

Literature Review 3 Annotated Bibliographies

How they are organized: Articles are organized in terms of information flow that goes from general to specific.

Hemsworth, P. H., Price, E. O., & Borgwardt, R. (1996). Behavioural responses of domestic pigs and cattle to humans and novel stimuli. *Applied Animal Behaviour Science*, 50(1), 43–56. [https://doi.org/10.1016/0168-1591\(96\)01067-2](https://doi.org/10.1016/0168-1591(96)01067-2).

Summary:

Past literature has proven that when animals are subjected to stress, they will also show more fear towards their human handlers, making farm animals uncooperative. A large part of this is due to the fact that human handlers play a substantial role in developing these visible behaviors indicative of aggression or fear. The study aimed to see if frequent experiences with novel stimuli would unravel any telltale signs of distress within beef cattle. To do this, cattle were either subjected to novel objects (moving chains or ropes), regular instances of positive handling, or little to no contact with humans or objects. After a period of treatment, cattle were then tested using the Human Approach Test. This involved an unfamiliar person standing in front of the cow while the time and distance taken to approach the human was recorded along with any behaviors evident. Next was the Novel Object Test where the cow was subjected to a large arena with many never-before-seen items while their behavioral tendencies were recorded. Results displayed those cattle who were in the treatment involving positive handling experiences were less afraid to approach the unknown person and would do so at a closer distance. However, no significant difference was found during the Novel Object Approach Test between all three treatment groups. This study exemplifies how vital it is for cattle to have positive handling experiences. They will display less stressful behaviors and be more cooperative during handling and when they are approached. Future studies could look at implementing these positive handling experiences into farming practices that benefit the farmers with greater farm productivity while their animals are calm and cared for.

Contribution:

This study ties in with my project as it discusses how previous human handling procedures will impact the present and future handling of animals. It shows that novel stressors such as unfamiliar humans will be less of a fearful experience for cattle if their stockpersons have been handling them with care. This study calls for better treatment and care for cattle when looked after and handled. Future studies could look at why cattle were not phased by novel objects by testing different sizes, colors, or types of novel objects to see if anything would elicit a response.

Grandin, T. (1997). Assessment of stress during handling and transport. *Journal of Animal Science*, 75(1), 249. <https://doi.org/10.2527/1997.751249x>

Summary:

Within the realm of studies involving handling stress, there seems to be a considerable amount of variation in them. The aim of this study was to compile an accurate base of information that discusses the many factors that contribute to handling stress in cattle and how to potentially assess for stress behaviors. To begin, this study discusses how prominent of an emotion fear is and how repetitive care and handling should eventually habituate cattle into being less stressed over time. This assumption does not apply to every individual cattle as there are many other factors that can cause them to randomly react with aggression or fear. One such factor is the temper which can be traced back to genetics. This can affect a cow's natural anger and aggression, proving regular handling very difficult for them to adapt to. Another factor influencing fear is pheromones (chemicals produced from the animal). A panicked cow can release pheromones which may cause distress for cattle around them. Due to multiple contributing fear factors, the researchers emphasize the need for assessing both behavioral and physiological parameters. One effective behavioral test is the aversion test which involves re-introducing the cow into a chute where it is normally handled and seeing how much time the ordeal takes. Cows that have been poorly handled will take more time to enter the chute. Stressed animals in the chute will also show signs such as kicking or increased vocalization. As for physiological measures, constantly measuring heart rate and cortisol levels following stressful situations is helpful for monitoring cattle. Taken together, this study shows how variable fear can be as a stressor. For a non-painful event such as routine handling or chute systems, one animal may perceive these events neutrally while triggering a fear response for another animal.

Contribution:

This article connects well with my topic as it provides a broad overview of all the factors that play into assessing stress behaviors during handling. It went over tests and measures that can help quickly assess the fear of animals. The study also discussed the complexities of developing better handling systems as each animal is unpredictable and will react differently based on a wide number of factors such as genetics and previous handling experience. The author also solidifies how important it is for studies and assessments to take both behavioral and physiological measurements to examine animal stressors.

