior, H., & Holbrook, M. (2021). **Strategies to encourage the adoption of social housing during cardiovascular telemetry recordings in non-rodents.** *Journal of Pharmacological and Toxicological Methods*, 108, 106959. <https://doi.org/10.1016/j.vascn.2021.106959>

Prior, H., Bottomley, A., Champeroux, P., Cordes, J., Delpy, E., Dybdal, N., Edmunds, N., Engwall, M., Foley, M., Hoffmann, M., Kaiser, R., Meecham, K., Milano, S., Milne, A., Nelson, R., Roche, B., Valentin, J.-P., Ward, G., & Chapman, K. (2016). **Social housing of non-rodents during cardiovascular recordings in safety pharmacology and toxicology studies.** In *Journal of Pharmacological And Toxicological Methods* (Vol. 81, pp. 75–87). Elsevier Science Inc. <https://doi.org/10.1016/j.vascn.2016.03.004>

Petak, I. (2013). **Communication patterns within a group of shelter dogs and implications for their welfare.** *Journal of Applied Animal Welfare Science* 16(2): 118-39.

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

Piccione, G., F. Arfuso, C. Giannetto, C. Faggio, and M. Panzera (2013). **Effect of housing conditions and owner's schedule on daily total locomotor activity in dogs (*Canis familiaris*).** *Biological Rhythm Research* 44(5): 778-786.

Prescott, M. J., D. B. Morton, D. Anderson, A. Buckwell, S. Heath, and R. Hubrecht (2004). **Refining dog husbandry and care - Eighth report of the BVA/WF/FRAME/RSPCA/UFAW Joint Working Group on Refinement.** *Laboratory Animals* (London) 38 (Suppl. 1): S1-S94

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

Pullen, A. J., R. J. N. Merrill, and J.W. S. Bradshaw (2013). **The effect of familiarity on behavior of kennelled dogs during interactions with conspecifics.** *Journal of Applied Animal Welfare Science* 16(1): 64-76.

Online: <https://dx.doi.org/10.1080/10888705.2013.741003>

Sadekova, N., G. Boudreau, B. Jalbert, and K. Norton (2016). **The effects of housing conditions on baseline cardiovascular parameters and the sensitivity to detect changes in contractility in telemetry-implanted dogs.** *Journal of Pharmacological and Toxicological Methods* 81: 60-74.

Online: <https://dx.doi.org/10.1016/j.vascn.2016.05.001>

Scullion Hall, L.E.M., S. Robinson, J. Finch, and H.M. Buchanan-Smith (2017). **The influence of facility and home pen design on the welfare of the laboratory-housed dog.** *Journal of Pharmacological and Toxicological Methods* 83: 21-29.

Online: <https://dx.doi.org/10.1016/j.vascn.2016.09.005>

Shiverdecker, M. D., P.A. Schiml, and M.B. Hennessy (2013). **Human interaction moderates plasma cortisol and behavioral responses of dogs to shelter housing.** *Physiology & Behavior* 109: 75-79.

Online: <https://dx.doi.org/10.1016/j.physbeh.2012.12.002>

Tsingos, K. (2018). *Gruppstorlek och sociala behov hos katter och hundar: Vetenskapligt underlag inför föreskriftsrevidering ; Group size and social needs of cats and dogs: Scientific support for regulations revision.* BASE.

<http://search.ebscohost.com/login.aspx?direct=true&db=edsbas&AN=edsbas.EF284444&site=eds-live>

Wagner, D., S. Newbury, P. Kass, and K. Hurley (2014). **Elimination behavior of shelter dogs housed in double compartment kennels.** *Plos One* 9(5).

Online: <https://dx.doi.org/10.1371/journal.pone.0096254>

Walker, J.K., C.J.C. Phillips, and N.K. Waran (2014). **The effect of conspecific removal on the behaviour and physiology of pair-housed shelter dogs.** *Applied Animal Behaviour Science* 158: 46-56.

Online: <https://dx.doi.org/10.1016/j.applanim.2014.06.010>

Wells, D.L. (2004). **A review of environmental enrichment for kennelled dogs, *Canis familiaris*** *Applied Animal Behaviour Science* 85(3-4): 307-317.

Online: <https://dx.doi.org/10.1016/j.applanim.2003.11.005>

Wells, D. L. (2004). **The influence of toys on the behaviour and welfare of kennelled dogs.** *Animal Welfare* 13(3): 367-373.

Yeon, S.C., G. Golden, W. Sung, H.N. Erb, A.J. Reynolds, and K.A. Houpt (2001). **A comparison of tethering and pen confinement of dogs.** *Journal of Applied Animal Welfare Science* 4(4): 257-270.

Online: https://dx.doi.org/10.1207/S15327604JAWS0404_03

Fish and Amphibians

- Aleström, P., D'Angelo, L., Midtlyng, P. J., Schorderet, D. F., Schulte-Merker, S., Sohm, F., & Warner, S. (2019). **Zebrafish: Housing and husbandry recommendations**. *Laboratory Animals*, 002367721986903. <https://doi.org/10.1177/0023677219869037>
- Arechavala-Lopez, P., Nazzaro-Alvarez, J., Jardi-Pons, A., Reig, L., Carella, F., Carrasson, M., & Roque, A. (2020). **Linking stocking densities and feeding strategies with social and individual stress responses on gilthead seabream (*Sparus aurata*)**. *Physiology & Behavior*, 213, 9. <https://doi.org/10.1016/j.physbeh.2019.112723>
- Berbel-Filho, W. M., Berry, N., Rodríguez-Barreto, D., Rodrigues Teixeira, S., Garcia de Leaniz, C., & Consuegra, S. (2020). **Environmental enrichment induces intergenerational behavioural and epigenetic effects on fish**. *Molecular Ecology*, 29(12), 2288–2299. <https://doi.org/10.1111/mec.15481>
- Collymore, C., Tolwani, R. J., & Rasmussen, S. (2015). **The Behavioral Effects of Single Housing and Environmental Enrichment on Adult Zebrafish (*Danio rerio*)**. *Journal of the American Association for Laboratory Animal Science: JAALAS*, 54(3), 280–285.
- Crank, K. M., Kientz, J. L., & Barnes, M. E. (2019). **An Evaluation of Vertically Suspended Environmental Enrichment Structures during Rainbow Trout Rearing**. *North American Journal of Aquaculture*, 81(1), 94–100. Scopus. <https://doi.org/10.1002/naaq.10064>
- Delgadin, T. H., D.I. Pérez Sirkin, I. Simó, M.P. Di Yorio, P.G. Vissio, & S.E. Arranz. (2018). **Cichlasoma dimerus responds to refeeding with a partial compensatory growth associated with an increment of the feed conversion efficiency and a rapid recovery of GH/IGFs axis**. *Aquaculture Nutrition*, 24(4), 1234–1243. Agricola.
- Dos Santos, T. G., Mussulini, B. H. M., Frangipani, L. A., & de Oliveira, D. L. (2020). **Differential impact of shorter and longer periods of environmental enrichment on adult zebrafish exploratory activity (*Danio rerio*) in the novel tank paradigm**. *Behavioural Processes*, 181, 104278. <https://doi.org/10.1016/j.beproc.2020.104278>
- Earley, R., Edwards, J., Aseem, O., Felton, K., Blumer, L., Karom, M., & Grober, M. (2006). **Social interactions tune aggression and stress responsiveness in a territorial cichlid fish (*Archocentrus nigrofasciatus*)**. *Physiology & Behavior*, 88(4–5), 353–363. <https://doi.org/10.1016/j.physbeh.2006.04.002>
- Forsatkar, M. N., Safari, O., & Boiti, C. (2017). Effects of social isolation on growth, stress response, and immunity of zebrafish. *Acta Ethologica*, 20(3), 255–261.

- Graham, C., von Keyserlingk, M. A. G., & Franks, B. (2018). **Zebrafish welfare: Natural history, social motivation and behaviour**. In *Applied Animal Behaviour Science* (Vol. 200, pp. 13–22). Elsevier Science Bv. <https://doi.org/10.1016/j.applanim.2017.11.005>
- Hesse, S.; Bakker, T.C.M.; Baldauf, S.A.; Thünken, T. (2016). **Impact of social environment on inter- and intrasexual selection in a cichlid fish with mutual mate choice**. *Animal behaviour* 111: 85-92. Online: <https://dx.doi.org/10.1016/j.anbehav.2015.10.004>
- Hesse, S.; Anaya-Rojas, J.M.; Frommen, J.G.; Thünken, T. (2015). **Social deprivation affects cooperative predator inspection in a cichlid fish**. *Royal society open science* 2(3): 140451.
- Hesse, S; Thunken, T (2014). **Growth and social behavior in a cichlid fish are affected by social rearing environment and kinship**. *Naturwissenschaften* 101(4): 273-283. Online: <https://dx.doi.org/10.1007/s00114-014-1154-6>
- Johansen, R; Needham, JR; Colquhoun, DJ; Poppe, TT; Smith, AJ (2006). **Guidelines for health and welfare monitoring of fish used in research**. *Laboratory animals* 40(4): 323-340.
- Jolles, J.W.; Aaron Taylor, B.; Manica, A. (2016). **Recent social conditions affect boldness repeatability in individual sticklebacks**. *Animal behaviour* 112: 139-145. Online: <https://dx.doi.org/10.1016/j.anbehav.2015.12.010>
- Jones, N. A. R., Spence, R., Jones, F. A. M., & Spence-Jones, H. C. (2019). **Shade as enrichment: Testing preferences for shelter in two model fish species**. *Journal of Fish Biology*, 95(4), 1161–1165. <https://doi.org/10.1111/jfb.14129>
- Karoglu-Eravsar, E. T., Tuz-Sasik, M. U., & Adams, M. M. (2021). **Environmental enrichment applied with sensory components prevents age-related decline in synaptic dynamics: Evidence from the zebrafish model organism**. *Experimental Gerontology*, 149. Scopus. <https://doi.org/10.1016/j.exger.2021.111346>
- Keck, V.A.; Edgerton, D.S.; Hajizadeh, S.; Swift, L.L.; Dupont, W.D.; Lawrence, C.; Boyd, K.L. (2015). **Effects of habitat complexity on pair-housed zebrafish**. *Journal of the american association for laboratory animal science* 54(4): 378-383.
- Kolb, A., Hildebrandt, F., & Lawrence, C. (2018). Effects of Diet and Social Housing on Reproductive Success in Adult Zebrafish, *Danio rerio*. In *Zebrafish* (Vol. 15, Issue 5, pp. 445–453). Mary Ann Liebert, Inc. <https://doi.org/10.1089/zeb.2018.1599>
- Cikanek, SJ; Nockold, S; Brown, JL; Carpenter, JW; Estrada, A; Guerrel, J; Hope, K; Ibanez, R; Putman, SB; Gratwicke, B (2014). **Evaluating Group Housing Strategies for the Ex-Situ Conservation of Harlequin Frogs (*Atelopus* spp.) Using Behavioral and Physiological Indicators**. *Plos one* | 2014. 9(2). Online: <https://dx.doi.org/10.1371/journal.pone.0090218>

- Krueger, L. D., Thurston, S. E., Kirk, J., Elsaiedi, F., Freeman, Z. T., Goldman, D., Lofgren, J. L., & Keller, J. M. (2020). **Enrichment Preferences of Singly Housed Zebrafish (*Danio rerio*)**. *Journal of the American Association for Laboratory Animal Science : JAALAS*, 59(2), 148–155. <https://doi.org/10.30802/AALAS-JAALAS-19-000078>
- 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.
- Lee, C. J., Paull, G. C., & Tyler, C. R. (2019). **Effects of environmental enrichment on survivorship, growth, sex ratio and behaviour in laboratory maintained zebrafish *Danio rerio***. *Journal of Fish Biology*, 94(1), 86–95. Scopus. <https://doi.org/10.1111/jfb.13865>
- Lidster, K., G.D. Readman, M.J. Prescott, and S.F. Owen (2017). **International survey on the use and welfare of zebrafish *Danio rerio* in research**. *Journal of Fish Biology* 90(5): 1891-1905.
Online: <https://dx.doi.org/10.1111/jfb.13278>
- Marchetto, L., Barcellos, L. J. G., Koakoski, G., Soares, S. M., Pompermaier, A., Maffi, V. C., Costa, R., da Silva, C. G., Zorzi, N. R., Demin, K. A., Kalueff, A. V., & de Alcantara Barcellos, H. H. (2021). **Auditory environmental enrichment prevents anxiety-like behavior, but not cortisol responses, evoked by 24-h social isolation in zebrafish**. *Behavioural Brain Research*, 404. Scopus.
<https://doi.org/10.1016/j.bbr.2021.113169>
- Morris, B., Huysman, N., Krebs, E., Voorhees, J. M., & Barnes, M. E. (2020). **Use of vertically-suspended environmental enrichment during early rainbow trout rearing**. *Journal of FisheriesSciences.Com*, 14(6). CAB Abstracts.
<http://search.ebscohost.com/login.aspx?direct=true&db=lah&AN=20210103094&site=ehost-live>
- Näslund, J., Rosengren, M., & Johnsson, J. I. (2019). **Fish density, but not environmental enrichment, affects the size of cerebellum in the brain of juvenile hatchery-reared Atlantic salmon**. *Environmental Biology of Fishes*. Scopus. <https://doi.org/10.1007/s10641-019-00864-9>
- Oldfield, RG (2011). **Aggression and Welfare in a Common Aquarium Fish, the Midas Cichlid**. *Journal of applied animal welfare science* 14(4): 340-360.
Online: <https://dx.doi.org/10.1080/10888705.2011.600664>
- Parker, M. O., Millington, M. E., Combe, F. J., & Brennan, C. H. (2012). **Housing Conditions Differentially Affect Physiological and Behavioural Stress Responses of Zebrafish, as well as the Response to Anxiolytics**. *PLoS ONE*, 7(4), e34992. <https://doi.org/10.1371/journal.pone.0034992>
- Reiser, S., Pohlmann, D. M., Koops, U., Gröger, J. P., & Focken, U. (2019). **Using gravel for environmental enrichment in salmonid hatcheries: The effect of gravel size during egg incubation, endogenous and**

first feeding in rainbow trout. *Journal of Applied Ichthyology*, 35(2), 465–472. Scopus.

