Proceedings of the 12th
ISAE North-American
Regional Meeting

May 30-31, 2014
Michigan State University
East Lansing, MI, USA

Organizing and scientific committee:
Janice SIEGFORD, Maja MAKAGON and Nicolas DEVILLERS
Acknowledgements

The organizing committee would like to thank the following persons for their help in organizing the conference and reviewing the abstracts:


Sponsorship for the conference has been generously provided by

MICHIGAN STATE UNIVERSITY

Department of Animal Science

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Extension

College of Veterinary Medicine
# Program Overview

**Friday, May 30th – Brody Center, Michigan State University Campus**

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<thead>
<tr>
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<tr>
<td>10:00 - 12:00</td>
<td>Morning outing: Walk/Jog along the River Trail</td>
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<td>12:00 - 13:00</td>
<td>Registration opens &amp; Poster set-up</td>
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<td>13:00 - 13:15</td>
<td>Meeting opening</td>
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<td>13:15 - 14:15</td>
<td>Keynote Lecture</td>
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<td><strong>Dr. Cheryl MURPHY</strong> (Michigan State University)</td>
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<tr>
<td></td>
<td><em>The Sublethal Effects of Stressors on Fish Behavior and the Link to Population Health</em></td>
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<td>14:15 - 15:00</td>
<td>Oral Session: <strong>Enrichment</strong></td>
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<td>15:00 - 15:30</td>
<td>Coffee break and 1st Poster session</td>
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<tr>
<td>15:30 - 17:00</td>
<td>Oral Session: <strong>Welfare &amp; Behavior Assessment</strong></td>
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<tr>
<td>18:30</td>
<td>Banquet at Harrison Road House</td>
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**Saturday, May 31st – Brody Center, Michigan State University Campus**

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<tr>
<td>09:00 - 10:00</td>
<td>Oral Session: <strong>Feeding Behavior</strong></td>
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<tr>
<td>10:00 - 10:30</td>
<td>Coffee break and 2nd Poster session</td>
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<td>10:30 - 11:00</td>
<td>ISAE Business Meeting</td>
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<td>11:00 - 12:00</td>
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<td>12:00 - 13:00</td>
<td>Lunch</td>
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<td>13:00 - 14:30</td>
<td>Oral Session: <strong>Environment &amp; Housing</strong></td>
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<td>14:30 - 15:00</td>
<td>Coffee break and 3rd Poster session</td>
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<tr>
<td>15:00 - 16:30</td>
<td>Oral Session: <strong>Social Behaviors</strong></td>
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<tr>
<td>16:30 - 17:00</td>
<td>Awards, closing discussion and meeting adjournment</td>
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# General Information

## Contact information

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Map of the Venue and Surrounding Area

1. Brody Hall = Conference venue & dining area (breakfasts & lunches)
2. Kellogg Center = Accommodations
3. Rather Hall = Accommodations
4. Harrison Road House = Friday Banquet venue
5a. Parking ramp (pay); 5b. lot 75 is free on Friday and Saturday, lot 66A is free on Saturday
Oral presentations

Friday, May 30th:  14:15 – 15:00  Enrichment

14:15  Can providing dustbathing substrates in enriched cages for laying hens help to control mite infestations?
Giuseppe Vezzoli and Joy A. Mench
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14:30  Hay bales redirect feather pecking away from conspecifics: The impact of environmental enrichment on laying hen behavior and stress responses
Courtney L. Daigle, T. Bas Rodenburg, J. Elizabeth Bolhuis, Janice M. Siegford
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14:45  Evaluation of chopped straw and aspen shavings as suitable bedding material for fur-farmed American mink (Neovison vison)
Amber H. Lester-Saenz, Dana L.M. Campbell, Jane E. Link and Steven J. Bursian
Page 14  Undergraduate Student Competition

Friday, May 30th:  15:30 – 17:00  Welfare & Behavior Assessment

15:30  Electroencephalography (EEG) and measures of pain in cattle
Kim Drnec, Jonathan Z. Simon and W. Ray Stricklin
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15:45  Validation of triaxial accelerometers to measure the lying behaviour of adult domestic horses
Cordelie C.N. DuBois, Emily M. Zakrajsek, Derek. B. Haley and Katrina Merkies
Page 16  Graduate Student Competition

16:00  The effect of chronic administration of furosemide on the physiology and ingestive behavior of ponies.
Katherine Houpt
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16:15  Trimming tail switches of dairy cows did not affect bacterial counts or udder hygiene
H. DeAnna Ingle, Crista A. Kurman, Randi A. Black, Sara Z. Childers, Maria E. Prado and Peter D. Krawczel
Page 18  Graduate Student Competition

16:30  Characterization of dairy cattle farms according to animal welfare level in the Plains of Bogota, Colombia
Catalina Medrano-Galarza, Aldemar Zuñiga-López and Fredy E. García-Castro
Page 19  Graduate Student Competition

16:45  Behavioral measures identified by dairy professionals to assess dairy cow welfare in Canada
Clémence G.R. Nash, Trevor J. DeVries, Jason B. Coe, Elsa Vasseur, David F. Kelton and Derek B. Haley
Page 20  Graduate Student Competition
### Saturday, May 31st: 9:00 – 10:00  Feeding Behavior

**9:00** Assessing the behaviour and welfare of broiler breeder pullets reared on different feeding schedules  
Brittany R. Lostracco, Tina M. Widowski, Ashleigh M. Arnone and Stephanie Torrey  
*Page 21*

**9:15** The effect of stocking density and feeder space on laying hen-feeding behavior in an enriched cage system  
Rachel A. Shoemaker, Courtney L. Daigle and Darrin M. Karcher  
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*Undergraduate Student Competition*

**9:30** Classifying rangeland-raised Brangus cows into behavioral syndrome groups: A preliminary assessment  
Laura E. Goodman, Andres F. Cibils and Lyndi Owensby  
*Page 23*

**9:45** Behaviour, growth and mortality of newly placed turkey poults  
Colleen Roehrig and Stephanie Torrey  
*Page 24*  
*Graduate Student Competition*

### Saturday, May 31st: 11:00 – 12:00  Learning & Cognition

**11:00** Generalization processes of a previous experience to human in weaned piglets  
Sophie Brajon, Jean-Paul Laforest and Nicolas Devillers  
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*Graduate Student Competition*

**11:15** The animal-machine interface: dairy calves’ adaptation to automated feeders  
Mayumi Fujiwara, Jeffrey Rushen and Anne Marie de Passillé  
*Page 26*

**11:30** Investigating the color and shape preferences of female commercial turkeys  
Victoria P. Spreyer, Marisa A. Erasmus, Janice M. Siegford and Janice C. Swanson  
*Page 27*  
*Undergraduate Student Competition*

**11:45** Operant conditioning of urination by calves  
Alison Vaughan, Anne Marie de Passillé, Joseph Stookey and Jeffrey Rushen  
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### Saturday, May 31st: 13:00 – 14:30  Environment & Housing

**13:00** Sprinkler flow rate affects dairy cattle behavioral and physiological responses  
Jennifer M. Chen, Karin E. Schütz and Cassandra B. Tucker  
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*Graduate Student Competition*

**13:15** The success of hen flight in a commercial aviary system over two flock cycles  
Dana L.M. Campbell, Shelby L. Goodwin, Maja M. Makagon, Janice C. Swanson and Janice M. Siegford  
*Page 30*
13:30 Differences in pre-laying behavior between nest and scratch area layers in large furnished cages  
Michelle E. Hunniford, Stephanie Torrey, Gregoy Bédécarrats and Tina M. Widowski  
Page 31  
Graduate Student Competition

13:45 The days and nights of zoo elephants  
Brian J. Greco, Cheryl L. Meehan, Jen Hogan, Katherine A. Leighty, Jill Mellen, Georgia J. Mason and Joy A. Mench  
Page 32  
Graduate Student Competition

14:00 Behavioral, physical, and production parameters of periparturient dairy cows on pasture and milked with automatic milking systems  
Melissa F. Elischer, Elizabeth L. Karcher and Janice M. Siegford  
Page 33

14:15 Providing portable shades at pasture and their effect on dairy cow behavior at pasture  
Santiago Palacio, Renée Bergeron and Elsa Vasseur  
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Graduate Student Competition

Saturday, May 31st: 15:00 – 16:30 Social Behaviors

15:00 Solitary play in chicks  
Stephanie Bourgon, Margaret Quinton and Alexandra Harlander-Matauschek  
Page 35  
Undergraduate Student Competition

15:15 Changes in leg health and injurious pecking in domestic male turkeys differing in body weights  
Hillary A. Dalton, Benjamin J. Wood and Stephanie Torrey  
Page 36  
Graduate Student Competition

15:30 Identifying behaviours observed during canine resource guarding  
Jacquelyn A. Jacobs, Jason Coe and Lee Niel  
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Graduate Student Competition

15:45 Do laying hens pick on the little guy?  
Samantha L. Kaplan, Courtney L. Daigle and Janice M. Siegford  
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Undergraduate Student Competition

16:00 Mixing strategies for group housed sows: Effects on aggression and productivity  
Megan M. Bouvier, Sarah A. Ethier, Jennifer A. Brown, Yuzhi Z. Li and Yolande M. Seddon  
Page 39

16:15 Why does novelty increase locomotor play in some veal calves but decrease it in others?  
Jeffrey Rushen and Anne Marie de Passillé  
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Posters

Presenting author underlined

Friday, May 30: 15:00 – 15:30 First Poster Session

1 Differences in open field test responses and feather pecking between male and female commercial turkeys
Rachel M. Baumgardner, Marisa A. Erasmus and Janice C. Swanson
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2 We’re all in this together: A multi-species look at lameness assessment
Christopher J. Byrd and Maja M. Makagon
Page 43 Graduate Student Competition