Chen, Y., Stookey, J., Arsenault, R., Scruten, E., Griebel, P., & Napper, S. (2016). Investigation of the physiological, behavioral, and biochemical responses of cattle to restraint stress. *Journal of Animal Science*, 94(8), 3240–3254. <https://doi.org/10.2527/jas.2016-0549>

Summary:

Being able to understand stress factors in cattle will in turn help to create better management practices that place priority on the well-being of the cattle. One such stressor is restraint stress which may occur when there is a need for cattle to be transported. The objective of this study was to observe and analyze behavioral and psychological parameters following multiple incidents of 5-minute restraint stress periods. The restraining was done weekly within a chute. During testing, behaviors such as the order in which they entered the chute and the speed of leaving the chute were observed. Serum cortisol was also collected from the cow's blood just after the restraint period as a physiological measure of stress. A few cattle displaying the highest serum cortisol represented the high cortisol responders while a few displaying the lowest serum cortisol represented the low cortisol responders. The results demonstrate higher cortisol levels were seen in individuals who entered the chute later while the exit velocity was showed no relation to cortisol levels. Sensitization may have played a role in the lack of correlation between cortisol levels and the observed behavioral responses as cattle were put under restraint stress multiple times. This study is significant as it bridges the gap between behavioral and physiological stress measures. It backs up observed stress behaviors with a quantifiable measure of cortisol levels found in the bloodstream. This study holds the potential to see if there are any patterns or similarities between the cattle exhibiting less stress after being restrained. These cattle could be stress-tolerant and might give insight as to how they came to be naturally less panicked or fearful. In theory, this could help farmers find ways to raise less panicked cattle so when stressors do come along, the herd will be calmer to work with.

Contribution:

A large goal of this investigation was to accurately measure stress in order to see if stress-tolerant cattle could be predicted. This information correlated with my research question as it gives insight into a great stress testing method that can assess and quantify the amount of stress a cow will exhibit after being restrained. This can help determine if some species or individuals are more naturally tolerant to stress or if they are more naturally panicked when placed under stressful situations. Furthermore, it raises the question of why some species are more resilient to stress and why some are not.

Chen, Y., Arsenault, R., Napper, S., & Griebel, P. (2015). Models and methods to investigate acute stress responses in cattle. *Animals*, 5(4), 1268–1295.
<http://doi.org/10.3390/ani5040411>

Summary:

A wide range of previous animal research has proved how vital it is to mediate stress within cattle to better suit their needs and to increase their productivity. In order to do so, stressors must not only be recognized but the effects of stress must also be assessed. Thus, this article aimed to study a wide variety of stressors. This was done via reviewing numerous stress models found in previous literature to compile information about the effects stress may have on the biology of cattle. From previous literature, it was gathered that different types of stressors will produce different physical effects on the body's immune system. The article begins by introducing the part of the body that controls stress is the glucocorticoid receptors which bind cortisol and thus plays a role in an individual's metabolism and immune system. The immune system weakens when there are stressors acting on it. For example, stressful events for cattle such as getting transported to a new location can lead to adverse health issues such as infections, respiratory illnesses, or even death. To better understand the impact of these stressors, they must be consistently measured and assessed. One way to measure cattle stress is taking a chute system which acts as a stressor and observing which cattle will enter the narrow enclosure first. A cortisol recording is taken right after the cattle have been subjected to the chute system. Many studies reported that cattle entering the chute system last had higher cortisol found in their blood or their urine. This translates to higher stress amounts seen in cattle that entered last versus cattle entering the system first. The significance of this article is that it paves the way for taking better care of cattle by consistent monitoring of their stress levels.

Contribution:

This article classifies previous literature done on cattle stress behavior. It points out gaps in knowledge within the field, one of them being the lack of studies conducted on behavioral measures of stress. This is an area I wish to explore throughout the term. The article describes ways in which each type of stress can be tested or observed including some simple ways of testing stress and monitoring stress levels. This information is vital for my topic as I am looking to incorporate these effective methods into ways that better monitoring and handling practices for cattle that help reduce stress.