<https://doi.org/10.1111/jai.13884>

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>

Stevens, C. H., Reed, B. T., & Hawkins, P. (2021). **Enrichment for Laboratory Zebrafish-A Review of the Evidence and the Challenges.** *Animals : An Open Access Journal from MDPI*, 11(3).

<https://doi.org/10.3390/ani11030698>

van de Nieuwegiessen, P. G., Boerlage, A. S., Verreth, J. A. J., & Schrama, J. W. (2008). **Assessing the effects of a chronic stressor, stocking density, on welfare indicators of juvenile African catfish, *Clarias gariepinus* Burchell.** *Applied Animal Behaviour Science*, 115(3–4), 233–243.

<https://doi.org/10.1016/j.applanim.2008.05.008>

White, L. J., Thomson, J. S., Pounder, K. C., Coleman, R. C., & Sneddon, L. U. (2017). **The impact of social context on behaviour and the recovery from welfare challenges in zebrafish, *Danio rerio*.** *Animal Behaviour*, 132, 189–199. <https://doi.org/10.1016/j.anbehav.2017.08.017>

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

- Angarita, B. K., Cantet, R. J. C., Wurtz, K. E., O'Malley, C. I., Siegford, J. M., Ernst, C. W., Turner, S. P., & Steibel, J. P. (2019). **Estimation of indirect social genetic effects for skin lesion count in group-housed pigs by quantifying behavioral interactions.** *Journal of Animal Science*, 97(9), 3658–3668. Scopus. <https://doi.org/10.1093/jas/skz244>
- Averos, X., L. Brossard, J. Dourmad, K.H. Greef, H.L. Edge, S.A. Edwards, and M. Meunier-Salaun(2010). **A meta-analysis of the combined effect of housing and environmental enrichment characteristics on the behaviour and performance of pigs.** *Applied Animal Behaviour Science* 127(3-4): 73-85
Online: <https://dx.doi.org/10.1016/j.applanim.2010.09.010>
- Baumann, S., W. Pflanz, E. Gallmann, and L. Schrader (2013). **The effect of rubber mats on preference and lying behaviour of group housed sows.** *Landtechnik* 68(6): 385-388.
- Bohnenkamp, A.-L., Traulsen, I., Meyer, C., Müller, K., & Krieter, J. (2013). **Group housing for lactating sows with electronically controlled crates: 1. Reproductive traits, body condition, and feed intake.** *Journal of Animal Science*, 91(7), 3413–3419. <https://doi.org/10.2527/jas.2012-5255>
- 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>
- Caldas, E. D., Michelon, A., Foppa, L., Simonelli, S. M., Pierozan, C. R., Dario, J. G. N., Duarte, J. V. S., Silva, C. C. R., & Silva, C. A. (2020). **Effect of stocking density and use of environmental enrichment materials on the welfare and the performance of pigs in the growth and finishing phases.** *Spanish Journal of Agricultural Research*, 18(4), 1–10. Scopus. <https://doi.org/10.5424/sjar/2020184-15946>
- Camerlink, I., S.P. Turner, W.W. Ursinus, I. Reimert, and J.E. Bolhuis (2014). **Aggression and affiliation during social conflict in pigs.** *PLOS One* 9(11): e113502.
Online: <https://dx.doi.org/10.1371/journal.pone.0113502>
- Camerlink, I., P. Bijma, B. Kemp, and J.E. Bolhuis (2012). **Relationship between growth rate and oral manipulation, social nosing, and aggression in finishing pigs.** *Applied Animal Behaviour Science* 142(1-2): 11-17.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.09.004>
- Campler, M., Pairis-Garcia, M., Kieffer, J., & Moeller, S. (2019). **Sow behavior and productivity in a small stable group-housing system.** In *Journal of Swine Health And Production* (Vol. 27, Issue 2, Pp. 76–86). Amer Assoc Swine Veterinarians.

- Capoferri, R., Parati, K., Puglisi, R., Moscati, L., Sensi, M., Lombardi, G., Sandri, G., Briani, C., & Galli, A. (2020). **Comparison between Single- and Group-housed Pregnant Sows for Direct and Indirect Physiological, Reproductive, Welfare Indicators and Gene Expression Profiling.** *Journal of Applied Animal Welfare Science*. Scopus. <https://doi.org/10.1080/10888705.2020.1790369>
- Choi, Y., Min, Y., Kim, Y., Jeong, Y., Kim, D., Kim, J., & Jung, H. (2020). **Effects of loose farrowing facilities on reproductive performance in primiparous sows.** In *Journal of Animal Science And Technology* (Vol. 62, Issue 2, Pp. 218–226). Korean Society Animal Science & Technology. <https://doi.org/10.5187/jast.2020.62.2.218>
- Clarke, T., Pluske, J. R., Miller, D. W., Collins, T., & Fleming, P. A. (2018). **Parity influences the demeanor of sows in group housing.** *Journal of Applied Animal Welfare Science*, 21(1), 17–26.
- Cornale, P.; Macchi, E.; Miretti, S.; Renna, M.; Lussiana, C.; Perona, G.; Mimosi, A. (2015). **Effects of stocking density and environmental enrichment on behavior and fecal corticosteroid levels of pigs under commercial farm conditions.** *Journal of veterinary behavior: clinical applications and research* 10(6): 569-576
Online: <https://dx.doi.org/10.1016/j.jveb.2015.05.002>
- Crone, C. (2014). **Let's stay together: Implications of social housing for laboratory pig welfare and management.** *The Enrichment Record* 19: 14-19.
Online: <http://enrichmentrecord.com/wp-content/uploads/2014/04/LETS-STAY-TOGETHER.pdf>
- D'Eath, R.B. (2005). **Socialising piglets before weaning improves social hierarchy formation when pigs are mixed post-weaning.** *Applied Animal Behaviour Science* 93: 199-2011.
Online: <https://dx.doi.org/10.1016/j.applanim.2004.11.019>
- DeBoer, S.P., J.P. Garner, D.C.Lay Jr., S.D. Eicher, J.R. Lucas, and J.N. Marchant-Forde (2013). **Does the presence of a human affect the preference of enrichment items in young, isolated pigs?** *Applied Animal Behaviour Science* 143: 96-103.
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>
- Durrell, J.L., I.A. Sneddon, N.E. O'Connell, and H. Whitehead. (2004). **Do pigs form preferential associations?** *Applied animal behaviour science* 89 (1-2): 41-52.
Online: <https://dx.doi.org/10.1016/j.applanim.2004.05.003>
- Einarsson, S., Sjunnesson, Y., Hultén, F., Eliasson-Selling, L., Dalin, A.-M., Lundeheim, N., & Magnusson, U. (2014). **A 25 years experience of group-housed sows-reproduction in animal welfare-friendly systems.** *Acta Veterinaria Scandinavica*, 56(1), 37. <https://doi.org/10.1186/1751-0147-56-37>

- Fu, L.; Li, H.; Liang, T.; Zhou, B.; Chu, Q.; Schinckel, A.P.; Yang, X.; Zhao, R.; Li, P.; Huang, R. (2016). **Stocking density affects welfare indicators of growing pigs of different group sizes after regrouping.** *Applied animal behaviour science* 174: 42-50.
Online: <https://dx.doi.org/10.1016/j.applanim.2015.10.002>
- Gentz, M., Lange, A., Zeidler, S., Lambertz, C., Gauly, M., Burfeind, O., & Traulsen, I. (2020). **Tail Lesions and Losses of Docked and Undocked Pigs in Different Farrowing and Rearing Systems.** In *AGRICULTURE-BASEL* (Vol. 10, Issue 4). MDPI. <https://doi.org/10.3390/agriculture10040130>
- Gentz, M., Lange, A., Zeidler, S., & Traulsen, I. (2019). **Classification of Pigs with Tail Lesions from Different Farrowing and Rearing Systems during Rearing and Fattening Period.** In *Animals* (Vol. 9, Issue 11). MDPI. <https://doi.org/10.3390/ani9110949>
- Grimberg-Henrici, C. G. E., Büttner, K., Lohmeier, R. Y., Burfeind, O., & Krieter, J. (2019). **The effect of group-housing with free-farrowing pens on reproductive traits and the behaviour of low-risk and high-risk crushing sows.** *Applied Animal Behaviour Science*, 211, 33–40. CAB Abstracts.
- Horback, K. M., & Parsons, T. D. (2016). **Temporal stability of personality traits in group-housed gestating sows.** *Animal : An International Journal of Animal Bioscience*, 10(8), 1351–1359.
<https://doi.org/10.1017/S1751731116000215>
- Huang, W., Zhu, W., Ma, C., & Guo, Y. (2020). **Weber texture local descriptor for identification of group-housed pigs.** *Sensors (Switzerland)*, 20(16), 1–19. Scopus. <https://doi.org/10.3390/s20164649>
- Jarvis, S, C. Moinard, S.K. Robson, E. Baxter, E. Ormandy, A.J. Douglas, J.R. Seckl, J.A. Russell, and A.B. Lawrence (2006). **Programming the offspring of the pig by prenatal social stress: Neuroendocrine activity and behavior.** *Hormones and Behavior* 49(1): 68-80
Online: <https://dx.doi.org/10.1016/j.yhbeh.2005.05.004>
- Koketsu, Y., & Iida, R. (2017). **Sow housing associated with reproductive performance in breeding herds.** *Molecular Reproduction and Development*, 84(9), 979–986. <https://doi.org/10.1002/mrd.22825>
- Krauss, A.V. (2013). **Social behaviour of sows in dynamic groups - an important factor for the successful group housing.** *Praktische Tierarzt* 94(6): 545-548.
- Kuwahara, M., Tsujino, Y., Tsubone, H., Kumagai, E., Tsutsumi, H., & Tanigawa, M. (2004). **Effects of pair housing on diurnal rhythms of heart rate and heart rate variability in miniature swine.** *Experimental Animals*, 53(4), 303–309. <https://doi.org/10.1538/expanim.53.303>
- Lang, F.C., S.M. Hayne, and H.W. Gonyou (2012). **Effects of temperament and floor space allowance on sows at grouping.** *31st Annual Centralia Swine Research Update*, Kirkton-Woodham Community Centre, Ontario, Canada, p.II-40-II-42.