3 Neonatal piglets can differentiate more productive from less productive teats
Nicolas Devillers, Delphine Giraud and Chantal Farmer
Page 44

4 Effect of high dietary fiber fed to pregnant sows on aggressive behavior during mixing
Avi Sapkota, Jeremy N. Marchant-Forde, Brian T. Richert and Donald C. Lay Jr
Page 45

5 University/zoo collaborations: applied ethological research improves the welfare of captive animals and the academic experience for students
Karin E. Jaffe, David Carroll, Daniel Cusimano and Jill Andrews
Page 46

6 What about the other 90%? - A look at working equids (horses, donkeys, mules & hinnies)
Camie R. Heleski and Amy C. McLean
Page 47

7 The impact of stall stocking rate on cow behavior and production in an automatic milking system
Ali A. Witaifi and Janice Siegfoid
Page 48 Graduate Student Competition

8 Using Zoo Studbooks to Analyze the Life History Events of Captive Elephants: Potential Applications for Management and Welfare
Mary Bonaparte-Saller, Natalia A. Prado-Oviedo, Cheryl L. Meehan, Janine L. Brown and Joy A. Mench
Page 49 Graduate Student Competition
Saturday, May 31: 10:00 – 10:30  Second Poster Session

9  The effects of chilled perches on body surface temperature of laying hens exposed to an acute heat episode
Emily A. Liedtke, Patricia Y. Hester, Giuseppe Vezzoli, Richard S. Gates, Stacey A. Enneking, Hang-Wei Cheng and Maja M. Makagon
Page 50  Undergraduate Student Competition

10  Heat abatement on commercial dry lots: Managing resources to improve cattle welfare
Grazyne Tresoldi, Karin E. Schütz and Cassandra B. Tucker
Page 51  Graduate Student Competition

11  How do veterinarians recognize and manage their patients’ fear?
Lauren C. Dawson, Cate E. Dewey, Elizabeth A. Stone, Michele T. Guerin, Lee Niel
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12  Evaluation of the efficacy of a new pheromone product versus placebo in the management of feline aggression in multi-cat households
Theresa L. DePorter, Aurelie Lopez and Elodie Ollivier
Page 53

13  Location of dead and compromised laying hens in an aviary-colony style housing system
Rebecca L. Parsons, Maggie R. Curtis, Joy A. Mench, Darrell Trampel and Suzanne T. Millman
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14  Development of a pig grimace scale for evaluation of pain and analgesia efficacy in neonatal pigs
Abbie Viscardi, Penny Lawlis, Matthew Leach and Patricia V. Turner
Page 55  Undergraduate Student Competition

15  Which is the best chicken shampoo? Preferred dustbathing substrates for aviary-housed laying hens
Samantha L. Dorey, Dana L.M. Campbell and Janice M. Siegford
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16  Methods for measuring fecal cortisol metabolites in domestic ponies (Equus caballus) using enzyme immunoassays
Cordelie C.N. DuBois, Laura H. Graham, Derek. B. Haley and Katrina Merkies
Page 57  Graduate Student Competition
**Saturday, May 31: 14:30 – 15:00  Third Poster Session**

17. **Travel distance and duration of increased locomotion post-weaning in domestic pony foals**  
   Cordelie C.N. DuBois, Kaitlyn J. Marshall, Severine Parois, Derek. B. Haley and Katrina Merkies  
   *Page 58*

18. **Impact of observer presence on milk and feed intake on tie-stall acclimated dairy cattle: A post-hoc analysis**  
   Melissa C. Cornett, Jeffrey M. Bewley and Amy L. Stanton  
   *Page 59  Graduate Student Competition*

19. **Are mules or donkeys better adapted for Egyptian brick kiln work? (Until we can change the kilns)**  
   Ahmed Badr Ali, Mohamed Youssef Matoock and Camie R. Heleski  
   *Page 60  Graduate Student Competition*

20. **Welfare assessment program for gathering wild horses**  
   Kathryn E. Holcomb and Carolyn L. Stull  
   *Page 61*

21. **Using behavioral and genomic tools to identify pigs suited for group living**  
   Kaitlin E. Wurtz, Juan P. Steibel, Ronald O. Bates, Catherine W. Ernst and Janice M. Siegford  
   *Page 62  Graduate Student Competition*

22. **Involving undergraduate students in behavioral research: A possible way to improve understanding and disseminate knowledge**  
   Alexis Hinson, Shelby Goodwin, Kaitlin Wurtz and Janice Siegford  
   *Page 63  Undergraduate Student Competition*

23. **Age cohort behavioral differences in captive reticulated giraffe (Giraffa camelopardalis reticulata) at the Brookfield Zoo, Brookfield, IL**  
   Amy L. Robinson-Junker, Catherine A. Mossman and Jason V. Watters  
   *Page 64  Undergraduate Student Competition*
ABSTRACTS FOR

ORAL PRESENTATIONS
Oral Session: Enrichment

Can providing dustbathing substrates in enriched cages for laying hens help to control mite infestations?

Giuseppe Vezzoli and Joy A. Mench

Department of Animal Science and Center for Animal Welfare, University of California, Davis, CA, USA (gvezzoli@ucdavis.edu, jamench@ucdavis.edu)

A presumed function of dustbathing behavior is to remove ectoparasites. Dustbathing substrates in enriched cages for laying hens might thus offer an alternative to pesticide use for controlling ectoparasites. We investigated the effectiveness of dustbathing substrates for controlling Northern fowl mites in individually caged beak-trimmed White Leghorn hens (N=32). Each cage contained a 32 x 32 cm plastic tray that was either: 1) filled with 1200 g of sand (SAND); 2) empty (CONTROL); 3) covered with AstroTurf (AT); 4) covered with AT on to which 150 g of feed was delivered daily (ATF). AT and ATF were evaluated because of their use in the dustbathing/foraging area of newer enriched cages. Hens were infested with approximately 35 mites at 25 weeks of age. Mite populations were visually estimated weekly using a 0-7 scale. Time spent dustbathing in the tray was video recorded immediately before and after infestation and at 1, 3, 5, and 7 week post-infestation for 2 consecutive days from 1200 to 2000 h. Data were analyzed using a repeated-measures ANCOVA in SAS; dustbathing data reported are back-transformed means. There was a substrate effect on the time spent dustbathing in the trays (F 2,21 = 3.61, P=0.045), with SAND spending more time (11.4 min) than AT (2.4). There was a substrate effect on mite numbers (F 3, 28= 3.72, P=0.02), with ATF having more mites (mean score = 5.3 ± 0.27) than AT (4.2 ± 0.27) and with SAND (4.5 ± 0.27) and CONTROL (4.4 ± 0.27) having intermediate scores. There was no relationship between mite numbers and the time spent dustbathing. Even though SAND was a preferred dustbathing substrate it was not effective for controlling mite numbers. Our data also suggest that the use of ATF in enriched cages might lead to increased mite numbers in infested hens, possibly because the fat content of the feed could contribute to an increase in feather lipids, thus creating a better habitat for the mites.

Graduate Student Competition
Oral Session: Enrichment

Hay bales redirect feather pecking away from conspecifics: The impact of environmental enrichment on laying hen behavior and stress responses

Courtney L. Daigle1, T. Bas Rodenburg2, J. Elizabeth Bolhuis3, Janice M. Siegford1

1 Department of Animal Science, Michigan State University, East Lansing, MI, USA (lyndcour@msu.edu, siegford@msu.edu)
2 Department of Behavioural Ecology, Wageningen Institute of Animal Sciences, Wageningen University, Wageningen, the Netherlands
3 Adaptation Physiology Group, Wageningen Institute of Animal Sciences, Wageningen, University, Wageningen, the Netherlands

Feather pecking (FP) can cause feather loss, resulting in physical injuries, which may lead to cannibalism. FP appears to be a redirection of foraging behavior, which is aggravated when hens have difficulty coping with stress and fear. The serotonergic system (5-HT), along with glucocorticoids (GC), can reflect the hens’ ability to cope with stress and fear and may be correlated with the hen’s pecking behavior. Dynamic environmental enrichment may redirect pecking behavior, alleviate hen injury, and allow expression of natural foraging behavior. Three treatments (a plastic box: BOX; a hay bale of the same size as BOX: HAY; and a negative control with no enrichment: CON) were randomly applied to thirty identical floor pens (10 hens/pen; 10 pens/trt). The number of severe feather pecks (SFP), gentle feather pecks (GFP), aggressive pecks (AP), and enrichment pecks (EP) were recorded from video prior to (d-2; 21wk) and after (d16; 24wk) treatment implementation, as well as when the hens were 27, 32, and 37wk of age. A manual restraint test (MR) was also performed immediately after behavioral observations and levels of blood 5-HT and GC were measured. A Generalized Linear Mixed Model (PROC GLIMMIX) and Tukey adjusted Least Square means determined that at the pen level, treatment did not impact the number of SFP, GFP, or AP. A paired T-test (PROC TTEST) identified differences between the same hens before and after treatment implementation. HAY hens performed more EP than BOX (t25=-7.63, P<0.0001) at d16, 32 and 37wk and gave fewer SFP (t16=2.41, P=0.028) and fewer GFP (t16=2.41, P=0.028) at d16 compared to d-2. Treatment did not affect latency to struggle, latency to vocalize or 5-HT in the MR. However, CON (t25=-2.60, P=0.015) and BOX (t27=-2.04, P=0.051) hens performed more vocalizations during MR on d16 than d-2. HAY hens performed fewer struggles during MR on d16 than d-2 (t27=2.10, P=0.045), and had increased GC (t24=-2.19, P=0.038) levels after treatment implementation. These results suggest that the presence of a hay bale is stimulating and may reduce feather pecking while encouraging hens to redirect their pecking towards a dynamic and rewarding enrichment device.
Oral Session: Enrichment