Kammel, D. W., Burgi, K., & Lewis, J. (2019). Design and management of proper handling systems for dairy cows. *Veterinary Clinics of North America: Food Animal Practice*, 35(1), 195–227. <https://doi.org/10.1016/j.cvfa.2018.11.003>

Summary:

When considering the welfare of cattle, it is important to ensure there are effective handling and management systems in place. The aim of this article was to cover different aspects that influence the handling systems for cows. This includes stockmanship skills, using cow behavior to depict how to best interact with them, and the design of the handling system. The interaction between a human and a cow is extremely important as it's been shown that handlers who are relaxed and consistent in their interactions will achieve a more cooperative interaction with the cattle. It is also important to consider a cow's behavior including its auditory and visual senses. This is because a cow can get panicked when they do not always see the handler and can stop to search around for them. Additionally, they do not have good depth perception so a change in ground levels can cause them to become defensive towards handling. As for a cow's auditory senses, they are more sensitive to high and low frequencies and may react hostilely to loud yelling and noises. In terms of the design of the handling system, a re-direction pen also called a bud box is an efficient design that can be used to gather cattle into one area or direct them into another area. The pen has a large open side whether cattle come in and are then moved through a narrow lane that moves cattle to the desired area in a single-file manner. It is vital to keep in mind that all design structures still require proper handling techniques to ensure that systems are used safely and won't cause harm or stress for the handlers or the cattle.

Contribution:

This article was chosen as it provided a great number of details regarding approaching and handling behaviors that can minimize stress in cattle. It shows how delicate their fear response can be and how proper planning and procedure can make a huge impact on reducing fear responses in cattle. By being thorough in designs and management, it can lead to less stress in cows and stock people, and this will inevitably help to lower the risk of injury for both. Future studies could examine how to effectively herd while keeping them with their pen to avoid social stressors.

Waiblinger, S., Menke, C., & Fölsch, D. W. (2003). Influences on the avoidance and approach behaviour of dairy cows towards humans on 35 farms. *Applied Animal Behaviour Science*, 84(1), 23–39. [https://doi.org/10.1016/S0168-1591\(03\)00148-5](https://doi.org/10.1016/S0168-1591(03)00148-5).

Summary:

Several investigations have shown just how important human-animal relationships are for the well-being and safety of not just the animals but also their handlers. Many negative reactions received from an animal during handling can be traced back to the human-animal relationship that was fostered early on in their development. Thus, this study aimed to quantify the importance of the human-animal relationship by using a few tests that would identify cattle reactions towards human beings. Cattle from numerous different farms had various parameters recorded such as how their handlers treated them and what management systems were in place

for them. These cows were then tested for avoidance and approach parameters. To test avoidance behaviors, researchers would measure the distance between the cow and the unfamiliar human being when cows were standing in the stable and when they were feeding. To test for approach behaviors, researchers looked at the number of cows that touched a small ball (novel object) and an unknown person standing in the middle of the stable (novel person). Results showed that cows who had poor handler relationships had a larger avoidance distance during testing as opposed to cattle who had affectionate handlers. On the other hand, approach behaviors were not related to human-animal relationships and those results could be more indicative of social factors. This study is significant as it emphasizes how important it is to handle and care for animals. It will cause major behavioral issues and make them more inclined to fear unfamiliar stimuli. Future studies could look into what could be the potential individual motivators that cause cows to approach novel objects more readily while some stay away from them. It would also be interesting to look at methods to change this behavior in order to make cows less afraid to approach novel items

Contribution:

This article dives into the basics of human-animal relationships and how they can affect an animal's fear of novelty. Since my topic is looking at cattle and their behavioral responses to novel stressors, I thought this study showed some valid preliminary factors that influence stress. It shows that cattle responses to stressors can be drawn back to how they are managed and treated on the farm. Furthermore, there are some behaviors that still need to be studied such as the influence of social settings so that we can understand how to make cattle less fearful and afraid of novelty.