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

- Li, B., Longshen Liu, Mingxia Shen, Yuwen Sun, & Mingzhou Lu. (2019). **Group-housed pig detection in video surveillance of overhead views using multi-feature template matching.** *Biosystems Engineering. IAgRE*, 181, 28–39. Agricola.
- Li, Y. Z., Wang, L. H., & Johnston, L. J. (2017). **Effects of social rank on welfare and performance of gestating sows housed in two group sizes.** *Journal of Swine Health and Production*, 25(6), 290–298.
- Lühken, E., Nicolaisen, T., Risch, B., Volkmann, N., Schnier, S., Schulz, J., & Kemper, N. (2019). **Comparison of two free-farrowing systems and a conventional farrowing crate system with special regard to air hygiene.** *Agriculture*, 9(1), 12–12. CAB Abstracts.
- Lühken, E., Nicolaisen, T., Stracke, J., Schulz, J., & Kemper, N. (2019). **Microbiological air quality in free-farrowing housing systems for sows.** *Veterinary and Animal Science*, 8, 100065–100065. CAB Abstracts.
- Mack, L.A., D.C. Lay, S.D. Eicher, A.K. Johnson, B.T. Richert, and E.A. Pajor (2014). **Group space allowance has little effect on sow health, productivity, or welfare in a free-access stall system.** *Journal of Animal Science* 92(6): 2554-2567.
Online: <https://dx.doi.org/10.2527/jas.2013-7352>
- Manteca, X., and S. Edwards (2009). **Feeding behaviour and social influences on feed intake.** *Voluntary feed intake in pigs*, Wageningen Academic Publishers: Wageningen, Netherlands, p.293-306.
ISBN: 978-90-8686-096-8
- Markert, M., Trautmann, T., Krause, F., Cioaga, M., Mouriot, S., Wetzel, M., & Guth, B. D. (2018). **A new telemetry-based system for assessing cardiovascular function in group-housed large animals. Taking the 3Rs to a new level with the evaluation of remote measurement via cloud data transmission.** *Journal of Pharmacological and Toxicological Methods*, 93, 90–97.
<https://doi.org/10.1016/j.vascn.2018.03.006>
- McLeman, M.A., M.T. Mendl, R. B. Jones, and C. M. Wathes (2008). **Social discrimination of familiar conspecifics by juvenile pigs, *Sus scrofa*: Development of a non-invasive method to study the transmission of unimodal and bimodal cues between live stimuli.** *Applied Animal Behaviour Science* 115(3-4): 123-137.
Online: <https://dx.doi.org/10.1016/j.applanim.2008.06.010>
- Merlot, E., Pastorelli, H., Prunier, A., Pere, M.-C., Louveau, I., Lefaucheur, L., Perruchot, M.-H., Meunier-Salaun, M. C., Gardan-Salmon, D., Gondret, F., & Quesnel, H. (2019). **Sow environment during gestation: Part I. Influence on maternal physiology and lacteal secretions in relation with neonatal survival.** In *ANIMAL* (Vol. 13, Issue 7, pp. 1432–1439). CAMBRIDGE UNIV PRESS.
<https://doi.org/10.1017/S1751731118002987>

- Morgan, T., J. Pluske, D. Miller, T. Collins, A.L. Barnes, P.A. Fleming, and F. Wemelsfelder (2014). **Socialising piglets in lactation positively affects their post-weaning behaviour.** *Applied Animal Behaviour Science* 158: 23-33.
Online: <https://dx.doi.org/10.1016/j.applanim.2014.06.001>
- Munoz, C. J., & Stein, H. H. (2019). **Description of a novel Calorimetric unit to determine net energy in group housed pigs.** In *JOURNAL OF ANIMAL SCIENCE* (Vol. 97, Issue 2, p. 178). OXFORD UNIV PRESS INC. <https://doi.org/10.1093/jas/skz122.314>
- Munsterhjelm, C., Nordgreen, J., Aae, F., Heinonen, M., Valros, A., & Janczak, A. M. (2019). **Sick and grumpy: Changes in social behaviour after a controlled immune stimulation in group-housed gilts.** *Physiology and Behavior*, 198, 76–83. Scopus. <https://doi.org/10.1016/j.physbeh.2018.09.018>
- Munsterhjelm, C., E. Brunberg, M. Heinonen, L. Keeling, and A. Valros (2013). **Stress measures in tail biters and bitten pigs in a matched case-control study.** *Animal Welfare* 22(3): 331-338.
- Nicolaisen, T., Risch, B., Luehken, E., van Meegen, C., Fels, M., & Kemper, N. (2019). **Comparison of three different farrowing systems: Skin lesions and behaviour of sows with special regard to nursing behaviour in a group housing system for lactating sows.** In *ANIMAL* (Vol. 13, Issue 11, pp. 2612–2620). CAMBRIDGE UNIV PRESS. <https://doi.org/10.1017/S1751731119000661>
- Norring, M., Valros, A., Bergman, P., Marchant-Forde, J. N., & Heinonen, M. (2019). **Body condition, live weight and success in agonistic encounters in mixed parity groups of sows during gestation.** *Animal*, 13(2), 392–398. CAB Abstracts.
- O'Malley, C. I., Steibel, J. P., Bates, R. O., Ernst, C. W., & Siegford, J. M. (2021). **Time budgets of group-housed pigs in relation to social aggression and production.** *Journal of Animal Science*. MEDLINE. <https://doi.org/10.1093/jas/skab110>
- Quesnel, H., Pere, M.-C., Louveau, I., Lefaucheur, L., Perruchot, M.-H., Prunier, A., Pastorelli, H., Meunier-Salaun, M. C., Gardan-Salmon, D., Merlot, E., & Gondret, F. (2019). **Sow environment during gestation: Part II. Influence on piglet physiology and tissue maturity at birth.** In *Animal* (Vol. 13, Issue 7, Pp. 1440–1447). Cambridge Univ Press. <https://doi.org/10.1017/S1751731118003087>
- 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>
- Rault, J.L. (2012). **Friends with benefits: Social support and its relevance for farm animal welfare.** *Applied Animal Behaviour Science* 136(1): 1-14.
Online: <https://dx.doi.org/10.1016/j.applanim.2011.10.002>

- Reimert, I., J.E. Bolhuis, B. Kemp, and T.B. Rodenburg (2014). **Social support in pigs with different coping styles.** *Physiology & Behavior* 129: 221-229.
Online: <https://dx.doi.org/10.1016/j.physbeh.2014.02.059>
- Reimert, I., J.E. Bolhuis, B. Kemp, and T.B. Rodenburg (2012). **Indicators of positive and negative emotions and emotional contagion in pigs.** *Physiology & Behavior* 109: 42-50.
Online: <https://dx.doi.org/10.1016/j.physbeh.2012.11.002>
- Rioja-Lang, F.C., S.M. Hayne, and H.W. Gonyou (2013). **The effect of pen design on free space utilization of sows group housed in gestation pens equipped with free access stalls.** *Applied Animal Behaviour Science* 148(1/2): 93-98.
Online: <https://dx.doi.org/10.1016/j.applanim.2013.07.002>
- Roy, C., Lippens, L., Kyeiwaa, V., Seddon, Y. M., Connor, L. M., & Brown, J. A. (2019). **Effects of Enrichment Type, Presentation and Social Status on Enrichment Use and Behaviour of Sows with Electronic Sow Feeding.** In *ANIMALS* (Vol. 9, Issue 6). MDPI. <https://doi.org/10.3390/ani9060369>
- Samarakone, T. S., and H.W. Gonyou (2009). **Domestic pigs alter their social strategy in response to social group size.** *Applied Animal Behaviour Science* 121(1): 8-15.
Online: <https://dx.doi.org/10.1016/j.applanim.2009.08.006>
- Schrey, L., Kemper, N., & Fels, M. (2019). **Behaviour and Skin Injuries of Piglets Originating from a Novel Group Farrowing System Before and After Weaning.** In *AGRICULTURE-BASEL* (Vol. 9, Issue 5). MDPI. <https://doi.org/10.3390/agriculture9050093>
- Schwarz, T., Małopolska, M., Nowicki, J., Tuz, R., Lazic, S., Kopyra, M., & Bartlewski, P. M. (2021). **Effects of individual versus group housing system during the weaning-to-estrus interval on reproductive performance of sows.** *Animal*, 15(2). Scopus. <https://doi.org/10.1016/j.animal.2020.100122>
- Scollo, A., S.A. Edwards, F. Gottardo, and B. Contiero (2014). **Does stocking density modify affective state in pigs as assessed by cognitive bias, behavioural and physiological parameters?** *Applied Animal Behaviour Science* 153: 26-35.
Online: <https://dx.doi.org/10.1016/j.applanim.2014.01.006>
- Smith, A.C, and M.M. Swindle (2006). **Preparation of swine for the laboratory.** *ILAR Journal* 47(4):358-363.
Online: <http://ilarjournal.oxfordjournals.org/content/47/4/358.full.pdf>
- Spoolder, H.A.M., A.A.J. Aarnink, H.M., Vermeer, J. van Riel, and S.A. Edwards (2012). **Effect of increasing temperature on space requirements of group housed finishing pigs.** *Applied Animal Behaviour Science* 138(3-4): 229-239.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.02.010>
- Street, B. R., & Gonyou, H. W. (2008). **Effects of housing finishing pigs in two group sizes and at two floor space allocations on production, health, behavior, and physiological variables1.** *Journal of Animal Science*, 86(4), 982–991. <https://doi.org/10.2527/jas.2007-0449>

- Tallet, C., A. Brillouet, M. Meunier-Salauen, V. Paulmier, C. Guerin, and A. Prunier (2013). **Effects of neonatal castration on social behaviour, human-animal relationship and feeding activity in finishing pigs reared in a conventional or an enriched housing.** *Applied Animal Behaviour Science* 145(3-4): 70-83.
Online: <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>
- Toenepoehl ,B., A. K. Appel, S. Welp, B. Voss, U.K. von Borstel, and M. Gaulty, M. (2012). **Effect of marginal environmental and social enrichment during rearing on pigs' reactions to novelty, conspecifics and handling.** *Applied Animal Behaviour Science* 140(3-4): 137-145.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.05.002>
- Turner, Simon P., M. Nath, G.W. Horgan, and S.A. Edwards. (2013). **Measuring chronic social tension in groups of growing pigs using inter-individual distances.** *Applied Animal Behaviour Science* 146(1-4): 26-36.
Online: <https://dx.doi.org/10.1016/j.applanim.2013.03.012>
- Turner, Simon P., R.B. D'Eath, R. Roehe, and A.B. Lawrence. (2010). **Selection against aggressiveness in pigs at re-grouping: practical application and implications for long-term behavioural patterns.** *Animal Welfare* 19(Supp. 1): 123-132.
- van Nieuwamerongen, S. E., Mendl, M., Held, S., Soede, N. M., & Bolhuis, J. E. (2017). **Post-weaning social and cognitive performance of piglets raised pre-weaning either in a complex multi-suckling group housing system or in a conventional system with a crated sow.** *Animal Cognition*, 20(5), 907–921.
<https://doi.org/10.1007/s10071-017-1110-x>
- van Nieuwamerongen, S.E., J.E. Bolhuis, C.M. van der Peet-Schwering, and N.M. Soede (2014). **A review of sow and piglet behaviour and performance in group housing systems for lactating sows.** *Animal* 8(3): 448-460.
Online: <https://dx.doi.org/10.1017/S1751731113002280>
- Verdon, M.; Hansen, C.F.; Rault, J.-.; Jongman, E.; Hansen, L.U.; Plush, K.; Hemsworth, P.H. (2015). **Effects of group housing on sow welfare: a review.** *Journal of animal science* 93(5): 1999-2017.
Online: <https://dx.doi.org/10.2527/jas.2014-8742>
- Widowski, T.M., Y. Yuan, and J.M. Gardner (2005). **Effect of accommodating sucking and nosing on the behaviour of artificially reared piglets.** *Laboratory Animals* 39(2): 240-250.
Online: <https://dx.doi.org/10.1258/0023677053739701>

- Xiao KeQuan, Fan XiaoYa, & Gao FengXian. (2019). **Effect of stocking density on performance and health status of pig herd.** *Journal of Economic Animal*, 23(3), 169–174. CAB Abstracts.
- Zhou, Q., Q. Sun, G. Wang, B. Zhou, M. Lu, J.N. Marchant-Forde, X. Yang, and R. Zhao (2014). **Group housing during gestation affects the behaviour of sows and the physiological indices of offspring at weaning.** *Animal* 8(7): 1162-1169.
- Zhuang, S., Maselyne, J., Van Nuffel, A., Vangeyte, J., & Sonck, B. (2020). **Tracking group housed sows with an ultra-wideband indoor positioning system: A feasibility study.** *Biosystems Engineering*, 200, 176–187. Scopus. <https://doi.org/10.1016/j.biosystemseng.2020.09.011>