Evaluation of chopped straw and aspen shavings as suitable bedding material for fur-farmed American mink (Neovison vison)

Amber H. Lester-Saenz¹, Dana L.M. Campbell¹, Jane E. Link² and Steven J. Bursian²

¹ Animal Behavior and Welfare Group, Department of Animal Science, Michigan State University, East Lansing, MI 48824, USA (lesteram@msu.edu, dcampbel@msu.edu)
² Department of Animal Science, Michigan State University, East Lansing, MI 48824, USA (linkj@msu.edu, bursian@msu.edu)

Mink kits are born hairless and immature and the dam must keep them warm and protected, therefore, nesting boxes are essential for successful whelping and kit rearing in farm-raised mink. Nesting boxes are also important for shelter during freezing temperatures. Two studies were conducted to evaluate the suitability of two types of bedding substrate: aspen shavings and chopped straw. For Experiment One, thirty-eight adult natural dark female mink housed at the Michigan State University Experimental Fur Farm were observed through whelping and lactation. We focused on the dams’ ability to manipulate each bedding substrate into a nest using a five-point scoring system (score five being a deep, compact nest with side walls) and their subsequent kit survival and growth. Wilcoxon signed-rank tests showed a significant difference in weekly nest scores over six weeks with shavings nests being manipulated more than straw nests (week one: Z = -4.39, P<0.0001, week three: Z = -1.93, P=0.05, week four: Z = -3.82, P=0.0001, week five: Z = -3.045, P=0.0022, week six: Z = -2.78, P=0.0053). But there was no significant difference between the two bedding groups in overall kit survivability (Z = 0.35, P=0.72) or weights measured at three and six weeks of age as assessed by t-tests (3 weeks: males t₁₀₇ = -0.14, P=0.89, females t₁₀₇ = -0.23, P=0.82; 6 weeks: males t₁₀₇ = 1.56, P=0.12, females t₁₀₇ = -0.25, P=0.80). Significant bedding loss was noted during the weaning period in the shavings group thus Experiment Two specifically compared bedding material loss. We used 51 juvenile males and females weaned from the above dams and housed with either shavings or straw material. Weekly nest checks throughout October and November 2013 showed significantly more bedding had to be replaced in the shavings group as assessed by a one-way ANOVA (F₁,₂₂.₆₅ = 6.37, P=0.0149). This bedding loss has welfare implications for mink during colder temperatures and is an economic concern for farmers needing to replace bedding.

Undergraduate Student Competition
Oral Session: Welfare & Behavior Assessment

Electroencephalography (EEG) and measures of pain in cattle

Kim Drnec, Jonathan Z. Simon and W. Ray Stricklin

Neuro and Cognitive Sciences Program, University of Maryland, College Park, MD 20742, USA.
(kdrnec@umd.edu, jzsimon@umd.edu, wrstrick@umd.edu)

A bovine evoked response potential (ERP) to noxious stimuli was measured using EEG in free-standing Holstein cows (n=5). Laser stimuli (which uniquely excite nociceptors) of varying intensities, equivalent to a pinprick sensation, were administered to the cows’ shoulders while continuous EEG were recorded. Repeated time-locked stimuli were necessary because the statistical development of an ERP requires the recording and averaging of multiple epochs. Behavioral scores were recorded to reflect the degree to which stimuli were experienced as nociceptive. Nociception is the perception of noxious stimuli that might become painful with increased intensity, and underlies pain perception because the same functional peripheral and central nervous systems mediate pain and nociception. Four persons blind to stimulus intensity categorically scored (0-3) behavioral responses (BR) of the cow. BR reflected: zero (0) no obvious stimulus perception, one (1) a skin twitch, two (2) a deeper muscle twitch, foot stomping or looking at the shoulder, and three (3) evasive behaviour, respectively. A score of three was considered unacceptable and stimulus intensity was reduced. Data were band-passed filtered (0.1-20 Hz) and wavelet denoised. Epochs (~500ms to 1500ms post stimulus) were averaged to derive the ERP. ERP peak amplitudes (PA) were measured (µV) and subjected to a Student t-test. ERP derived from trials of BR 2/3 were significantly larger ($t_4=4.6; P<0.05$) than ERP from trials of BR 0/1 demonstrating that ERP amplitude reflects degree of nociception. Human ERPs have been shown to be useful in pain studies. Human and cattle ERPs share important commonalities, suggesting that the two species process nociception, and by extension, pain, similarly. We contend that the ERP methodology from neuroscience, when combined with an ethological understanding of animals, has the potential to provide a greater understanding of pain in animals, possibly leading to a method to objectively quantify animal pain.
Oral Session: Welfare & Behavior Assessment

Validation of triaxial accelerometers to measure the lying behaviour of adult domestic horses

Cordelie C.N. DuBois¹, Emily M. Zakrajsek¹, Derek. B. Haley² and Katrina Merkies¹

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Examining the characteristics of an animal’s lying behaviour, such as frequency and duration of lying bouts, has become increasingly relevant for animal welfare concerns. Triaxial accelerometers have the advantage of being able to continuously monitor an animal’s standing and lying behaviour without requiring live observations or video recordings. Multiple models of accelerometers have been validated for use in monitoring dairy cattle; however, no units have been validated for use in equines. Onset Pendant G data loggers were tested on two mature Standardbred horses for a period of five days. Data loggers were attached vertically to a single hind limb of each of horse and set to record position every twenty seconds. Horses were monitored by two independent observers via live observations during the day and video recordings during the night. Data collected from the loggers was converted and edited using a macro program to calculate the time the animal spent lying down by hour and by day as well as the number of lying bouts. A paired t-test compared lying bout duration calculated from video observations and data loggers. All lying events occurred overnight (3 to 5 lying bouts per night per horse). The data loggers did not distinguish standing hipshot from standing square. There was no significant difference between the video observation recordings and the output from the data loggers (t₁₄ = -1.0732, P=0.301) and the macro was able to tabulate the correct number of lying bouts with predictability, sensitivity, and specificity all greater than 99%. This study validates Onset Pendant G data loggers in adult horses to determine the frequency and duration of standing and lying bouts when set to sample and register readings at twenty second intervals. The validation of automated data recording devices such as the Onset Pendant G data logger will assist in reducing the time expenditure of live observation and improve our understanding of equine time budgets with respect to standing and lying behaviours.

Graduate Student Competition
Oral Session: Welfare & Behavior Assessment

The effect of chronic administration of furosemide on the physiology and ingestive behavior of ponies.

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The use of drugs in performance horses is controversial. A drug that is administered legally to almost all racing horses, ostensibly to prevent exercise induced pulmonary hemorrhage, is the diuretic furosemide (Lasix®). The effect of long-term use of this drug on the behavior and physiology of horses has not been assessed. The objectives of this study were to measure salt and water intake as well as sodium and water balance in ponies treated chronically with furosemide. The salt and water intake of ponies (n= 6) was measured for three weeks before and three weeks during treatment with furosemide at a dose 0.5 mg/kg/day. Salt was available as a salt block for an hour/day. Water was available from a bucket 24 h/day. The ponies were kept in tie stalls, fed grass hay, and released daily in a grassless paddock. Fecal dry matter was measured before and during furosemide treatment. Urine volume and urine sodium content were measured for three days before, during, and after furosemide treatment while the ponies were housed in metabolism stalls. Wilcoxon signed rank tests were used to assess significance. NaCl intake was 7.87 ± 2.2 g/day before furosemide treatment and 20.3 g ±1.82 during furosemide treatment (t= 5.65 P<0.002). Water intake was 8.9 ± 1.0 kg/day before furosemide treatment and 11.0 ± 0.7 kg during furosemide treatment (t= 3.90, P<0.01). Urine volume was 2.1± 0.1 l /day before treatment, 6.6 ± 0.5 l /day during furosemide treatment and 3.2 ± 0.5 l/day after furosemide treatment (P<0.01). Urinary sodium excretion was 48.6  ± 13.4 meq /day before furosemide treatment, 360.8 ± 79.46 meq/day during furosemide treatment and 98.5 ± 23.0 meq after treatment (P< 0.03). Fecal dry matter content was 30.2 ± 0.9% before treatment and 31.3 ± 1.2% during treatment. (t= 0.96, P >0.05). Sodium loss increased markedly during furosemide treatment and, despite an increase in sodium intake, the ponies were in negative sodium balance. Use of diuretics has major effects on equine physiology and behavior.
Oral Session: Welfare & Behavior Assessment

Trimming tail switches of dairy cows did not affect bacterial counts or udder hygiene