Mackay, J. R. D., Haskell, M. J., Deag, J. M., & Reenen, K. Van. (2014). Fear responses to novelty in testing environments are related to day-to-day activity in the home environment in dairy cattle. *Applied Animal Behaviour Science*, 152, 7–16.
<https://doi.org/10.1016/j.applanim.2013.12.008>.

Summary:

Cattle are prey animals which makes them all the more susceptible to exhibiting panicked behavior when confronted with novel stimuli. It becomes difficult to study stress behaviors as many tests only add unnecessary stress for cattle. The aim of this investigation was to develop a less stress-intensive method to study stress behaviors. This was done by testing cattle in their pre-existing habitat with the help of automated milkers and technology that automatically tracks cattle activity. For a period, all cattle activity was recorded including the number of times they visited the automated milker. Next, two tests were used including the novel object test (NOVA) and the human approach test (HAP). For the NOVA test, a never-before-seen item was presented to the cow. For the HAP test, the unfamiliar experimenter would walk up to the cow while pausing at each step. During both tests, there was video footage shot throughout the test in order

to capture and record behaviors that are indicative of stress including their movements and the noises they would produce. The results show that cattle who would go up to the automatic milker prior to the testing period showed less fearful behaviors during the NOVA and the HAP test. The cows exhibiting less stressful behaviors such as decreased time spent lying around also tended to be older and possibly were more sensitized to novel situations. This study shows that when carrying out novel tests, there is usually some sort of personality associated with the results seen in cattle. Naturally, some cattle are less afraid of novel situations as seen in their ability to boldly approach the automatic milker, and in turn, they will exhibit fewer stress behaviors during novel tests. This information can help identify factors that determine personality traits that make cattle less panicked.

Contribution:

This study shows that when conducting fearful tests there might be underlying personality traits that explain the testing results. This might also mean that cattle responses to novel tests are predictable. This investigation is useful to my research as I appreciated the fact that this method of testing was significantly less stressful for cattle to endure. Additionally, if this testing method that uses automatic milkers and activity monitors produces accurate results, I would like to see it being used in future stress studies as well. It also includes ways to test cattle fear responses (the NOVA and HAP test).

Herskin, M. S., Kristensen, A. M., & Munksgaard, L. (2004). Behavioural responses of dairy cows toward novel stimuli presented in the home environment. *Applied Animal Behaviour Science*, 89(1–2), 27–40. <https://doi.org/10.1016/j.applanim.2004.06.006>

Summary:

Dairy cows are continuously presented with challenging events and novel stimuli. The welfare of these animals depends on the ability to cope with these novelties. The aim of this study was to test cattle within their natural environment, exposing them to novel stimuli to observe behavioral responses. Researchers were also very interested in seeing if there were any detectable patterns across the board of behaviors observed during the presentation of novel stimuli. The study involves subjecting cattle to one of four novel stimuli including new foods, an unknown object (white plastic container), and an unknown human being standing next to them. During the test, behaviors were observed and recorded. The results demonstrated that when cows are presented with an unknown object, they will show several behavioral reactions including sniffing. They would also stand up for longer periods of time and would lick themselves. More of these behaviors were seen when cows were presented with an unknown object and not much stress behaviors were observed with the unknown human being standing next to them. The only behavior observed when cows had an unknown human being next to them was sniffing. This

study is significant as it shows that even in their natural setting, cattle can still experience fear due to novelty. It is also significant as it shows that cattle are not as afraid of being around unknown individuals as not many stress behaviors were exhibited when the unfamiliar experimenter stood by them. However, a small novel object such as the white container was stress-inducing for them. Future studies could explore variables in the duration of exposure to novel stimuli along with changing the types of novel stimuli (novel object of different size, novel interactions with multiple humans) and how that may affect their behavior.

Contribution:

This paper discusses common behavioral responses that can be seen in cattle when they are exposed to novel stimuli. It ties in with my research topic as I am exploring cattle stress within novel and acute stressors. Within the focus of handling, it is informative to know what behaviors to look out for if the cattle will be exposed to unfamiliarity. The findings discussed in this paper are consistent with past studies but is unique as it studies cattle in their home environment and looks at the differences in types of novel stimuli.