Rabbits

- Andrist, C.A., L.M. Bigler, H.W. Würbel, and B.A. Roth (2014). **Masking odour when regrouping rabbit does: Effect on aggression, stress and lesions.** *Livestock Science* 170: 150-157.
Online: <https://dx.doi.org/10.1016/j.livsci.2014.10.017>
- Andrist, C.A., L.M. Bigler, H.W. Würbel, and B.A. Roth (2012). **Effects of group stability on aggression, stress and injuries in breeding rabbits.** *Applied Animal Behaviour Science* 142(3/4): 182-188.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.10.017>
- Bartley, K. A., & Johnson, C. H. (2019). **Human Infant Pants for Postoperative Protection during Social Housing of New Zealand White Rabbits (*Oryctolagus cuniculus*).** *Journal of the American Association for Laboratory Animal Science*, 58(4), 510–516. <https://doi.org/10.30802/aalas-jaalas-18-000116>
- Baumans, V. (2005). **Environmental enrichment for laboratory rodents and rabbits: Requirements of rodents, rabbits, and research.** *ILAR Journal* 46(2): 162-170.
- Braconnier, M., Gómez, Y., & Gebhardt-Henrich, S. G. (2020). **Different regrouping schedules in semi group-housed rabbit does: Effects on agonistic behaviour, stress and lesions.** *Applied Animal Behaviour Science*, 228. Scopus. <https://doi.org/10.1016/j.applanim.2020.105024>
- Buijs, S., J. Vangeyte, F.A.M. Tuytens (2016). **Effects of communal rearing and group size on breeding rabbits' post-grouping behaviour and its relation to ano-genital distance.** *Applied animal behaviour science* 182: 53-60.
Online: <https://dx.doi.org/10.1016/j.applanim.2016.06.005>
- Buijs, S.; Maertens, L.; Tuytens, F.A.M.; Hermans, K.; Vangeyte, J. (2015). **Behaviour, wounds, weight loss and adrenal weight of rabbit does as affected by semi-group housing.** *Applied animal behaviour science* 172: 44-51.
Online: <https://dx.doi.org/10.1016/j.applanim.2015.09.003>
- Buijs, S., K. Hermans, L. Maertens, A. Van Caelenberg, and F.A. Tuytens (2014). **Effects of semi-group housing and floor type on pododermatitis, spinal deformation and bone quality in rabbit does.** *Animal: an International Journal of Animal Bioscience* 8(10): 1728-1734.
- Buijs, S., L. Maertens, F.A.M. Tuytens, L.J. Keeling, and S. Rettenbacher (2011). **Glucocorticoid metabolites in rabbit faeces-Influence of environmental enrichment and cage size.** *Physiology and Behavior* 104(3): 469-473.
Online: <https://dx.doi.org/10.1016/j.physbeh.2011.05.008>
- Burn, C. C., and P. Shields. **"Do Rabbits Need Each Other? Effects of Single versus Paired Housing on Rabbit Body Temperature and Behaviour in a UK Shelter."** *Animal Welfare*, vol. 29, no. 2, 2020, pp. 209–19, doi:10.7120/09627286.29.2.209. Scopus.

- Carter, C.L.; Adams, J.K.; Czarra, J.A.; Coan, P.N. (2016). **An Incidence of Pseudopregnancy Associated with the Social Enrichment of Rabbits (*Oryctolagus cuniculi*)**. *Journal of the American Association for Laboratory Animal Science* 55(1): 98-99.
- Chu, L.R., J.P. Garner, and J.A. Mench (2004). **A behavioral comparison of New Zealand White rabbits (*Oryctolagus cuniculus*) housed individually or in pairs in conventional laboratory cages**. *Applied Animal Behaviour Science* 85(1-2): 121-139.
Online: <https://dx.doi.org/10.1016/j.applanim.2003.09.011>
- Dal Bosco, Alessandro, Alice Cartoni Mancinelli, et al. **“Assessing the Preference of Rabbit Does to Social Contact or Seclusion: Results of Different Investigations.”** *Animals*, vol. 10, no. 2, Feb. 2020, p. 286, doi:10.3390/ani10020286.
- Dal Bosco, Alessandro, Cecilia Mugnai, et al. **“Housing Rabbit Does in a Combi System with Removable Walls: Effect on Behaviour and Reproductive Performance.”** *Animals*, vol. 9, no. 8, Aug. 2019, p. 528, doi:10.3390/ani9080528.
- Dalle Zotte, A., Z. Princz, Z. Gerencs, S. Metzger, Z. Szendro, and Z. Matics (2009). **Rabbit preference for cages and pens with or without mirrors**. *Applied Animal Behaviour Science* 116(2-4): 273-278.
Online: <https://dx.doi.org/10.1016/j.applanim.2008.08.011>
- DiVincenti, L. and A.N. Rehrig (2017). **Social Behavior of Adult Male New Zealand White Rabbits Housed in Groups or Pairs in the Laboratory**. *Journal of Applied Animal Welfare Science* 20(1): 86-94.
Online: <https://dx.doi.org/10.1080/10888705.2016.1247352>
- DiVincenti, L. and A.N. Rehrig (2016). **The Social Nature of European Rabbits (*Oryctolagus cuniculus*)**. *Journal of the American Association for Laboratory Animal Science: JAALAS* 55(6): 729-736.
Online: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC5113872/>
- Drion, P. and R. Dewree (2006). **Towards a better use of the rabbit as an experimental model: Review and perspectives**. *Annales De Medecine Veterinaire* 150(3): 153-162.
- Fuentes, G.C. and J. Newgren (2008). **Physiology and clinical pathology of laboratory New Zealand white rabbits housed individually and in groups**. *Journal of the American Association for Laboratory Animal Science* 47(2): 35-38.
- Gerencser, Zsolt, et al. **“Aggressiveness, Mating Behaviour and Lifespan of Group Housed Rabbit Does.”** *Animals*, vol. 9, no. 10, Oct. 2019, doi:10.3390/ani9100708.
- Hedenqvist, P., et al. **“The Effect of Housing Environment on Bone Healing in a Critical Radius Defect in New Zealand White Rabbits.”** *PLoS ONE*, vol. 15, no. 5, 2020, doi:10.1371/journal.pone.0233530.
Scopus.
- Held, S. D. E., Turner, R. J., & Wooton, R. J. (1995). **Choices of laboratory rabbits for individual or group-housing**. *Applied Animal Behaviour Science*, 46(1), 81–91.

- Hoy, S. (2009). **Rabbit housing with respect to animal welfare.** *Deutsche Tierärztliche Wochenschrift* 116(3): 97-100.
Online: <https://dx.doi.org/10.2376/0341-6593-116-97>
- Hoy, St., M. Ruis, and Zs. Szendroe (2006). **Housing of rabbits - Results of a European research network.** *Archiv Fur Geflugelkunde* 70(5): 223-227.
- Johnson, C.A., W.A. Pallozzi, N.P. Dahl, J.A. Destefano, S.J. Pratt, M. Gallagher Alat, H.J. Klein, J.L. Szumiloski, S.J. Hall, C.M. Beare, L. Geiger, and L. Castiglia (2003). **The effect of an environmental enrichment device on individually caged rabbits in a safety assessment facility.** *Contemporary Topics in Laboratory Animal Science* 42(5): 27-30.
- Matics, Z., Szendrő, Z., Odermatt, M., Gerencsér, Z., Nagy, I., Radnai, I., & Zotte, A. D. (2014). **Effect of housing conditions on production, carcass and meat quality traits of growing rabbits.** *Meat Science*, 96(1), 41–46. <https://doi.org/10.1016/j.meatsci.2013.07.001>
- Matzek, D., Baldauf, H.-M., Schieweck, R., & Popper, B. (2021). **Evaluation of a configurable, mobile and modular floor-pen system for group-housing of laboratory rabbits.** *Animals*, 11(4). Scopus.
<https://doi.org/10.3390/ani11040977>
- Mikó, A., S. Matics, Z. Gerencsér, M. Odermatt, I. Radnai, I. Nagy, K. Szendrő, and Z. Szendrő (2014). **Performance and welfare of rabbit does in various caging systems.** *Animal* 8(7): 1146-1152.
Online: <https://dx.doi.org/10.1017/S1751731114001244>
- Mirabito, L. (2007). **Housing and welfare of rabbits: More questions than answers.** *Productions Animales* 20(1): 59-64.
- Mugnai, C., A. Dal Bosco, and C. Castellini (2009). **Effect of different rearing systems and pre-kindling handling on behaviour and performance of rabbit does.** *Applied Animal Behaviour Science* 118(1-2): 91-100.
Online: <https://dx.doi.org/10.1016/j.applanim.2009.02.007>
- Nevalainen, T.O., F.A. Guhad, C.M. Lang, and J.I. Nevalainen (2007). **Pair housing of rabbits reduces variances in growth rates and serum alkaline phosphatase levels.** *Laboratory Animals* 41(4): 432-440.
Online: <https://dx.doi.org/10.1258/002367707782314247>
- Omar, M. A. E., El-Shahat, M., & Hassan, F. A. M. (2020). **Impact of stocking density on growth performance, carcass traits, and economic feasibility of growing rabbits.** *Journal of Animal Health and Production*, 9(Special Issue 1), 50–55. Scopus.
<https://doi.org/10.17582/journal.jahp/2020/9.s1.50.55>
- Onbasilar, E.E. and I. Onbasilar (2007). **Effect of cage density and sex on growth, food utilization and some stress parameters of young rabbits.** *Scandinavian Journal of Laboratory Animal Science* 34(3): 189-195.

- Poggiagliolmi, S., S.L. Crowell-Davis, L.C. Alworth, and S.B. Harvey (2011). **Environmental enrichment of New Zealand White rabbits living in laboratory cages.** *Journal of Veterinary Behavior: Clinical Applications and Research* 6(6): 343-350.
Online: <https://dx.doi.org/10.1016/j.jveb.2010.12.001>
- Princz, Z., I. Radnai, E. Bameth, Z. Matics, Z. Gerencsér, I. Nagy, Z. Szendro, and A. Dalle Zotte (2008). **Behaviour of growing rabbits under various housing conditions.** *Applied Animal Behaviour Science* 111(3-4): 342-356.
Online: <https://dx.doi.org/10.1016/j.applanim.2007.06.013>
- Reinhardt, V. (2004). **Common husbandry-related variables in biomedical research with animals.** *Laboratory Animals* 38(3): 213-235.
Online: <https://dx.doi.org/10.1258/002367704323133600>
- Rommers, J.M., B.J.F. Reuvekamp, H. Gunnink, and I.C. de Jong (2014). **Effect of hiding places, straw and territory on aggression in group-housed rabbit does.** *Applied Animal Behaviour Science* 157: 117-126.
Online: <https://dx.doi.org/10.1016/j.applanim.2014.05.011>
- Rommers, J.M., I. De Jong, C. Boiti, and G. Brecchia (2006). **Performance and behaviour of rabbit does in a group-housing system with natural mating or artificial insemination.** *Reproduction Nutrition Development* 46(6): 677-687.
Online: <https://dx.doi.org/10.1051/rnd:2006038>
- Seaman, S.C., N.K. Waran, G. Mason, and R.B. D'Eath (2008). **Animal economics: assessing the motivation of female laboratory rabbits to reach a platform, social contact and food.** *Animal Behaviour* 75(1): 31-42.
Online: <https://dx.doi.org/10.1016/j.anbehav.2006.09.031>
- 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>
- Szendro, Z., A. Miko, M. Odermatt, Z. Gerencser, I. Radnai, B. Dezsery, E. Garai, I. Nagy, K. Szendro, and Z. Matics (2013). **Comparison of performance and welfare of single-caged and group-housed rabbit does.** *Animal* 7(3): 463-468.
Online: <https://dx.doi.org/10.1017/S1751731112001760>
- Szendro, Z. and J.I. McNitt (2012). **Housing of rabbit does: group and individual systems: a review.** *Livestock Science* 150(1/3): 1-10.
- Thurston, S., Burlingame, L., Lester, P. A., & Lofgren, J. (2018). **Methods of Pairing and Pair Maintenance of New Zealand White Rabbits (*Oryctolagus Cuniculus*) Via Behavioral Ethogram, Monitoring, and Interventions.** *Journal of Visualized Experiments: JoVE*, (133).