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The objective of this study was to determine the effect of tail trimming of dairy cows on teat end bacterial counts and udder hygiene. Cows (n=102) from the Middle Tennessee Research and Education Center (MTREC; n=49) and the East Tennessee Research and Education Center (ETREC; n=53) were blocked by days in milk, milk production, and parity then assigned to: 1) treatment (removal of the switch and hair on the lower tail) or 2) control group (unaltered switches and tails). A subset of cows (MTREC: control n=5, treatment n=5; ETREC: control n=6, treatment n=5) were used to assess the bacterial populations on the teat ends. A cotton swab was run across the left front teat end before milking on d 0 (assignment of treatment), d 32 and d 64 and cultured using MacConkey and Edwards agars within 24 h of sampling. Visual evaluation of udder hygiene was recorded for all cows on the same days. All data were analyzed using GLIMMIX procedure (bacterial data) and FREQ procedure (hygiene data) of SAS. Bacterial data were log10 transformed with back-transformed means reported. There was no treatment effect for swabs cultured using MacConkey ($F_{1,16}=0.01; P=0.91$), but farms differed ($ETREC=12.1±4.0$ CFU/mL and $MTREC=2.7±1.2$ CFU/mL; $F_{1,16}=8.39; P=0.01$) and a farm by time interaction was evident ($F_{2,20}=10.43; P<0.001$; ETREC: d 0: 27.1±12.3 CFU/mL, d 64: 9.9±4.8 CFU/mL; MTREC: d 0: 0.2±0.5 CFU/mL, d 64: 9.3±4.7 CFU/mL). No treatment effect was evident on the cultures using Edwards agar ($F_{1,16}=1.91; P=0.19$), but data indicated a time by treatment interaction ($F_{2,22}=7.74; P=0.003$). Mean counts on Edwards were higher ($F_{1,16}=11.83; P=0.003$) on ETREC (102.2±32.2 CFU/mL) than MTREC (20.1±7.1 CFU/mL). There was also an interaction between farm and treatment ($F_{1,16}=4.91; P=0.04$). ETREC had higher means for treatment (231.3±107.1 CFU/mL) than MTREC (17.1±8.4 CFU/mL). Hygiene scores did not differ ($Cochran-Mantel-Haenszel_3=4.05, P=0.26$). These data indicate that overall farm management may be more important for control bacterial counts on teat ends or udder hygiene compared to tail status.

Graduate Student Competition
Oral Session: Welfare & Behavior Assessment

Characterization of dairy cattle farms according to animal welfare level in the Plains of Bogota, Colombia

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In Colombia, dairy farms are mainly pasture-based. Keeping cows on pasture does not necessarily mean good welfare; many factors can affect cows’ quality of life in extensive systems. Currently, free trade agreements have aroused concern due to the high food quality, safety and welfare standards required to access international markets. Developing welfare assessment protocols is necessary to help producers improve cows’ welfare. The objective of this study was to evaluate the level of welfare on dairy cattle farms in the Plains of Bogota, Colombia. An observational study was done on 25 farms (two visits per farm – summer/winter 2013). We evaluated 27 variables, 13 resource-based and 14 animal-based (for 8 variables, 100% of lactating cows per farm were assessed, for 6 variables the proportion of cows assessed depended on the herd size, ranging from 35-100%). Behavior measurements taken were individual flight distance and reactivity of cows during milking. The former was measured by the distance a human could approach before the cow moved away. The latter was evaluated using a four-point numerical scale (1=calm to 4=aggressive). The mean (±SD) flight distance was 2.6±1.2 m (min=0; max=9.2 m). The behavior of cows during milking was mainly calm (90.9% of all evaluated animals; 6.6%: agitated; 2%: uneasy; 0.6%: aggressive). Nine variables (5 animal-based and 4 resources-based) had a high percentage of non-compliance; it is necessary to take action to reduce subclinical mastitis (mean prevalence was 31.2%), lameness (16% of farms had prevalence over 10%); and to improve cleanliness and fly control. Additionally, it is important that farms provide shade in all paddocks (only 24% of the farms provided shade), and regularly clean water troughs and paths (68% and 56% of farms had no clean water troughs and paths, respectively). These results were evaluated by a panel of experts who classified farms as excellent, good, fair or bad welfare. Forty-eight percent of the farms received a “Good” welfare classification and 52% were classified as “Fair”. This study is the first of this kind in Colombia, and could be used as a guide to promote discussions about the importance of welfare assessment schemes on farms.

Graduate Student Competition
Oral Session: Welfare & Behavior Assessment

Behavioral measures identified by dairy professionals to assess dairy cow welfare in Canada

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Behavioral measures for the assessment of animal welfare have recently had a lot of attention in the scientific community. In dairy, behavioral measures such as lying time, flight distance and feeding behavior have all been assessed for scientific validity and used for welfare assessments. However, it remains unclear whether dairy professionals (e.g., producers, veterinarians, etc) are aware of these measures as welfare indicators. This question was addressed as part of a national Canadian on-line survey undertaken from September 1 to November 15 2013 in French and English. Canadian dairy professionals such as producers, government workers and veterinarians were recruited with an open recruitment design through e-mail lists, advertisements in industry publications and word of mouth. The survey included open- and close-ended questions relating to respondent demographics (n=15) and use of welfare measures (n=4). A total of 113 surveys were completed and 7 professional groups were identified: 47 surveys were completed by veterinarians, 30 by extension workers, 28 by dairy producers, 18 by researchers, 8 by government workers and two by “others”. Years of dairy experience among participants was 20.6 years (range 2-59 years). Of the respondents, 99% specified they would use animal-based measures, 86% specified they would use resource-based measures, 79% specified they would use management-based measures and 71% specified they would use all three to assess dairy cow welfare. The most common animal-based measure offered by respondents was lameness (99/113), followed by body condition score (89/113) and injury (60/113). When looking specifically at behavioral measures, lying time (45/113), flight distance (12/113) and dry matter intake (6/113) were most commonly offered by respondents as important indicators of welfare. These results demonstrate that participating dairy professionals were aware of the most well-publicized behavioral measures for the assessment of dairy cow welfare; however identification of other varieties of behavioral measures, such as flight distance, remains limited. These findings helps us better understand the knowledge base Canadian dairy professional possess in order to develop programs that are easily adoptable to assess the welfare of dairy cattle on farm.

Graduate Student Competition
Oral Session: Feeding Behavior

Assessing the behaviour and welfare of broiler breeder pullets reared on different feeding schedules

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Commercial broiler breeders are feed restricted to maintain healthy weights. However, these severe feed restriction practices lead to chronic hunger. In North America, feed restriction is often managed through non-daily feeding regimens due to their purported success in improving flock uniformity. Yet, little is known about the welfare of breeders on these feeding frequencies. Our objective was to compare the behaviour of breeder pullets fed on daily, ‘4/3’ (4 days on feed, 3 non-consecutive days off feed each week) or ‘5/2’ (5 days on feed, 2 non-consecutive days off feed each week) feeding schedules. In groups of 5, 75 Ross 708 pullets were reared from 1 day until 12 wk. Beginning at 3 wk, pullets were fed the same restricted amount of feed per week, but at one of the three frequencies. Video cameras were used to record behaviour for on- and off-feed days every other week for 3 hr beginning at feed delivery. The numbers of birds drinking, foraging, walking and inactive were determined by scan sampling every 2 min. A feed intake motivation (FIM) test was performed at 6 and 12 wk, whereas birds were given ad libitum feed for a 48 hr period, and their feed intake was determined as a measure of hunger. Data were analyzed with mixed model ANOVA with repeated measures. Daily-fed birds had the lowest intake in the FIM test at 12 wk (F₁,₁₀ = 42.83, P=0.001; Daily, 158+5g/bird/d; 4/3, 192+5g/bird/d; 5/2, 174+5g/bird/d), although all birds consumed 2-3 times their recommended feed allotment. Feeding was the most common behaviour for all treatments during on-feed days, although there was an interaction between treatment and week (F₈,₄₈ = 4.03, P=0.001) with 4/3 and 5/2 birds increasing time spent feeding with age, while daily birds decreased feeding behaviour after 5 wk. On days when non-daily treatments were not fed, foraging was the most frequent behaviour for 5/2 and 4/3 birds (43.3±2.8% and 51.7±4.0% of scans, respectively), whereas feeding remained the most common behaviour performed by daily birds (31.7±2.6% of scans). Overall, there was little evidence to support one feeding regime over the other in terms of reducing hunger.
Oral Session: Feeding Behavior

The effect of stocking density and feeder space on laying hen-feeding behavior in an enriched cage system

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Stocking density (SD) in enriched colony cages is important for laying hen welfare and farm management. SD can impact the hen’s ability to feed influencing hen production and well-being—along with impacting feeder accessibility. Our objective was to determine the effect of feeder space (FS) on laying hen-feeding behavior across nine enriched colony cages. Three FS (3 cages/FS; 9 total cages) were observed providing hens either HIGH (10.59 cm/hen), MID (9.50 cm/hen), or LOW (7.52 cm/hen) linear inches of FS. We hypothesized that LOW hens would perform the least amount of anticipatory feeding behavior. HIGH hens were also expected to have the largest proportion of the population feeding simultaneously because they had the highest amount of FS per hen. The daily feeding schedule consisted of four feedings (FEED – feed chain travels 360 degrees around housing system) and six stimulations (STIM – feed chain travels 180 degrees around housing system). Instantaneous scans were taken from video recordings of fifty-nine week old W-36 laying hens on d0, d1, d2, d8, d9, d15, and d16 to identify the proportion of hens that were engaged in feeding behavior during each FEED and STIM. Observations were taken before chain movement (t-5min), at chain movement (t0min) and after chain movement (t5min, t10min) for each FEED and STIM. A Generalized Linear Mixed Model (PROC GLIMMIX) with a binomial distribution assessed whether FS (LOW, MED, HIGH), feeding type (FEED or STIM), day (d1, d2, d8, d9, d15, d16) or interactions impacted feeding behavior. Neither density (F²,6 = 0.38, P=0.70), type (F¹,545 = 0.00, P=0.97), day (F⁵,545 = 0.08, P=0.99) nor any two or three-way interaction impacted the proportion of hens feeding simultaneously. Furthermore, a Generalized Linear Mixed Model (PROC GLIMMIX) with a binomial distribution assessed whether anticipatory behavior differed among the densities. No differences (P>0.05) were observed among densities for either feeding types at t-5, t0, t5 and t10. These results suggest that feeder space does not directly determine the proportion of hens able to feed simultaneously or influence anticipatory behavior in an enriched cage system during either FEED or STIM.