Vieira, A. D. P., Passillé, A. M. De, & Weary, D. M. (2012). Effects of the early social environment on behavioral responses of dairy calves to novel events. *Journal of Dairy Science*, 95(9), 5149–5155. <https://doi.org/10.3168/jds.2011-5073>

Summary:

Existing studies point to the fact that a cow's reactive behaviors towards novelty have a lot to do with the environment in which they were raised. This study aimed to test if early housing conditions and ages within the group, could influence a cow's response to a novel situation. Within the study, the cows were divided into experimental groups, the first two being individual housing or pair housing. The other two experimental groups were group housing with all calves of the same age or group housing with one older cow and two other calves of the same age. After a few months, calves were subjected to a novelty test (placing calves with unfamiliar calf) while their behaviors were recorded. The results demonstrate that cow's that spent time developing individually were more reactive during the novelty tested compared to cows raised in the paired-housing system. This could be attributed to heightened anxiety from loneliness when spending lots of time alone/ Additionally, more stress behaviors such as vocalization were found in cows that were grouped with an older cow versus housing groups that contained all young calves. This could be attributed to the young calves getting attached to the older companion and when they are inevitably separated, it causes additional stress. However, the cows who had an older companion with them did show less violent behaviors than those groups with other young calves. This research shows that raising them in typical environments does not properly prepare calves for novel situations and leaves them less able to deal with the introduction of new cows, people and, stressful events in general. Future studies could involve a much longer experiment

conducted during their developmental time or they could test to see if these behaviors can somehow be changed down the road once already instilled.

Contribution:

This article questions some of the current practices that are going on in cattle farms right now. The research proves that the current housing practices could be setting up calves with the inability to effectively survive with novel stressors. I choose this as part of my literature review as my topic was investigating behavioral responses to novel and acute stress behaviors in cattle. This article highlights some key behaviors seen in cattle when they were introduced to environmental and social stressors. It also poses the question of how important the early social environment is and if these behaviors are long-standing.

Hubbard, A. J., Carstens, G. C., Forehand, L., & Daigle, C. L. (2019). The bovine zero maze: Development of a novel fear test for cattle. *Applied Animal Behaviour Science*, 221(3), 104865. <https://doi.org/10.1016/j.applanim.2019.104865>.

Summary:

Previous literature has proven that studying cattle emotional states is challenging considering the limited measures of emotional assessment. One such emotion is their fear which contributes to a large portion of their well-being. The aim of this study was to implement a newly developed fear test called the Bovine Zero Maze test. The researchers hoped that this new test could help accurately measure anxiety or panicked behaviors in cattle while also seeing how useful the test was and if it can be repeated. The Bovine Zero Maze is a track that contains an inner and outer circle. The test begins when the young cow is put in an opening while and watched for ten minutes while they explore. Video cameras are placed to record behaviors such as vocalizations and direction changes and to also measure steps taken. This test was conducted twice to see if it was re-testable. Results show that cattle had decreased vocalizations during the second round of testing, making this measure not repeatable. There was no difference in the total number of steps between the two articles, making this measure repeatable. Habituation is a possible explanation as to why many measures were not re-testable and produced different results during the second test. The study could be a great way to quickly assess distress within cattle by setting up the maze and just focusing on examining the total number of steps taken. Future research directions could look at whether habituation could be used in a constructive manner such as getting cattle more accustomed to novel events and how researchers could go about implementing that.

Contribution:

I choose this article as it introduces a potential test that can be quickly conducted to assess the welfare of cattle. The article was published in 2019, meaning it was a fairly new and innovative

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approach to testing fear and anxiety in cattle. Since emotional testing and monitoring is so difficult with animals as they can not clearly communicate their emotions, having simple tests such as these serves as a good assessment. I would be interested in seeing the results of a third and fourth re-test to see if the steps taken are still repeatable after the second re-test.