- Thurston, Sarah, et al. “**Methods of Pairing and Pair Maintenance of New Zealand White Rabbits (Oryctolagus Cuniculus) Via Behavioral Ethogram, Monitoring, and Interventions.**” *Jove-Journal of Visualized Experiments*, no. 133, Mar. 2018, p. e57267, doi:10.3791/57267.
- Tillmann, K., Windschnurer, I., Gamper, J., Hinney, B., Rulicke, T., Podesser, B. K., Troxler, J., & Plasenzotti, R. (2019). **Welfare assessment in rabbits raised for meat and laboratory purposes in enclosures with two floor types: Perforated plastic with holes versus slats.** *Research in Veterinary Science*, 122, 200–209.
Online: <https://doi.org/10.1016/j.rvsc.2018.11.016>
- Trocino, A., Majolini, D., Tazzoli, M., Filiou, E., & Xiccato, G. (2013). **Housing of growing rabbits in individual, bicellular and collective cages: fear level and behavioural patterns.** *Animal*, 7(04), 633–639.
Online: <https://doi.org/10.1017/S1751731112002029>
- Valuska, A.J. and J.A. Mench (2013). **Size does matter: The effect of enclosure size on aggression and affiliation between female New Zealand White rabbits during mixing.** *Applied Animal Behaviour Science* 149(1-4): 72-76.
Online: <https://dx.doi.org/10.1016/j.applanim.2013.10.002>
- Verwer, C.M., R. van den Bos, C.F.M. Hendriksen, and G. van Amerongen (2009). **Handling effects on body weight and behaviour of group-housed male rabbits in a laboratory setting.** *Applied Animal Behaviour Science* 117(1-2): 93-102.
Online: <https://dx.doi.org/10.1016/j.applanim.2008.12.004>
- Zomeño, C., Birolo, M., Gratta, F., Zuffellato, A., Xiccato, G., & Trocino, A. (2018). **Effects of group housing system, pen floor type, and lactation management on performance and behaviour in rabbit does.** *Applied Animal Behaviour Science*, 203, 55–63.
- Zomeño, C., Birolo, M., Zuffellato, A., Xiccato, G., & Trocino, A. (2017). **Aggressiveness in group-housed rabbit does: Influence of group size and pen characteristics.** *Applied Animal Behaviour Science*, 194, 79–85.

Rodents

- Agren, G. and B.J. Meyerson (1977). **Influence of gonadal hormones and social housing conditions on agonistic, copulatory, and related sociosexual behaviour in the Mongolian gerbil (*Meriones unguiculatus*)**. *Behavioural Processes* 2(3): 265-282.
Online: [https://dx.doi.org/10.1016/0376-6357\(77\)90030-4](https://dx.doi.org/10.1016/0376-6357(77)90030-4)
- Arndt, S.S., M.C. Laarakker, H.A. van Lith, A.R. Salomons, J. van't Klooster, F. Ohl, F.J. van der Staay, and E. Gieling (2009). **Individual housing of mice - Impact on behaviour and stress responses**. *Physiology and Behavior* 97(3-4): 385-393.
Online: <https://dx.doi.org/10.1016/j.physbeh.2009.03.008>
- Arndt, S.S., M. Laarakker, R. Sommer, I. Lemmens, X. Fielmich, H.A. Van Lith, and F. Ohl (2006). **Social housing in male mice - impact on experimental anxiety-related behaviour?** *European Neuropsychopharmacology* 16(Suppl. 4).
- Bailoo, J. D., Murphy, E., Varholick, J. A., Novak, J., Palme, R., & Würbel, H. (2018). **Evaluation of the effects of space allowance on measures of animal welfare in laboratory mice**. *Scientific Reports*, 8(1), 713.
- Baker, S. and C. Bielajew (2007). **Influence of housing on the consequences of chronic mild stress in female rats**. *Stress* 10(3): 283-293.
Online: <https://dx.doi.org/10.1080/10253890701265362>
- Barabas, A. J., Aryal, U. K., & Gaskill, B. N. (2019). Proteome characterization of used nesting material and potential protein sources from group housed male mice, *Mus musculus*. *Scientific Reports*, 9(1).
Scopus. <https://doi.org/10.1038/s41598-019-53903-x>
- Bartal, I.B., D.A. Rodgers, M.S. Sarria, J. Decety, and P. Mason (2014). **Pro-social behavior in rats is modulated by social experience**. *Elife* 3.
Online: <https://dx.doi.org/10.7554/eLife.01385.001>
- Bartolomucci, A. (2007). **Social stress, immune functions and disease in rodents**. *Frontiers in Neuroendocrinology* 28(1): 28-49.
Online: <https://dx.doi.org/10.1016/j.yfrne.2007.02.001>
- Bartolomucci, A., P. Palanza, A. Chirieleison, S. Parmigiani, P. Sacerdote, A.E. Panerai, and G. Ceresini (2003). **Individual housing induces altered immuno-endocrine responses to psychological stress in male mice**. *Psychoneuroendocrinology* 28(4): 540-558.
Online: [https://dx.doi.org/10.1016/S0306-4530\(02\)00039-2](https://dx.doi.org/10.1016/S0306-4530(02)00039-2)
- Burgdorf, J. and J. Panksepp (2001). **Tickling induces reward in adolescent rats**. *Physiology and Behavior* 72(1-2): 167-173.
Online: [https://dx.doi.org/10.1016/S0031-9384\(00\)00411-X](https://dx.doi.org/10.1016/S0031-9384(00)00411-X)

- Burman, O., L. Buccarello, V. Redaelli, and L. Cervo (2014). **The effect of two different Individually Ventilated Cage systems on anxiety-related behaviour and welfare in two strains of laboratory mouse.** *Physiology & Behavior* 124: 92-99.
Online: <https://dx.doi.org/10.1016/j.physbeh.2013.10.019>
- Burn, C.C. (2008). **What is it like to be a rat? Rat sensory perception and its implications for experimental design and rat welfare.** *Applied Animal Behaviour Science* 112(1-2): 1-32.
Online: <https://dx.doi.org/10.1016/j.applanim.2008.02.007>
- Burn, C.C., A. Peters, and G.J. Mason (2006). **Acute effects of cage cleaning at different frequencies on laboratory rat behaviour and welfare.** *Animal Welfare* 15(2): 161-171.
- Buwalda, B., M. Geerdink, J. Vidal, and J.M. Koolhaas (2011). **Social behavior and social stress in adolescence: A focus on animal models.** *Neuroscience and Biobehavioral Reviews* 35(8): 1713-1721.
Online: <https://dx.doi.org/10.1016/j.neubiorev.2010.10.004>
- Cloutier, S., C. Baker, K. Wahl, J. Panksepp, and R.C. Newberry (2013). **Playful handling as social enrichment for individually- and group-housed laboratory rats.** *Applied Animal Behaviour Science* 143(2-4): 85-95.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.10.006>
- Cloutier, S., J. Panksepp, and R.C. Newberry (2012). **Playful handling by caretakers reduces fear of humans in the laboratory rat.** *Applied Animal Behaviour Science* 140(3-4): 161-171.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.06.001>
- Doulames, V., S. Lee, and T.B. Shea (2014). **Environmental enrichment and social interaction improve cognitive function and decrease reactive oxidative species in normal adult mice.** *The International Journal of Neuroscience* 124(5): 369-376.
- Endo, N., Makinodan, M., Somayama, N., Komori, T., Kishimoto, T., & Nishi, M. (2019). Characterization of behavioral phenotypes in the btbr T+ Itpr3tf/J mouse model of autism spectrum disorder under social housing conditions using the multiple animal positioning system. *Experimental Animals*, 68(3), 319–330. Scopus. <https://doi.org/10.1538/expanim.18-0177>
- Febinger, H.Y., A. George, J. Priestley, L.A. Toth, and M.R. Opp (2014). **Effects of housing condition and cage change on characteristics of sleep in mice.** *Journal of the American Association for Laboratory Animal Science* 53(1): 29-37.
- Fuss, J., S.H. Richter, J. Steinle, G. Deubert, R. Hellweg, and P. Gass (2013). **Are you real? Visual simulation of social housing by mirror image stimulation in single housed mice.** *Behavioural Brain Research* 243: 191-198.
Online: <https://dx.doi.org/10.1016/j.bbr.2013.01.015>
- Gaskill, B.N.; Pritchett-Corning, K.R. (2015). **Effect of cage space on behavior and reproduction in Crl:CD(SD) and BN/Crl laboratory rats.** *Journal of the American association for laboratory animal science* 54(5): 497-506.

- Gaskill, B. (2014). **Aggression in laboratory mice: Potential influences and how to manage it.** *The Enrichment Record* 18: 22-25.
- Gasparotto, O.C., D.M. Lopes, and S.G. Carobrez (2005). **Pair housing affects anxiety-like behaviors induced by a social but not by a physiological stressor in male Swiss mice.** *Physiology and Behavior* 85(5): 603-612.
Online: <https://dx.doi.org/10.1016/j.physbeh.2005.06.014>
- Greenberg, G.D., C.L. Howerton, and B.C. Trainor (2014). **Fighting in the home cage: Agonistic encounters and effects on neurobiological markers within the social decision-making network of house mice (*Mus musculus*).** *Neuroscience Letters* 566: 151-155.
Online: <https://dx.doi.org/10.1016/j.neulet.2014.02.051>
- Grégoire, C., D. Bonenfant, A. Le Nguyen, A. Aumont, and K.J. Fernandes (2014). **Untangling the influences of voluntary running, environmental complexity, social housing and stress on adult hippocampal neurogenesis.** *PLOS One* 9(1).
Online: <https://dx.doi.org/10.1371/journal.pone.0086237>
- Grippe, A.J., E. Ihm, J. Wardwell, N. McNeal, M.L. Scotti, D.A. Moenk, D.L. Chandler, M.A. LaRocca, and K. Preihs (2014). **The effects of environmental enrichment on depressive and anxiety-relevant behaviors in socially isolated prairie voles.** *Psychosomatic Medicine* 76(4): 277-284.
Online: <https://dx.doi.org/10.1097/PSY.0000000000000052>
- Gudsnuk, K. and F.A. Champagne (2012). **Epigenetic influence of stress and the social environment.** *IJAR Journal* 53(3-4): 279-288.
Online: <https://dx.doi.org/10.1093/ilar.53.3-4.279>
- Halpin, Z.T. and K.C. Noonan (1982). **Social housing and odor preferences in the mongolian gerbil *Meriones-unguiculatus*.** *Biology of Behaviour* 7(4): 293-302.
- Harper, L.; Choleris, E.; Ervin, K.; Fureix, C.; Reynolds, K.; Walker, M.; Mason, G. (2015). **Stereotypic mice are aggressed by their cage-mates, and tend to be poor demonstrators in social learning tasks.** *Animal welfare* 24(4): 463-473.
- Heimer-McGinn, V. R., et al. **“Social Housing Enhances Acquisition of Task Set Independently of Environmental Enrichment: A Longitudinal Study in the Barnes Maze.”** *Learning and Behavior*, 2020, doi:10.3758/s13420-020-00418-5. Scopus.
- Hennessy, M.B., S. Kaiser, and N. Sachser (2009). **Social buffering of the stress response: Diversity, mechanisms, and functions.** *Frontiers in Neuroendocrinology* 30(4): 470-482.
Online: <https://dx.doi.org/10.1016/j.yfrne.2009.06.001>
- Hennessy, M.B. and A. Morris (2005). **Passive responses of young guinea pigs during exposure to a novel environment: Influences of social partners and age.** *Developmental Psychobiology* 46(2): 86-96.
Online: <https://dx.doi.org/10.1002/dev.20045>

- Hohlbaum, K., Frahm, S., Rex, A., Palme, R., Thöne-Reineke, C., & Ullmann, K. (2020). **Social enrichment by separated pair housing of male C57BL/6JRj mice.** *Scientific Reports*, 10(1). Scopus. <https://doi.org/10.1038/s41598-020-67902-w>
- Hohlbaum, K., Leidinger, C., Palme, R., Erickson, N. A., Kemper, N., Baumgart, N., Baumgart, J., & Thöne-Reineke, C. (2020). **Castration of adult male c57bl/6jrj mice allows for resocialization and social housing of previously single-housed males: A harm-benefit analysis.** *Berliner Und Munchener Tierarztliche Wochenschrift*, 133(5–6), 279–290. Scopus. <https://doi.org/10.2376/0005-9366-19055>
- Hori, M., K. Yamada, J. Ohnishi, S. Sakamoto, H. Furuie, K. Murakami, and Y. Ichitani (2014). **Tickling during adolescence alters fear-related and cognitive behaviors in rats after prolonged isolation.** *Physiology & Behavior* 131: 62-67.
Online: <https://dx.doi.org/10.1016/j.physbeh.2014.04.008>
- Jensen, V.F.H., A. Mølck, M. Mårtensson, M.A. Strid, M. Chapman, J. Lykkesfeldt, and I.B. Bøgh (2017). **Assessment of implantable infusion pumps for continuous infusion of human insulin in rats: potential for group housing.** *Laboratory Animals* 51(3): 273-283.
Online: <https://dx.doi.org/10.1177/0023677216660740>
- Jirkof, P. (2015). **Effects of experimental housing conditions on recovery of laboratory mice.** *Lab animal* 44(2): 65-70.
- Jirkof, P., N. Cesarovic, A. Rettich, T. Fleischmann, and M. Arras (2012). **Individual housing of female mice: influence on postsurgical behaviour and recovery.** *Laboratory Animals* 46(4): 325-334.
Online: <https://dx.doi.org/10.1258/la.2012.012027>
- Kamakura, R.; Kovalainen, M.; Leppäluoto, J.; Herzig, K.; Mäkelä, K.A. (2016). **The effects of group and single housing and automated animal monitoring on urinary corticosterone levels in male C57BL/6 mice.** *Physiological reports* 4(3).
- Keesom, S. M., Morningstar, M. D., Sandlain, R., Wise, B. M., & Hurley, L. M. (2018). **Social isolation reduces serotonergic fiber density in the inferior colliculus of female, but not male, mice.** *Brain Research*, 1694, 94–103.
- Keesom, S.M., C.J. Finton, G.L. Sell, L.M. Hurley, and M.J. Coleman (2017). **Early-Life Social Isolation Influences Mouse Ultrasonic Vocalizations during Male-Male Social Encounters.** *PLOS One* 12(1): e0169705.
Online: <https://dx.doi.org/10.1371/journal.pone.0169705>
- Kenkel, W.M. and C.S. Carter (2016). **Voluntary Exercise Facilitates Pair-Bonding in Male Prairie Voles.** *Behavioural brain research* 296: 326-330.
Online: <https://dx.doi.org/10.1016/j.bbr.2015.09.028>
- Kiyokawa, Y., A. Ishida, Y. Takeuchi, and Y. Mori (2016). **Sustained housing-type social buffering following social housing in male rats.** *Physiology & Behavior* 158: 85-89.
Online: <https://dx.doi.org/10.1016/j.physbeh.2016.02.040>