Undergraduate Student Competition
Oral Session: Feeding Behavior

Classifying rangeland-raised Brangus cows into behavioral syndrome groups: A preliminary assessment

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Consistent behavioral differences among individuals across situations/time are known as behavioral syndromes. We previously demonstrated that supplement consumption rate (SCR) was a dependable criterion to classify Hereford-Angus crossbred cows into behavioral types (individuals with different behavioral syndromes). Our objective was to determine whether SCR could also be used to classify desert-raised Brangus cows into behavioral types. We determined SCR on 99 adult Brangus cows by placing animals in individual stalls and measuring their consumption rate of 1 kg of cotton seed cake, a familiar supplement. Twelve cows with fastest (n=6) and slowest (n=6) SCR were subjected to controlled behavior tests to measure three personality traits: shyness-boldness (reaction to a simulated predator and to human handling); exploration-avoidance (reaction to novel food); and social rank (proportion of feed bunk interactions won). Shyness-boldness and exploration-avoidance tests were repeated on three consecutive days, whereas social dominance tests were repeated on seven different days. Variables analyzed were: number of times animals were observed moving, scanning, or feeding in an arena with a predator decoy (every 15s for 10min); chute exit velocity (s), avoidance of novel feed (orts, g), and social rank. We conducted Pearson correlations, cluster and discriminant analyses using PROCs CORR, CLUSTER, DISCRIM and STEPDISC in SAS 9.3. SCR was positively correlated (n=12) with time spent feeding in an arena with a predator decoy (r=0.57; \( P=0.05 \)). Avoidance of novel feeds was positively correlated with vigilance (times observed scanning) (r = 0.61, \( P=0.03 \), and chute exit velocity tended to be positively correlated with avoidance of the predator decoy (r = 0.56; \( P=0.057 \)). Cluster analysis classified cows into two behavioral types which did not coincide with SCR groups (fast vs. slow supplement eaters). A discriminant function with three predictors associated with shyness-boldness and exploration-avoidance behaviors discriminated cows into detectably different behavioral type groups (\( F_{3, 8}=38.4; P<0.01 \)). When cross-validated, the discriminant function correctly classified 11 of the 12 cows. Although we were able to classify animals into distinct behavioral type groups on the basis of a suite of personality traits, SCR was not a dependable criterion to detect Brangus cows with contrasting behavioral syndromes.
Oral Session: Feeding Behavior

Behaviour, growth and mortality of newly placed turkey poults

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Understanding feeding behaviour in turkey poults is important as turkeys are susceptible to early mortality and poor initial feed intake for reasons that are not well understood. Literature reports estimate that 2-5% of placed poults die due to poor feed intake. Our objective was to study the development of turkey poult feeding behaviour and early mortality rates, with a focus on the effect of hatch age (HA). Nine hundred and sixty female turkey poults were randomly assigned to 24 pens (40 poults/pen). The study was conducted as a completely randomized block design with a factorial arrangement of two HA (early or standard) and 3 diets (control, modified Ca/P 1, and modified Ca/ P 2). Early behaviour time budget was determined by scan sampling video recordings every 10 min for the first 24 h after placement. Body weights were measured at 0, 3 and 7 d. Mortality and flips were recorded as they occurred, and post-mortem analyses were done to determine cause of death. Data were analyzed using the mixed model procedure where HA and diet were considered fixed effects and block was considered random. Behaviour during the first 24 h was similar between HA; poults spent 2.5% of the time drinking (F₁, 19=0.09; P=0.76), 7% feeding (F₁,18=0.67; P=0.42), 12% active (F₁,21=0.34; P=0.56) and 80% inactive (F₁,14=1.69; P=0.21). There was no effect of diet or HA on latency to feed or drink. Growth variables were not affected by HA. However, there was a diet effect on bodyweight (F₂,17=3.61; P=0.049) and feed intake (F₂,17=7.79; P=0.004) from 3 to 7 d, with increasing Ca/P resulting in heavier wt and higher FI. Overall mortality rate (4.1%) was not influenced by HA (F₁,18=1.03; P=0.32). Infections were the leading cause of mortality (64.1%), with starve-outs accounting for 25.6% of mortality, regardless of treatment. Twelve birds were found flipped (1.3%), with no difference among treatments. These results indicate that failure to establish feeding behaviour within the first 24 h as the primary cause mortality and poor feed intake may be overestimated in published literature as early poult mortality was due to factors other than feeding behaviour establishment.

Graduate Student Competition
Oral Session: Learning & Cognition

Generalization processes of a previous experience to human in weaned piglets

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This study aimed at measuring the influence of the valence of previous experience with humans on generalization processes in piglets. After weaning, 48 groups of three piglets were subjected to two consecutive conditioning periods of 5 days comprising 18 5-min sessions each. For each session, a human gave a reinforcement each time a piglet approached: gentle contacts (+) or capture attempts (-). Two modalities varied between each period: the human who gives the experience (H1 or H2) and the valence of the experience (positive (+) or negative (-)). Two consistent and four inconsistent treatments were given: H1+H2+, H1-H2-, H1+H2-, H1-H2+, H1+H1-, H1-H1+. Reactivity tests were performed after each conditioning with familiar and unknown (UH) humans: the human sat passively for 5 min. Thereafter, he attempted to touch the snout and the ears of piglets and a reactivity score was given (0: no withdraw, 4: no contact). Percentage of time near the human and reactivity scores were analyzed using mixed models. In case of non-normality, Kruskal-Wallis tests were performed for validation. Following the first conditioning, piglets generalized their experience regarding their similar percentage of time in contact with H1 and UH (H1+: 78.9±2.9% vs. 75.6±5.0%, F₁,₃₈=0.36, P=0.553; H1-: 1.6±1.1% vs. 6.5±4.6%, F₁,₃₆=1.53, P=0.225). However, H1+ piglets were able to discriminate both humans as they were more reactive to the UH approach (F₁,₃₈=73.13, P<0.0001). Following both conditioning periods, H1+H2+ piglets had similar reactivity scores between H1 and UH (F₁,₁₄=1.27, P=0.278) but were more reactive with UH than with H2 (Χ²₁=5.62, P=0.02). Regarding inconsistent treatments, the percentage of time in contact with UH depended of the last experience when the same human gave both treatments (H1-H1+: 89.0±3.6%, H1+H1-: 40.4±11.5%, F₁,₁₄=16.34, P=0.001), but not when humans were different between periods (H1-H2+: 69.5±12.0%, H1+H2-: 64.6±6.5%, F₁,₁₃=0.14, P=0.714). Piglets that received an inconsistent treatment had reactivity scores comparable to H1-H2- piglets when confronted with UH (F₄,₃₄=1.52, P=0.219) suggesting that the effects of a negative early experience cannot be offset with a positive early experience. To conclude, piglets can discriminate familiar from unknown humans, but they also generalize their experience to human depending on the context.

Graduate Student Competition
Oral Session: Learning & Cognition

The animal-machine interface: dairy calves’ adaptation to automated feeders

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Feeding dairy calves with automated feeders has likely welfare advantages but calves’ difficulties adapting to feeders may reduce these advantages. We examined factors influencing calves’ adaptation to automated milk feeders. In Exp. 1, 77 calves were introduced to group pens with automated feeders 6d after birth. Latency to first voluntary milk ingestion, milk intakes and weight gains were recorded. A large variation was found in the latency to the first voluntary milk ingestion (9.5h – 238.5h) and this was negatively correlated with 14d milk intake (r = -0.29, P =0.02). In Exp. 2, 55 calves were housed for 8-14d after birth either individually or as pairs in double pens and then transferred to group pens. There were no differences between the types of early housing on the latency to first voluntary milk intake after group housing (Wilcoxon test: P>0.10). The latency to first milk ingestion was negatively correlated with milk intake over 6d in the group pens (r = -0.38, P =0.03). When data from the two experiments were combined, latency to the first milk intake was negatively correlated with age at time of introduction (r = -0.23, P =0.009) and duration of standing (measured by accelerometers) in the days after birth (r = -0.21, P =0.02). There are large differences between calves in how quickly they learn to use automated milk feeders and slow adapting calves can have reduced milk intakes. Pair housing immediately after birth did not help. Younger calves at the time of introduction are more likely to take longer to adapt but many 6d old calves adapt quickly, especially those that show high vigour (i.e. can stand for longer) in the first week after calving. To profit from potential advantages of automation, we need to understand the factors that help animals learn to use these machines.
Oral Session: Learning & Cognition

Investigating the color and shape preferences of female commercial turkeys

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Public concern for the welfare of poultry continues to increase. In particular, the turkey industry has continued to grow over the last thirty years, necessitating better and more efficient methods of production, while maintaining and improving turkey welfare. Early mortality due to transport and subsequent starvation of commercial turkeys is a major concern among commercial turkey producers. One possible method to help reduce early mortality due to starvation is to promote feeding by using colors or shapes that attract poults to the feeder. The objective of this study was to determine whether day-old commercial female turkeys preferred a particular color or shape. Pairs of turkeys (n=82) were placed in a grey 30cm³ test box. The test box contained a test sheet consisting of 270 colored dots (1 cm diameter) of six colors (red, orange, yellow, green, blue, and purple) or black shapes (star, cross, serrated circle, square, hexagon, and triangle) randomly scattered on a grey background. The first peck at a colored dot on the test sheet by a poult was recorded as its color or shape preference for the pair of poults. Test order was randomized and balanced for color and shape preference. The chi-square test was used to analyze turkeys' color and shape preferences. A total of 25.6% of turkeys did not choose a particular color, but of the 74.4% that did peck at a colored dot, a significant percentage (36.6%) preferred the color green, versus red (4.9%, $\chi^2_{1}=25.1$, $P<0.0001$), orange (7.3%, $\chi^2_{1}=20.5$, $P<0.0001$), yellow (13.4%, $\chi^2_{1}=11.7$, $P=0.0006$), blue (6.1%, $\chi^2_{1}=22.7$, $P<0.0001$), or purple (6.1%, $\chi^2_{1}=22.7$, $P<0.0001$). Of the 71.6% of poults that selected a shape, a significant percentage chose the serrated circle (35.8%) versus triangle (3.7% $\chi^2_{1}=26.3$, $P<0.0001$), star (11.1%, $\chi^2_{1}=13.8$, $P=0.0002$), square (14.8%, $\chi^2_{1}=9.4$, $P<0.0001$), cross (0%, $\chi^2_{1}=35.3$, $P<0.0001$), or hexagon (6.2%, $\chi^2_{1}=21.4$, $P<0.0001$). Turkey welfare may be improved by incorporating their preference for green and circular shapes into their environment. Further research is necessary to determine if changing the color of the feed or the feeder to match the turkey’s color preference promotes feeding and reduces early mortality.

Undergraduate Student Competition
Oral Session: Learning & Cognition

Operant conditioning of urination by calves

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Accumulation of feces and urine in dairies is a cause of health concerns and environmental problems. Cattle are often assumed to lack control over defecation and urination. We tested whether calves could be taught to urinate using classical or operant conditioning. Twenty-four calves were assigned as treatment or control; exp. 1 (n=12, median age, range = 39, 31-50d), exp. 2 (n=12, median age, range = 50, 29-64d). Experiment 1 used classical conditioning. During the training period (d1-5), treatment calves were placed in the stall and injected IV with diuretic (Salix, Intervet Inc. 0.5 mL/kg BW) to rapidly induce urination (mean latency = 4min 23s). During the test period (d6-15), calves were held in the stall for 10 min without diuretic, and urinations, defecations and vocalisations were recorded. The procedure was identical for control calves using saline instead of diuretic. In the test period, classically conditioned calves did not urinate more than controls (\(P=0.41, t=6.17; \text{mean±SE: 4.30±1.28 vs. 6.00±1.41 for treatment and control calves, respectively}\)). In experiment 2, calves were trained using operant conditioning. On training days, operant calves were placed in the stall, received diuretic IV and, upon urination, were released to receive approx. 250 mL milk. On test days, calves were placed in the stall but not given diuretic. Calves that urinated received the milk reward but calves failing to urinate within 15 min were given a 5 min “time out”. The following day, calves which had urinated in the stall were given another test day (no diuretic) and those which had not another training (diuretic) day. Yoked controls were never given diuretic but held in the stall for the same amount of time and received the same “reward” or “punishment” as their matched calf. Urinations, defecations and vocalisations occurring in the stall on test days were compared between operant calves and controls. Calves trained using operant conditioning had a higher frequency of urinations in the stall than their controls (\(P=0.03, t=3.32; \text{means±SE = 5.25±0.95 vs. 2.32±0.52 for treatment and control calves, respectively}\)). It may be feasible to train cattle to urinate in specific areas using operant conditioning.
Sprinkler flow rate affects dairy cattle behavioral and physiological responses

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Sprinklers reduce heat load in dairy cows, but little is known about the optimal amount of water for cooling, or about behavioral responses to this resource. Two studies with lactating cows assessed how flow rate affected 1) effectiveness of sprinklers and 2) cattle preferences. In Exp 1, 19 cows received all 4 treatments repeatedly in a crossover design (1 treatment/d): Control (0 L/min; 3 d total) or sprinkler (0.4, 1.3, ≥ 4.5 L/min, 6 d each). Cows were restrained for 1 h/d; spray was delivered in 4 cycles (3-min on, 12-min off). Cooling effectiveness was evaluated using body temperature (BT) and respiratory rate (RR), by taking the differences between measurements recorded before spray cycle 1 (-2 min) and after cycle 4 (49 min). In Exp 2, 18 cows were tested in a shaded Y-maze, with 3 pairwise comparisons between either Control (0 L/min) and/or 0.4 or 4.5 L/min sprinklers. For each pairing, cows chose once daily (12 min/d) for 8 consecutive d. In Exp 1, BT and RR differed among all 4 treatments: as flow rate increased, both measures decreased (F3,351=60.5, P<0.01). However, for BT there was an interaction with weather [volume*air temperature (AirT), F3,353=4.7, P<0.004]. At AirT < 28°C, both sprinklers ≥1.3 L/min kept BT from rising (F3,25=8.1, P≤0.003), whereas at AirT ≥ 32°C, only the ≥4.5 L/min sprinkler did (F3,45=46.2, P≤0.001). In Exp 2, cows tended to choose 0.4 L/min over Control 69% of the time (SE:9.3%, Wilcoxon S=38, P=0.096), and showed no preferences in the other comparisons (4.5 L/min: 58% vs. Control, SE:9.4%; 42% vs. 0.4 L/min, SE:9.6%; S≤14, P≥0.552). However, preferences for 4.5 L/min over Control tended to depend on weather (Z=1.8, P=0.065): at AirT ≤ 24.9°C, the probability of choosing 4.5 L/min was 0.40, whereas at AirT ≥ 30.0°C, this increased to 0.74. In conclusion, sprinkler flow rate influenced both cooling effectiveness and preferences. In warmer weather, sprinklers ≥ 4.5 L/min were most effective, and were preferred over shade alone. However, more work is needed to fully understand how cattle choose to use cooling throughout the day.

Graduate Student Competition
Oral Session: Environment & Housing

The success of hen flight in a commercial aviary system over two flock cycles

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Egg producers in North America are phasing out conventional cages and moving towards alternative housing systems aimed at improving hen welfare and addressing consumer concerns. One such system is an aviary-style where birds are provided a tiered cage and floor litter area. This open space encourages expression of behaviors not seen in cages, including flight, which is important for strengthening bones. But imperfect flight might cause injuries such as keel bone breaks if hens cannot control landings accurately. To assess the potential implications of flight in alternative systems we evaluated the accuracy of flight by Lohmann white laying hens in a commercial aviary in the United States. Video recordings were taken from four aviary sections at peak lay, mid lay and end lay across two flock cycles, which were analyzed separately due to substantial differences in flock management. These sections contained either single cage rows housing 852 hens at population, or double cage rows housing 1704 hens at population. Behavioral observations were made of all flights throughout the day and success or failure of landing noted. Failed landings were defined as a hen slipping on the ground, colliding with other hens, or crashing into any part of the cage structure. The results showed that 9.1% of all flights failed in Flock 1 and 21% for Flock 2. Proportionately, more failed landings occurred in double sections for Flock 2 ($\chi^2 (1, N = 4692) = 285.47$, $P<0.0001$) but not Flock 1 ($\chi^2 (1, N = 755) = 1.37$, $P=0.24$). Of all failed flights, there were more crashes into cage structure at peak lay for Flock 1 ($\chi^2 (2, N = 145) = 6.14$, $P=0.0465$) and Flock 2, including more slipping on the ground at peak lay for Flock 2 ($\chi^2 (4, N = 988) = 196$, $P<0.0001$: for both types of failure). These results indicate potential for hen injuries in aviary systems resulting from clumsy flight and have implications for hen welfare and optimal system design and management. This study was a part of the Coalition for a Sustainable Egg Supply (CSES) project.
Oral Session: Environment & Housing

Differences in pre-laying behavior between nest and scratch area layers in large furnished cages

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A greater number of eggs laid in the nest is often considered to be an indicator of nest acceptability and sometimes as an indicator of welfare for laying hens housed in furnished cages. However, more “settled” pre-laying behavior (more time sitting at oviposition site, fewer sitting bouts, less locomotion, less aggression) may give a better indication of hen welfare regardless of where they lay their eggs in the cage. Our objective was to compare pre-laying behavior of hens laying in different locations within large furnished cages (only 77±0.6% nest use). LSL-Lite hens were housed in groups of 60 in 12 cages (750cm^2/hen). Each cage was furnished with a nest area (red plastic curtains, yellow plastic mesh floor, 94cm^2/hen) and a scratch area (smooth red plastic scratch mat, 42cm^2/hen) at opposite ends of the cage. Four hens/cage were wing tagged at 18 weeks, then observed at start of lay (week 20; n=48) and at peak lay (~week 32; n=48). Behavior was recorded during live observations from lights-on at 05:00 h until oviposition. Criteria for analysis included an observation duration >1h prior to oviposition in either the nest (within curtained area; n=47, >1 obs from all 12 cages) or scratch (on scratch mat; n=22, >1 obs from 10 of 12 cages). Behavior data from the final hour before oviposition was transformed when necessary before Mixed model ANOVA, repeated measures (SAS 9.3); cage was included in the model. Scratch layers sat longer at the oviposition site than nest layers (25.4±3.0 min vs. 17.3±1.9 min; F_{1,58}=11.98, P=0.0010) but had more sitting bouts (12.5±1.5 vs. 8.0±0.8; F_{1,58}=4.62, P=0.0358). Scratch layers also expressed more bouts of aggressive behavior than nest layers (18.9±5.6 vs. 5.3±1.7; F_{1,58}=10.92, P=0.0016). However, neither the duration (12.6±1.3 min vs. 10.0±1.6 min; F_{1,47.9}=0.47, P=0.4965) nor number of bouts (29.4±2.4 vs. 29.0±3.9; F_{1,58}=0.09, P=0.7637) of pre-laying locomotion (walking + searching) differed between nest and scratch layers. Although most hens laid in the nest area, the behavior of scratch layers did not clearly indicate that nest layers were more settled and scratch layers were more restless during the hour before oviposition in large furnished cages.