- Kraeuter, A.-K., Guest, P. C., & Sarnyai, Z. (2019). **The Nest Building Test in Mice for Assessment of General Well-Being** (Vol. 1916). Humana Press Inc.; Scopus.
Online: https://doi.org/10.1007/978-1-4939-8994-2_7
- Kruegel, U., J. Fischer, K. Bauer, U. Sack, and H. Himmerich (2014). **The impact of social isolation on immunological parameters in rats.** *Archives of Toxicology* 88(3): 853-855.
Online: <https://dx.doi.org/10.1007/s00204-014-1203-0>
- Krueger, L. D., Chang, S. E., Motoc, M., Chojecki, M., Freeman, Z. T., & Fligel, S. B. (2021). **Effects of Pair Housing on Patency of Jugular Catheters in Rats (*Rattus norvegicus*).** *Journal of the American Association for Laboratory Animal Science : JAALAS*. MEDLINE. <https://doi.org/10.30802/AALAS-JAALAS-20-000071>
- Kuleshkaya, N., N.N. Karpova, L. Ma, L. Tian, and V. Voikar (2014). **Mixed housing with DBA/2 mice induces stress in C57BL/6 mice: implications for interventions based on social enrichment.** *Frontiers in Behavioral Neuroscience* 8.
- Lee, Y.-A., Obora, T., Bondonny, L., Toniolo, A., Miville, J., Yamaguchi, Y., Goto, Y. (2018). **The Effects of Housing Density on Social Interactions and Their Correlations with Serotonin in Rodents and Primates.** *Scientific Reports*, 8(1), 3497.
- Leshem, M. and M. Sherman (2006). **Troubles shared are troubles halved: Stress in rats is reduced in proportion to social propinquity.** *Physiology and Behavior* 89(3): 399-401.
Online: <https://dx.doi.org/10.1016/j.physbeh.2006.07.010>
- Liang, F., et al. **“Social Housing Promotes Cognitive Function through Enhancing Synaptic Plasticity in APP/PS1 Mice.”** *Behavioural Brain Research*, vol. 368, 2019, doi:10.1016/j.bbr.2019.111910. Scopus.
- Lidfors, L., A. Wichman, B. Ewaldsson, and A. Lindh (2014). **Enriched cages for groups of laboratory male rats and their effects on behaviour, weight gain and adrenal glands.** *Laboratory Animals* 48(1): 36-49.
Online: <https://dx.doi.org/10.1177/0023677213505085>
- Lidster, K., Owen, K., Browne, W. J., & Prescott, M. J. (2019). **Cage aggression in group-housed laboratory male mice: An international data crowdsourcing project.** *Scientific Reports*, 9(1). Scopus.
<https://doi.org/10.1038/s41598-019-51674-z>
- Liu, X., Wu, R., Tai, F., Ma, L., Wei, B., Yang, X., ... Jia, R. (2013). **Effects of group housing on stress induced emotional and neuroendocrine alterations.** *Brain Research*, 1502, 71–80.
- Liu, Y.J., L.F. Li, Y.H. Zhang, H. F. Guo, M. Xia, M.W. Zhang, X.Y. Jing, J.H. Zhang, and J.X. Zhang (2017). **Chronic Co-Species Housing Mice and Rats Increased the Competitiveness of Male Mice.** *Chemical Senses* 42(3): 247-257.
- 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>

Mason, G.J. and N.R. Latham (2004). **Can't stop, won't stop: Is stereotypy a reliable animal welfare indicator?** *Animal Welfare* 13(SUPPL.).

Mayr, K. A., Young, L., Molina, L. A., Tran, M. A., & Whelan, P. J. (2020). **An economical solution to record and control wheel-running for group-housed mice.** *Journal of Neuroscience Methods*, 331. Scopus. <https://doi.org/10.1016/j.jneumeth.2019.108482>

Meijer, M.K., K. Kramer, R. Remie, B.M. Spruijt, L.F. van Zutphen, and V. Baumans (2006). **The effect of routine experimental procedures on physiological parameters in mice kept under different husbandry conditions.** *Animal Welfare* 15(1): 31-38.

Menich, S.R. and A. Baron (1984). **Social housing of rats: Life-span effects on reaction time, exploration, weight, and longevity.** *Experimental Aging Research* 10(2): 95-100.

Mertens, S., Vogt, M. A., Gass, P., Palme, R., Hiebl, B., & Chourbaji, S. (2019). **Effect of three different forms of handling on the variation of aggression-associated parameters in individually and group-housed male C57BL/6NCrl mice.** *PLoS ONE*, 14(4). Scopus. <https://doi.org/10.1371/journal.pone.0215367>

Monteiro, B.M., F.A. Moreira, A.R. Massensini, M.F. Moraes, and G.S. Pereira (2014). **Enriched environment increases neurogenesis and improves social memory persistence in socially isolated adult mice.** *Hippocampus* 24(2): 239-248.
Online: <https://dx.doi.org/10.1002/hipo.22218>

Neff, E. P. (2019). **Go long(-itudinal)! Social housing protects working memory in rats.** *Lab Animal*, 48(3), 81. Scopus. <https://doi.org/10.1038/s41684-019-0245-6>

O'Connor, R., & Eikelboom, R. (n.d.). **The effects of changes in housing on feeding and wheel running.** *Physiology & Behavior*, 68(3), 361–371.

Olsson, I.A.S. and K. Westlund (2007). **More than numbers matter: The effect of social factors on behaviour and welfare of laboratory rodents and non-human primates.** *Applied Animal Behaviour Science* 103(3-4): 229-254.
Online: <https://dx.doi.org/10.1016/j.applanim.2006.05.022>

Pan, Y., M. Li, C. Lieberwirth, Z. Wang, and Z. Zhang (2014). **Social defeat and subsequent isolation housing affect behavior as well as cell proliferation and cell survival in the brains of male greater long-tailed hamsters.** *Neuroscience* 265: 226-237.

Patterson-Kane, E.P., M. Hunt, and D. Harper (2004). **Short communication: Rat's demand for group size.** *Journal of Applied Animal Welfare Science* 7(4): 267-272.
Online: https://dx.doi.org/10.1207/s15327604jaws0704_4

- Patterson-Kane, E.G., M. Hunt, and D. Harper (2002). **Rats demand social contact.** *Animal Welfare* 11(3): 327-332.
- Paul, M.J., P. Indic, and W.J. Schwartz (2014). **Social forces can impact the circadian clocks of cohabiting hamsters.** *Proceedings of the Royal Society B: Biological Sciences* 281(1779).
Online: <https://dx.doi.org/10.1098/rspb.2013.2535>
- Pinnell, R.C.; Almajidy, R.K.; Hofmann, U.G. (2016). **Versatile 3D-printed headstage implant for group housing of rodents.** *Journal of neuroscience methods* 257: 134-138.
- Reinhardt, V. (2004). **Common husbandry-related variables in biomedical research with animals.** *Laboratory Animals* 38(3): 213-235.
Online: <https://dx.doi.org/10.1258/002367704323133600>
- Ross, A.P., A. Norvelle, D.C. Choi, J.C. Walton, H.E. Albers, and K.L. Huhman (2017). **Social housing and social isolation: Impact on stress indices and energy balance in male and female Syrian hamsters (Mesocricetus auratus).** *Physiology & Behavior* 177: 264-269.
Online: <https://dx.doi.org/10.1016/j.physbeh.2017.05.015>
- Sharp, J., T. Azar, and D. Lawson (2014). **Effects of a complex housing environment on heart rate and blood pressure of rats at rest and after stressful challenges.** *Journal of the American Association for Laboratory Animal Science* 53(1): 52-60.
- Sherwin, C.M. (2004). **The influences of standard laboratory cages on rodents and the validity of research data.** *Animal Welfare* 13(SUPPL.1): 9-15.
- Shoji, H., & Mizoguchi, K. (2011). **Aging-related changes in the effects of social isolation on social behavior in rats.** *Physiology & Behavior*, 102(1), 58–62. <https://doi.org/10.1016/j.physbeh.2010.10.001>
- Skinner, M., Ceuppens, P., White, P., & Prior, H. (2019). **Social-housing and use of double-decker cages in rat telemetry studies.** *Journal of Pharmacological and Toxicological Methods*, 96, 87–94.
Online: <https://doi.org/10.1016/j.vascn.2019.02.005>
- Sørensen, D., Hanse, H., Krohn, T., & Bertelsen, T. (2010). **Preferences for limited versus no contact in SD rats.** *Laboratory Animals*, 44(3), 274–277. <https://doi.org/10.1258/la.2010.009099>
- Sörensen, D.B., T. Krohn, A.K. Hansen, H.N. Hansen, and J.L. Ottesen (2005). **An ethological approach to housing requirements of golden hamsters, Mongolian gerbils and fat sand rats in the laboratory - A review.** *Applied Animal Behaviour Science* 94(3-4): 181-195.
Online: <https://dx.doi.org/10.1016/j.applanim.2005.02.004>
- Späni, D., B. König, M. Arras, and T. Rüllicke (2003). **Higher heart rate of laboratory mice housed individually vs in pairs.** *Laboratory Animals* 37(1): 54-62.
Online: <https://dx.doi.org/10.1258/002367703762226692>
- Stickney, J. D., & Morgan, M. M. (2021). **Social housing promotes recovery of wheel running depressed by**

- inflammatory pain and morphine withdrawal in male rats.** *Behavioural Brain Research*, 396. Scopus. <https://doi.org/10.1016/j.bbr.2020.112912>
- 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.
- Templer, V. L., Wise, T. B., & Heimer-McGinn, V. R. (2019). **Social housing protects against age-related working memory decline independently of physical enrichment in rats.** *Neurobiology of Aging*, 75, 117–125. Scopus. <https://doi.org/10.1016/j.neurobiolaging.2018.11.016>
- Theil, J. H., Ahloy-Dallaire, J., Weber, E. M., Gaskill, B. N., Pritchett-Corning, K. R., Felt, S. A., & Garner, J. P. (2020). The epidemiology of fighting in group-housed laboratory mice. *Scientific Reports*, 10(1). Scopus. <https://doi.org/10.1038/s41598-020-73620-0>
- Tribble, J. E., & Fanselow, M. S. (2019). Pair-Housing Rats Does Not Protect from Behavioral Consequences of an Acute Traumatic Experience. *Behavioral Neuroscience*, 133(2), 232–239. Scopus. <https://doi.org/10.1037/bne0000295>
- Tueting, P. and G. Pinna (2002). **Behavior associated with an enriched environment and with social isolation in mice.** *Society for Neuroscience Abstract Viewer and Itinerary Planner* 2002.
- Turner, P.V., J. Sunohara-Neilson, J. Ovari, A. Healy, and F. Leri (2014). **Effects of single compared with pair housing on hypothalamic-pituitary-adrenal axis activity and low-dose heroin place conditioning in adult male Sprague-Dawley rats.** *Journal of the American Association for Laboratory Animal Science* 53(2): 161-167.
- Turner, P.V., K.L. Smiler, M. Hargaden, and M.A. Koch (2003). **Refinements in the Care and Use of Animals in Toxicology Studies - Regulation, Validation, and Progress.** *Contemporary Topics in Laboratory Animal Science* 42(6): 8-15.
- van Goethem, N.P., K. Rutten, S. Akkerman, H.W.M. Steinbusch, J. Prickaerts, L.A.W. Jans, A. Blokland, F.J. van der Staay, and J. van't Klooster (2012). **Object recognition testing: Rodent species, strains, housing conditions, and estrous cycle.** *Behavioural Brain Research* 232(2): 323-334. Online: <https://dx.doi.org/10.1016/j.bbr.2012.03.023>
- Van Loo, P.L.P., N. Kuin, R. Sommer, V. Baumans, H. Avsaroglu, and T. Pham (2007). **Impact of 'living apart together' on postoperative recovery of mice compared with social and individual housing.** *Laboratory Animals* 41(4): 441-455. Online: <https://dx.doi.org/10.1258/002367707782314328>
- Vaughan, L.M., J.S. Dawson, P.R. Porter, and A.L. Whittaker (2014). **Castration promotes welfare in group-housed male Swiss outbred mice maintained in educational institutions.** *Journal of the American Association for Laboratory Animal Science* 53(1): 38-43.
- Verma, R., B.D. Friedler, N.M. Harris, and L.D. McCullough (2014). **Pair housing reverses post-stroke depressive behavior in mice.** *Behavioural Brain Research* 269: 155-163.

Online: <https://dx.doi.org/10.1016/j.bbr.2014.04.044>

Verwer, C.M., R.V.D. Bos, C.F.M. Hendriksen, and L.T.M. van der Ven (2007). **Effects of housing condition on experimental outcome in a reproduction toxicity study.** *Regulatory Toxicology and Pharmacology* 48(2): 184-193.

Online: <https://dx.doi.org/10.1016/j.yrtph.2007.03.004>

Wang, Y.-C., Wang, C.-C., Lee, C.-C., & Huang, A. C. W. (2010). **Effects of single and group housing conditions and alterations in social and physical contexts on amphetamine-induced behavioral sensitization in rats.** *Neuroscience Letters*, 486(1), 34–37.

Online: <https://doi.org/10.1016/j.neulet.2010.09.039>

Weber, E.M., J.A. Dallaire, B.N. Gaskill, K.R. Pritchett-Corning, and J.P. Garner (2017). **Aggression in group-housed laboratory mice: why can't we solve the problem?** *Lab Animal* 46: 157-161.

Online: <https://dx.doi.org/10.1038/lablan.1219>

Weegh, N., Fünér, J., Janke, O., Winter, Y., Jung, C., Struve, B., Wassermann, L., Lewejohann, L., Bleich, A., & Häger, C. (2020). **Wheel running behaviour in group-housed female mice indicates disturbed wellbeing due to DSS colitis.** *Laboratory Animals*, 54(1), 63–72. Scopus.

<https://doi.org/10.1177/0023677219879455>

Weil, Z.M., J.L. Workman, and R.J. Nelson (2007). **Housing condition alters immunological and reproductive responses to day length in Siberian hamsters (Phodopus sungorus).** *Hormones and Behavior* 52(2): 261-266.

Online: <https://dx.doi.org/10.1016/j.yhbeh.2007.05.001>

Westenbroek, C., J.A. Den Boer, M. Gerrits, D.S. Fokkema, G.J. Ter Horst, and T.A.B. Snijders (2005). **Pair-housing of male and female rats during chronic stress exposure results in gender-specific behavioral responses.** *Hormones and Behavior* 47(5): 620-628.

Online: <https://dx.doi.org/10.1016/j.yhbeh.2005.01.004>

Westenbroek, C., J.A. Den Boer, G.J. Ter Horst, and M. Veenhuis (2004). **Chronic stress and social housing differentially affect neurogenesis in male and female rats.** *Brain Research Bulletin* 64(4): 303-308.

Online: <https://dx.doi.org/10.1016/j.brainresbull.2004.08.006>

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>

Zhang, Y.-L., Zhang, J., Lu, H., Tang, J., Luo, J.-L., Long, H.-P., Li, J.-C., & Shi, S.-L. (2019). **Group housing with young mice relieves Alzheimer's disease behaviors in aging mice.** *European Review for Medical and Pharmacological Sciences*, 23(18), 8058–8067. Scopus.

https://doi.org/10.26355/eurrev_201909_19022

Zidar, J., et al. **"Group and Single Housing of Male Mice: Collected Experiences from Research Facilities in Sweden."** *Animals*, vol. 9, no. 12, 2019, doi:10.3390/ani9121010.

Zidar, J., Weber, E. M., Ewaldsson, B., Tjader, S., Lilja, J., Mount, J., Svensson, C. I., Svensk, E., Uden, E., & Toernqvist, E. (2019). **Group and Single Housing of Male Mice: Collected Experiences from Research Facilities in Sweden.** *Animals*, *9*(12), 1010.
Online: <https://doi.org/10.3390/ani9121010>

Ruminants

- Abdelfattah, E. M., Schutz, M. M., Lay Jr, D. C., Marchant-Forde, J. N., & Eicher, S. D. (2013). **Effect of group size on behavior, health, production, and welfare of veal calves.** *Journal of Animal Science*, 91(11), 5455–5465.
- Arrazola, Aitor, et al. “**The Effect of Early Housing and Companion Experience on the Grazing and Ruminating Behaviour of Naive Heifers on Pasture.**” *Applied Animal Behaviour Science*, vol. 226, May 2020, p. UNSP 104993, doi:10.1016/j.applanim.2020.104993.
- Aschwanden, J., L. Gygax, B. Wechsler, and N.M. Keil (2009). **Loose housing of small goat groups: Influence of visual cover and elevated levels on feeding, resting and agonistic behaviour.** *Applied Animal Behaviour Science* 119(3-4): 171-179.
Online: <https://dx.doi.org/10.1016/j.applanim.2009.04.005>
- Aschwanden, J., Gygax, L., Wechsler, B., & Keil, N. M. (2008). **Social distances of goats at the feeding rack: Influence of the quality of social bonds, rank differences, grouping age and presence of horns.** *Applied Animal Behaviour Science*, 114(1–2), 116–131.
- Bøe, K.E. and G. Færevik (2003). **Grouping and social preferences in calves, heifers and cows.** *Applied Animal Behaviour Science* 80(3): 175-190.
Online: [https://dx.doi.org/10.1016/S0168-1591\(02\)00217-4](https://dx.doi.org/10.1016/S0168-1591(02)00217-4)
- Bolt, S. L. “**The Effect of Social Contact on the Performance and Behaviour of Young Dairy Calves.**” *Livestock*, vol. 23, no. 1, 2018, pp. 22–26. CAB Abstracts.
- Bučková, K., et al. “**Pair Housing Makes Calves More Optimistic.**” *Scientific Reports*, vol. 9, no. 1, 2019, doi:10.1038/s41598-019-56798-w. Scopus.
- Cantor, M. C., Neave, H. W., & Costa, J. H. C. (2019). **Current perspectives on the short- And long-term effects of conventional dairy calf raising systems: A comparison with the natural environment.** *Translational Animal Science*, 3(1), 549–563. Scopus. <https://doi.org/10.1093/tas/txy144>
- Caroprese, M., L. Schena, A. Muscio, A. Sevi, G. Annicchiarico, and R. Migliore (2009). **Influence of space allowance and housing conditions on the welfare, immune response and production performance of dairy ewes.** *Journal of Dairy Research* 76 (1): 66-73.
Online: <https://dx.doi.org/10.1017/S0022029908003683>
- Chua, B., E. Coenen, J. Van Delen, and D.M. Weary (2002). **Effects of pair versus individual housing on the behavior and performance of dairy calves.** *Journal of Dairy Science* 85(2): 360-364.
- Cobb, C.J., B.S. Obeidat, M.D. Sellers, A.R. Pepper-Yowell, and M.A. Ballou (2014). **Group housing of Holstein calves in a poor indoor environment increases respiratory disease but does not influence performance or leukocyte responses.** *Journal of Dairy Science* 97(5): 3099-3109.
Online: <https://dx.doi.org/10.3168/jds.2013-7823>

- Cobb, C.J., B.S. Obeidat, M.D. Sellers, A.R. Pepper-Yowell, D.L. Hanson, and M.A. Ballou (2014). **Improved performance and heightened neutrophil responses during the neonatal and weaning periods among outdoor group-housed Holstein calves.** *Journal of Dairy Science* 97(2): 930-939.
- Cook, N.B. and R.A. Smith (2008). **Designing welfare-friendly housing for dairy cows.** *Proceedings of the 41st Annual Conference of the American Association of Bovine Practitioners, Charlotte, North Carolina, USA, 25-27 September 2008: 78-84.*
- Costa, J. H. C., Cantor, M. C., Adderley, N. A., & Neave, H. W. (2019). **Key animal welfare issues in commercially raised dairy calves: Social environment, nutrition, and painful procedures.** *Canadian Journal of Animal Science*, 99(4), 649–660. Scopus. <https://doi.org/10.1139/cjas-2019-0031>
- Costa, J. H. C., von Keyserlingk, M. A. G., & Weary, D. M. (2016). Invited review: **Effects of group housing of dairy calves on behavior, cognition, performance, and health.** *Journal of Dairy Science*, 99(4), 2453–2467.
- Costa, J. H. C., Daros, R. R., von Keyserlingk, M. A. G., & Weary, D. M. (2014). **Complex social housing reduces food neophobia in dairy calves.** *Journal of Dairy Science*, 97(12), 7804–7810.
- De Moura, F. H., Batalha, I., Franco, A., Bello, C., Archilia, E., Silva, A., Moreira, G., Norris, A., Schutz, L., & Fonseca, M. (2020). **Evaluation of an automated system for monitoring water intake in group-housed beef cattle.** *Journal of Animal Science*, 98, 432–432. <https://doi.org/10.1093/jas/skaa278.753>
- De Paula Vieira, A., D.M. Weary, and A.M. de Passillé (2012). **Effects of the early social environment on behavioral responses of dairy calves to novel events.** *Journal of Dairy Science* 95(9): 5149-5155. Online: <https://dx.doi.org/10.3168/jds.2011-5073>
- De Paula Vieira, A., M.A.G. von Keyserlingk, and D.M. Weary (2010). **Effects of pair versus single housing on performance and behavior of dairy calves before and after weaning from milk.** *Journal of Dairy Science* 93(7): 3079-3085. Online: <https://dx.doi.org/10.3168/jds.2009-2516>
- Duve, L.R. and M.B. Jensen (2012). **Social behavior of young dairy calves housed with limited or full social contact with a peer.** *Journal of Dairy Science* 95(10): 5936-5945.
- Duve, L.R., D.M. Weary, U. Halekoh, and M.B. Jensen (2012). **The effects of social contact and milk allowance on responses to handling, play, and social behavior in young dairy calves.** *Journal of Dairy Science* 95(11): 6571-6581. Online: <https://dx.doi.org/10.3168/jds.2011-5170>
- Ehrlenbruch, R., G.H.M. Jørgensen, I.L. Andersen, and K.E. Bøe (2010). **Provision of additional walls in the resting area-The effects on resting behaviour and social interactions in goats.** *Applied Animal Behaviour Science* 122(1): 35-40. Online: <https://dx.doi.org/10.1016/j.applanim.2009.11.004>
- Færevik, G. (2008). **Social dynamics in dairy calves in relation to housing conditions.** PhD Thesis, Norwegian

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

- Færevik, G., K.E. Bøe, and M.B. Jensen (2006). **Dairy calves social preferences and the significance of a companion animal during separation from the group.** *Applied Animal Behaviour Science* 99(3-4): 205-221.
Online: <https://dx.doi.org/10.1016/j.applanim.2005.10.012>
- Franz, H., E. Roitberg, B. Lührke, G. Nürnberg, G. Dietl, and R. Kinzelbach (2002). **Visual discrimination learning of group-housed goats at an automated learning device.** *Archiv Fur Tierzucht* 45(4): 387-401.
- Gaillard, C., R.K. Meagher, M.A. von Keyserlingk, and D.M. Weary (2014). **Social housing improves dairy calves' performance in two cognitive tests.** *Plos One* 9(2).
Online: <https://dx.doi.org/10.1371/journal.pone.0090205>
- Gingerich, K. N., Choulet, V., & Miller-Cushon, E. K. (2020). **Disbudding affects use of a shelter provided to group-housed dairy calves.** *Journal of Dairy Science*, 103(11), 10519–10529. Scopus.
<https://doi.org/10.3168/jds.2020-18267>
- 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>
- Hänninen, L., A.M. De Passillé, and J. Rushen (2005). **The effect of flooring type and social grouping on the rest and growth of dairy calves.** *Applied Animal Behaviour Science* 91(3-4): 193-204.
Online: <https://dx.doi.org/10.1016/j.applanim.2004.10.003>
- Hawkins, A., Burdine, K. H., Amaral-Phillips, D. M., & Costa, J. H. C. (2020). **Effects of Housing System on Dairy Heifer Replacement Cost From Birth to Calving: Evaluating Costs of Confinement, Dry-Lot, and Pasture-Based Systems and Their Impact on Total Rearing Investment.** *Frontiers in Veterinary Science*, 7, 625. <https://doi.org/10.3389/fvets.2020.00625>
- Hepola, H., L. Hänninen, P. Pursiainen, V.M. Tuure, L. Syrjälä-Qvist, M. Pyykkönen, and H. Saloniemi (2006). **Feed intake and oral behaviour of dairy calves housed individually or in groups in warm or cold buildings.** *Livestock Science* 105(1-3): 94-104.
Online: <https://dx.doi.org/10.1016/j.livsci.2006.04.033>
- Herskin, M.S., L. Munksgaard, and J.B. Andersen (2007). **Effects of social isolation and restraint on adrenocortical responses and hypoalgesia in loose-housed dairy cows.** *Journal of Animal Science* 85(1): 240-247.
Online: <https://dx.doi.org/10.2527/jas.2005-346>
- Jensen, M.B. and L.E. Larsen (2014). **Effects of level of social contact on dairy calf behavior and health.** *Journal of Dairy Science* 97(8): 5035-5044.
Online: <https://dx.doi.org/10.3168/jds.2013-7311>