Graduate Student Competition
Oral Session: Environment & Housing

The days and nights of zoo elephants

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Stereotypies are one of the most commonly used indicators of compromised animal welfare. Zoo elephants often perform stereotypies, but little is known about the factors that contribute to the performance of these behaviors. As part of a study funded by the Institute of Museum and Library Services, we collected behavioral observations of elephants at 42 North American zoos, and analyzed the demographic and environmental variables that contributed to stereotypy performance. Eighty-nine elephants (46 African, 43 Asian) were each videoed for approximately 12 hours during the day (zoo operating hours) in the winter and summer of 2012. Nocturnal behavioral data were live-collected for 10 hours per elephant during non-operating hours from a subset of 32 elephants (19 African, 13 Asian) during the fall of 2012. Rates of behavior as percentages of visible active-behavior scans were calculated using 5-min scan samples. Stereotypy was the second most commonly performed behavior (after feeding), with elephants performing stereotypies an average of 16% of scans during the day and 25% at night. We then developed predictive models evaluating risk factors for stereotypy rate. These models were fitted with generalized estimating equations and used repeated measures negative binomial regression. Five variables contributed to stereotypy risk during the day. Spending time in mixed-sex groups (P<0.04, RR=1.01), as well as the life-history characteristics of experiencing deaths of other elephants at the zoo (P<0.01, RR=1.06) and transfers between institutions (P<0.01, RR=1.17), increased risk. Spending more time with elephants under eight years old (P<0.01, RR=0.98) and in varied social groupings with unique social partners (i.e., social experience) (P=0.03, RR=0.82) both reduced risk. At night the number of transfers experienced (P<0.01, RR=1.28) and the amount of time an elephant spent confined indoors (P<0.01, RR=1.02) increased risk, while social experience (P=0.02, RR=0.71) corresponded with reduced risk. Age and sex had no effect in either model, but Asian elephants were at greater risk. These results show that life-history and confinement stressors increase stereotypy rate risk in elephants, while more complex social environments reduce stereotypy rate risk. Thus, efforts to reduce stereotypy in zoo elephants should focus on these factors.

Graduate Student Competition
Oral Session: Environment & Housing

Behavioral, physical, and production parameters of periparturient dairy cows on pasture and milked with automatic milking systems

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The periparturient period (PPP), three weeks prior to and three weeks following calving, is a time of great physiological and behavioral change for dairy cows. To date, little research has explored how automatic milking systems (AMS) combined with pasture-based diets affect cows during the PPP. The aim of this study was to characterize the welfare and health of cows in a pastured-AMS dairy during the PPP to elucidate the impact of this system. Twenty-eight (19 Friesian (F) and 9 Holstein (H)) multiparous cows (average parity: 2.64±1.10) were enrolled approximately 21d prepartum through 21d postpartum. Body condition score (BCS), gait score (GS), and lying times (LT) were assessed during the PPP (-21, -14, -7, 1, 7, 14, and 21 days relative to calving (DRTC)), adding milk yield (MY) and body weight (BW) postpartum. Data were analyzed using PROC MIXED with the main effects of breed and DRTC examined for BCS, GS, and LT. Breed, DRTC, and milking frequency (MF) were the main effects examining postpartum data. Breed impacted GS (F₁,26=30.50, P<0.01; H: 2.26±0.13; F: 1.41±0.09) and LT (F₁,16=4.82, P=0.04; H: 9.44±0.36 h; F: 8.42±0.29 h), but not BCS during the PPP. DRTC impacted GS, LT and BCS with GS increasing over time (-21d: 1.60±0.13; 21d: 2.07±0.12; F₆,₁₅₁=4.83, P<0.01), while LT (-21d: 11.00±0.70 h; 21d: 7.22±0.61 h; F₆,₈₄=4.80, P<0.01) and BCS (-21d: 3.25±0.07; 21d: 2.82±0.07; F₆,₁₅₁=29.18, P<0.01) decreased. GS and BCS changed, but remained in a healthy range (GS < 3.0; BCS = 3.0). DRTC and breed remained significant postpartum; GS increasing; BCS, LT, and BW decreasing. MY was the only parameter significantly impacted by MF (F₄,₆₁=3.97, P=0.0063; 2x: 22.97±3.27 kg; 3x: 25.74±3.25 kg). MF was important in several interactions (e.g., breed and MF for MY, F₃,₆₁=4.61, P<0.01; BW, F₃,₆₁=4.49, P<0.01). These results indicate that pastured-AMS multiparous cows experienced physiology changes in GS, BCS, LY during the PPP and BW post-partum, however, changes remained in ranges considered to be normal for a lactating cow.
Oral Session: Environment & Housing

Providing portable shades at pasture and their effect on dairy cow behavior at pasture

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The presence of shade can influence the behaviour of dairy cattle in temperate Canadian summers. The goal of the experiment was to investigate the effect of access to shade, provided with a portable structure (blocking 80 % of UV), on the behaviour of dairy cows. Over 8 weeks, 24 lactating Holstein cows were separated into two treatment groups, one with access to shade and one without access to shade (control), with a total of 6 field sections (3/treatment) and 4 cows/field section. Behaviours (drinking, lying, grazing, other, and whether each behavior was performed under the shade or not) of both treatment groups were recorded using instantaneous scan sampling every 5min for 3h a day during the hottest part of the day (1130-1530h) 3d/week from July-August 2013. Ambient temperature and humidity were automatically recorded with data loggers at 10-min intervals. Weekly average (±SD) temperature, relative humidity, and temperature humidity index (THI) during the hottest part of the days were 27.75±4.51, 57.81±13.92, and 76.12±5.69, respectively. Differences between treatments by week were analyzed using the Generalized Linear Mixed model (PROC GLIMMIX) with cow as random effect and treatment as fixed effect. Cows without access to shade spent up to 6.42 times more time drinking (LS-Mean±SE % of observation time; shade 3.94±1.82, no shade 25.30±1.82, F<sub>1,260</sub> = 68.93, P<0.0001) and lied down up to 1.75 times less (31.24±4.27) than cows with access to shade (17.80±4.27, F<sub>1,260</sub> = 4.95, P<0.05). Cows without shade grazed up to 1.5 times less (shade 22.27±2.63, no shade 14.65±2.63, F<sub>1,260</sub> = 4.91, P<0.05) only when the THI was above their comfort threshold (≥72) past the hottest part of the day (week 2). Cows sought shade when made available, but spent less than half of their time in the shade (40.81±37.37), with the exception of week 2 when most of the time was spent under the shade (74.34±28.61) (Mean±SD). Cows sought shade at pasture when given the opportunity. However, cows without access to shade altered their behaviour and drank more as well as lied down less in order to properly cope with the potential heat stress.

Graduate Student Competition
Oral Session: Social Behaviors

Solitary Play in Chicks

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Solitary play is likely to identify children with behavioural disorders including problems related to under-controlled, impulsive, or aggressive behavior. Included in this category is attention deficit hyperactivity disorder (ADHD). It was suggested that feather pecking in laying hens represents an animal model for ADHD. We hypothesized that offspring of laying hens selected for high (H) feather-pecking activity perform higher rates of solitary play behaviour than birds selected for low (L) feather-pecking activity. In groups of 10, 60 one-day-old H birds and 60 one-day-old L chicks were kept in identical floor pens littered with a mix of straw and wood shavings under conventional management conditions. On 2 consecutive days during weeks 2-7 behavioural video observations were performed to quantify juvenile solitary play. Play behaviour was considered as any sequence that contained some or all of the following characteristics: repetition, incomplete, quick, exaggerated sequences; and that lacked final consummatory acts. Data were analyzed using PROC GLIMMIX (SAS 9.3). The number of juvenile running events—spontaneous running in circles or in straight line—was not different between the H and L chicks (22.7±2.0 vs. 23.4±2.0; F1,7=0.06 P=0.8). The number of juvenile hopping events—chicks pushing off with both feet simultaneously and flapping their wings—was higher in H than in L chicks (24±1.9 vs. 17±1.4; F1,49=9.35 P=0.004). The number of times an inanimate object (straw) was dropped and picked up multiple times, and the number of times an object was dropped and picked up while the bird was running was greater in H than in L chicks (1.5±0.3 vs. 0.7±0.2; F1,59=4.75 P=0.033). Taken together, H birds performed higher rates of solitary play. Further research is warranted to determine whether there is an association between chick’s solitary play and under-controlled or aggressive behavior later in life.