- 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>
- Jensen, M.B., L. Munksgaard, L. Mogensen, and C.C. Krohn (1999). **Effects of housing in different social environments on open-field and social responses of female dairy calves.** *Acta Agriculturae Scandinavica - Section a: Animal Science* 49(2): 113-120.
- Jensen, M.B., C.C. Krohn, and K.S. Vestergaard (1998). **Play behaviour in dairy calves kept in pens: The effect of social contact and space allowance.** *Applied Animal Behaviour Science* 56(2-4): 97-108.
Online: [https://dx.doi.org/10.1016/S0168-1591\(97\)00106-8](https://dx.doi.org/10.1016/S0168-1591(97)00106-8)
- Jensen, M.B., C.C. Krohn, L. Munksgaard, and K.S. Vestergaard (1997). **Effect of single versus group housing and space allowance on responses of calves during open-field tests.** *Applied Animal Behaviour Science* 54(2-3): 109-121.
Online: [https://dx.doi.org/10.1016/S0168-1591\(96\)01183-5](https://dx.doi.org/10.1016/S0168-1591(96)01183-5)
- Jiang, M., Rao, Y., Zhang, J., & Shen, Y. (2020). **Automatic behavior recognition of group-housed goats using deep learning.** *Computers & Electronics in Agriculture*, 177, N.PAG-N.PAG. Environment Complete.
- Jóhannesson, T. and J.T. Sørensen (2000). **Evaluation of welfare indicators for the social environment in cattle herds.** *Animal Welfare* 9(3): 297-316. ISSN: 09627286.
- Jørgensen, G.H.M., I.L. Andersen, S. Berg, and K.E. Bøe (2009). **Feeding, resting and social behaviour in ewes housed in two different group sizes.** *Applied Animal Behaviour Science* 116(2-4): 198-203.
Online: <https://dx.doi.org/10.1016/j.applanim.2008.08.014>
- Kerr, S.G.C. and D.G.M. Wood-Gush (1987). **The development of behaviour patterns and temperament in dairy heifers.** *Behavioural Processes* 15(1): 1-16.
- Knauer, W. A., Godden, S. M., Rendahl, A. K., Endres, M. I., & Crooker, B. A. (2021). **The effect of individual versus pair housing of dairy heifer calves during the preweaning period on measures of health, performance, and behavior up to 16 weeks of age.** *Journal of Dairy Science*, 104(3), 3495–3507. Environment Complete.
- Krohn, C.C. (1994). **Behaviour of dairy cows kept in extensive (loose housing/pasture) or intensive (tie stall) environments. III. Grooming, exploration and abnormal behaviour.** *Applied Animal Behaviour Science* 42(2): 73-86.
- Lecorps, B., Kappel, S., Weary, D. M., & von Keyserlingk, M. A. G. (2019). **Social proximity in dairy calves is affected by differences in pessimism.** *PLoS One*, 14(10), e0223746.
<https://doi.org/10.1371/journal.pone.0223746>

- Lindner, E. E., Gingerich, K. N., Rivera, J. M., & Miller-Cushon, E. K. (2020). **Effects of early social contact on dairy calf reactivity to novelty following introduction to group housing.** *Journal of Dairy Science*, *103*, 211–211.
- Liu, S., Ma, J., Li, J., Alugongo, G. M., Wu, Z., Wang, Y., Li, S., & Cao, Z. (2020). **Effects of pair versus individual housing on performance, health, and behavior of dairy calves.** *Animals*, *10*(1). Scopus. <https://doi.org/10.3390/ani10010050>
- Lorenz, I. (2021). **Calf health from birth to weaning—An update.** *Irish Veterinary Journal*, *74*(1). Scopus. <https://doi.org/10.1186/s13620-021-00185-3>
- Mahendran, S. A., Claire Wathes, D., Booth, R. E., & Blackie, N. (2021). **The health and behavioural effects of individual versus pair housing of calves at different ages on a UK commercial dairy farm.** *Animals*, *11*(3), 1–15. Scopus. <https://doi.org/10.3390/ani11030612>
- Mahmoud, U. T., and M. H. A. Darwish. “**Effect of Pair Housing versus Individual and Group Housing on Behavioural Patterns of Buffalo Calves.**” *Journal of Advanced Veterinary Research*, vol. 8, no. 1, 2018, pp. 12–15. Scopus.
- Meagher, R.K.; Daros, R.R.; Costa, J.H.; von Keyserlingk, M.A.; Hoetzel, M.J.; Weary, D.M. (2015). **Effects of degree and timing of social housing on reversal learning and response to novel objects in dairy calves.** *Plos one* *10*(8). Article No.: e0132828.
- Menke, C., D.W. Fölsch, and S. Waiblinger (2000). **The importance of herd management in loose housing systems to the social behaviour of dairy cows.** *Deutsche Tierärztliche Wochenschrift* *107*(7): 262-268.
- Neisen, G., B. Wechsler, and L. Gyax (2009). **Effects of the introduction of single heifers or pairs of heifers into dairy-cow herds on the temporal and spatial associations of heifers and cows.** *Applied Animal Behaviour Science* *119*(3-4): 127-136.
Online: <https://dx.doi.org/10.1016/j.applanim.2009.04.006>
- Nikkhah, A. and R. Kowsar (2012). **Seasonal and group effects on dairy cow behavior in large yards.** *Turkish Journal of Veterinary and Animal Sciences* *36*(2): 123-129.
Online: <https://dx.doi.org/10.3906/vet-1012-626>
- Ninomiya, S. (2019). **Grooming device effects on behaviour and welfare of Japanese black fattening cattle.** *Animals*, *9*(4). Scopus. <https://doi.org/10.3390/ani9040186>
- 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>
- Overvest, M. A., et al. “**Social Housing Influences the Behavior and Feed Intake of Dairy Calves during Weaning.**” *Journal of Dairy Science*, vol. 101, no. 9, 2018, pp. 8123–34. CAB Abstracts.

- Park, R. M., Foster, M., & Daigle, C. L. (2020). **A scoping review: The impact of housing systems and environmental features on beef cattle welfare.** *Animals*, 10(4). Scopus. <https://doi.org/10.3390/ani10040565>
- Patt, A., L. Gyax, B. Wechsler, E. Hillmann, R. Palme, and N.M. Keil (2013). **Factors influencing the welfare of goats in small established groups during the separation and reintegration of individuals.** *Applied Animal Behaviour Science* 144(1/2): 63-72.
Online: <https://dx.doi.org/10.1016/j.applanim.2012.11.009>
- Pempek, J. A., Eastridge, M. L., Swartzwelder, S. S., Daniels, K. M., & Yohe, T. T. (2016). **Housing system may affect behavior and growth performance of Jersey heifer calves.** *Journal of Dairy Science*, 99(1), 569–578.
- Perttu, R. K., Ventura, B. A., & Endres, M. I. (2020). **Youth and adult public views of dairy calf housing options.** *Journal of Dairy Science*, 103(9), 8507–8517. Scopus. <https://doi.org/10.3168/jds.2019-17727>
- Raussi, S. (2005). **Group management of young dairy cattle in relation to animal behaviour and welfare.** *Agrifood Research Reports*(71).
- Raussi, S., J. Kaihilahti, A. Boissy, E. Delval, I. Veissier, and P. Pradel (2005). **Does repeated regrouping alter the social behaviour of heifers?** *Applied Animal Behaviour Science* 93(1-2): 1-12.
Online: <https://dx.doi.org/10.1016/j.applanim.2004.12.001>
- Raussi, S. (2003). **Human-cattle interactions in group housing.** *Applied Animal Behaviour Science* 80(3): 245-262.
Online: [https://dx.doi.org/10.1016/S0168-1591\(02\)00213-7](https://dx.doi.org/10.1016/S0168-1591(02)00213-7)
- Reedman, C. N., Duffield, T. F., DeVries, T. J., Lissemore, K. D., Duncan, I. J., & Winder, C. B. (2021). **Randomized controlled trial assessing the effects of xylazine sedation in 2- to 6-week-old dairy calves disbudded with a cautery iron.** *Journal of Dairy Science*, 104(5), 5881–5897. Scopus. <https://doi.org/10.3168/jds.2020-19689>
- Röttgen, V., Schön, P. C., Becker, F., Tuchscherer, A., Wrenzycki, C., Düpjan, S., & Puppe, B. (2020). **Automatic recording of individual oestrus vocalisation in group-housed dairy cattle: Development of a cattle call monitor.** *Animal*, 14(1), 198–205. Scopus. <https://doi.org/10.1017/S1751731119001733>
- Rushen, J., A.M. de Passillé, M.C. Appleby, D.M. Weary, and P. Sandøe (2014). **Alone or together: a risk assessment approach to group housing.** *Dilemmas in Animal Welfare*: 169-187.
- Schneider, L., Kemper, N., & Spindler, B. (2020). **Stereotypic behavior in fattening bulls.** *Animals*, 10(1). Scopus. <https://doi.org/10.3390/ani10010040>
- Scoley, G., Gordon, A., & Morrison, S. J. (2019). **The effect of calf jacket usage on performance, behaviour and physiological responses of group-housed dairy calves.** *Animal*, 13(12), 2876–2884. Scopus.

<https://doi.org/10.1017/S1751731119001071>

- Verbeek, E., Colditz, I., Blache, D., & Lee, C. (2019). **Chronic stress influences attentional and judgement bias and the activity of the HPA axis in sheep.** *PLoS ONE*, 14(1). Scopus.
<https://doi.org/10.1371/journal.pone.0211363>
- Villeneuve, L., H. Méthot, D. Cinq-Mars, and R. Bergeron (2009). **Effect of individual or paired housing during post-weaning on feed intake, growth rate and behaviour of lambs.** *Small Ruminant Research* 85(2-3): 99-104.
Online: <https://dx.doi.org/10.1016/j.smallrumres.2009.07.007>
- 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>
- 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>
- Walker, J.K.; Arney, D.R.; Waran, N.K.; Handel, I.G.; Phillips, C.J. (2015). **The effect of conspecific removal on behavioral and physiological responses of dairy cattle.** *Journal of dairy science* 98(12): 8610-8622.
Online: <https://dx.doi.org/10.3168/jds.2011-5170>
- Whalin, L., et al. **“Short Communication: Pair Housing Dairy Calves in Modified Calf Hutches.”** *Journal of Dairy Science*, vol. 101, no. 6, 2018, pp. 5428–33, doi:10.3168/jds.2017-14361. Scopus.
- Wierenga, H.K. (1990). **Social dominance in dairy cattle and the influences of housing and management.** *Applied Animal Behaviour Science* 27(3): 201-229.
- Wormsbecher, L., Bergeron, R., Haley, D., de Passillé, A. M., Rushen, J., & Vasseur, E. (2017). **A method of outdoor housing dairy calves in pairs using individual calf hutches.** *Journal of Dairy Science*, 100(9), 7493–7506. <https://doi.org/10.3168/jds.2017-12559>
- Zhang, C., Juniper, D. T., & Meagher, R. K. (2021). **Effects of physical enrichment items and social housing on calves’ growth, behaviour and response to novelty.** *Applied Animal Behaviour Science*, 237. Scopus. <https://doi.org/10.1016/j.applanim.2021.105295>
- 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>
- Zobel, G., Proudfoot, K., Cave, V., Huddart, F., & Webster, J. (2020). **The Use of Hides during and after Calving in New Zealand Dairy Cows.** *Animals*, 10(12). <https://doi.org/10.3390/ani10122255>