Undergraduate Student Competition
Oral Session: Social Behaviors

Changes in leg health and injurious pecking in domestic male turkeys differing in body weights

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Injurious pecking in turkeys is a serious welfare and economic issue in commercial production. Yet, very little is known about the development of the behaviour, and whether it relates to physical characteristics such as body weight or leg health. The objective of this study was to investigate if there was a relationship among body weight, leg health, and injurious pecking over time in adult male turkeys. Beginning at 11 wk of age, a total of 50 tom turkeys were allocated to 1 of 3 treatments based on body weight: heavy (BW:8.217±0.152kg), mixed (BW:7.543±0.165kg), or light (BW:7.139±0.157kg). Turkeys were housed in groups of 8-9 birds (2 replicates per treatment) and weighed and scored weekly for plumage condition (separate scores for head, neck, back, wings, and tail) and leg health (gait, footpad condition and cleanliness, and number and severity of deviated toes). Data were divided into three periods: 11-13, 14-17, and 18-21 weeks of age, and analyzed with a mixed model procedure in SAS. With time, gaits worsened ($F_{1,117}=32.61$, $P<0.0001$) and birds had more deviated toes ($F_{1,68}=316.26$, $P<0.0001$) and a greater severity of toe deviations ($F_{1,48}=161.54$, $P<0.0001$) across all weight classes. All birds showed worse foot cleanliness over time ($F_{1,111}=45.41$, $P<0.001$), which may have led to the increase in footpad health problems ($F_{1,58}=11.84$, $P<0.002$). Pecking injuries to the head ($F_{1,118}=19.43$, $P<0.0001$) and neck ($F_{1,90}=4.64$, $P<0.035$) became more prevalent after the first period, whereas pecking injuries to the back ($F_{1,66}=13.92$, $P<0.0005$) and tail ($F_{1,74}=69.79$, $P<0.0001$) increased significantly in the final period. As birds grew heavier, signs of injurious pecking in domestic male turkeys increased, while leg health deteriorated. However, early bird weights were not predictive of leg health and destructive pecking behaviour later in life.

\textit{Graduate Student Competition}
Oral Session: Social Behaviors

Identifying behaviors observed during canine resource guarding

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Threats or aggressive behaviour in relation to valued food or objects, often termed resource guarding (RG), is a common form of canine aggression. It is a normal behaviour but is often deemed unacceptable by pet owners due to its potential to inflict harm. Anecdotally there are behavioural indicators of RG that precede potentially harmful aggressive behaviour but these have yet to be examined in the scientific literature. This information could help pet owners recognize RG at an earlier stage and apply interventions to prevent escalation. Companion animal behaviour experts (n=85) were invited to participate in a Delphi survey to identify behaviours associated with canine RG. The Delphi survey method involves repeated stages of consultation with participants, wherein each round of questions is based upon previous responses. A 42% and 80% response was achieved in the initial and second stage, respectively. Thirty-seven unique behaviours were initially reported. This list was returned to participants in stage 2 for comment on expected observed frequency. Agreement was defined as ≥ 70% consensus. Body tension (81%), freezing (75%), and facial tension (70%) were agreed by experts to always or often occur during RG events. Lip licking (78%), tail held high (75%), and piloerection (70%) were agreed to sometimes be displayed suggesting that specific context and individual characteristics may play a role in the behaviours observed. To confirm the behaviour frequencies reported by experts, videos of dogs of various breeds performing resource guarding were collected (n=10). Body tension and freezing behaviours were observed in 90% of the dogs recorded. Facial tension and lip licking were difficult to observe from video recordings, and thus both behaviours require further investigation. The tail was held high in 70% of dogs; 30% of dogs had a neutral or tucked tail. Interestingly, piloerection was never observed although this behaviour may have occurred but not been visible in the short hair dogs (n=7). With the exception of piloerection, these results suggest that observed behaviours are in agreement with expert consensus. Data collection is ongoing and future analysis will examine whether distinct behavioural profiles exist, with concomitant performance of particular behaviours.

Graduate Student Competition
Oral Session: Social Behaviors

Do laying hens pick on the little guy?

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Establishing a social hierarchy is a natural phenomenon in flocks of laying hens, and socially subordinate hens have been observed to be more frequently on the receiving end of aggressive social interactions- which could impact their welfare. If body weight (BW) at a young age is predictive of aggressive behavior throughout the hen’s lifetime, laying facility operators might better be able to implement management practices that could reduce undesirable pecking behaviors. For this study, aggressive behaviors of laying hens fitted with a sensor across three rooms (n = 135 hens/room) were recorded. In each room, 10 hens were fitted with a sensor to individually identify specific individuals across time. The sensors were attached with a nylon figure eight harness around the wings and custom fit for each hen’s unique size. Video observations were conducted on the 30 sensor hens during two 30-minute sessions (09:30 – 10:00, 15:30 – 16:00) when the hens were 11 and 52 weeks. The times chosen for data collection were selected because hens have been observed to walk more frequently during those periods and would subsequently have a greater opportunity for social interactions. Aggressive interactions involving a sensor hen were recorded along with whether the harnessed hen was the aggressor or recipient. In addition to behavioral observation, each harnessed hen’s BW was recorded at 11 and 52wk after the observations were taken to determine whether there was a relationship between BW and aggressive interactions. This repeated measure design was analyzed with a Mixed Model (PROC MIXED) and identified a positive relationship between body weight and the log-transformed number of pecks given ($F_{1,18}=4.62; P=0.0454$), but that BW did not have an impact on the log-transformed number of pecks received ($F_{1,41}=0.94; P=0.3384$). These results suggest that, regardless of age, hens with higher BW tend to be more aggressive, though not necessarily towards low BW hens. Furthermore, BW does not appear to characterize hens that would be recipients of aggression. Therefore future studies could further investigate whether weight may be a valuable tool in attempting to limit aggression in flocks of laying hens.

Undergraduate Student Competition
Oral Session: Social Behaviors

Mixing strategies for group housed sows: effects on aggression and productivity

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Breeding stalls are commonly used for sows from weaning until five weeks after breeding. However, a number of countries have banned or are phasing out stall use completely. Mixing sows can cause social stress and injury, which can negatively affect sow welfare and productivity. This study compared three mixing schedules on sow aggression and performance. Sows were housed in free-access stall group housing (14 sows/pen, 2.23 m²/sow). Treatments were studied in six replicates and consisted of: i) early mixing (EM) - sows mixed into groups at weaning; ii) late mixing (LM) - sows stall-housed at weaning, mixed into groups at five weeks gestation; iii) pre-socialisation (PS) - sows mixed into groups for two days after weaning (PS1), then stall housed for breeding and re-mixed at five weeks gestation (PS2). All sows were locked out of stalls except for feeding. Following mixing, behaviour was continuously recorded from 0-48 hours, and the total frequency and duration of aggressions recorded. Breeding performance was recorded. Preliminary results (three replicates: n=126, 42/treatment) show the total duration of aggression was low, ranging from 8 to 24mins per pen per 48h. Results (observations over 48h) show a tendency for reduced total incidences of head to head fights in PS2 (EM: 34, LM: 34, PS1: 29, PS2: 9; F₃,₆ = 3.52, P=0.08), but no difference in the number of threats made (EM: 208, LM: 183, PS1: 182, PS2: 112; F₃,₆ = 0.95, P>0.05), or the total duration of aggression (EM: 1243s, LM: 1209s, PS1: 1154s, PS2: 697s; F₃,₆ = 1.16, P>0.05). The wean-to-service interval was similar for all treatments (EM: 4.6d, LM: 4.5d, PS: 4.9d, pooled SD 2.1), however numerically the EM group had the lowest conception rate (EM: 88%, LM: 93%, PS: 95%; F₂,₄ = 0.24, P>0.05). Initial results suggest that no treatment was better at reducing mixing aggression. While aggression was low in duration, it may be enough to affect productivity. The lower conception rate of EM sows suggests social stress may occur in the weeks following breeding. While the PS group had the highest conception rate, repeated mixing aggression suggests that two mixings may be sub-optimal for welfare.
Oral Session: Social Behaviors

Why does novelty increase locomotor play in some veal calves but decrease it in others?

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Locomotor play by calves is increased by novelty, which appears to contradict the suggestion that locomotor play is a sign of good welfare since novelty usually produces fearfulness in animals. We hypothesized that calves responding to novelty most with exploratory behaviour would show more locomotor play, while those responding to novelty with signs of fear would show less. In two experiments, we examined the locomotor play of 48 veal calves placed for 15 min in a novel arena (11 X 3.2 m) and measured the frequency of jumping (locomotor play) and the frequency of sniffing (as a measure of exploration) and vocalization, defecation, and the latency to enter the arena (as measures of fear). Vocalizations were classified either as onomatopoeically-named “moos” or “baa-ocks”. In exp. 1 (6 weeks of age), the jumping was correlated with sniffing ($r = 0.46; P<0.05$) and negatively correlated with the latency to enter the arena ($r = -0.64; P<0.01$). Defecation was not correlated with jumping. In exp. 2 (11 weeks of age), sniffing was positively correlated with jumping ($r = 0.51; P<0.001$), while mooing vocalizations were negatively correlated ($r = -0.35; P<0.05$). In contrast, the “baaock” vocalizations were positively correlated with jumping ($r=0.35; P<0.01$). Jumping increased with age (Wilcoxon test; $P<0.001$), as did the frequency of sniffing (Wilcoxon test; $P<0.001$), and the size of the change with age in jumping was correlated with the size of the change in sniffing ($r = 0.54; P=0.01$). The effects of novelty and age on locomotor play appear to be mediated by the calves’ levels of exploratory behaviour, with calves that show more exploration doing more play. Among younger calves, fear reduces playfulness, but the increase in locomotor play with age does not appear to be due to a reduction in fearfulness.
ABSTRACTS FOR
POSTERS
Poster 1

Differences in open field test responses and feather pecking between male and female commercial turkeys

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Feather pecking (FP) results in carcass and tissue damage, and is a welfare concern of commercial turkey production. Contributing factors to the development of FP in turkeys are currently unknown, although correlations have been found between fear responses and propensity to develop FP in chickens. The objectives of this study were to 1) examine sex differences in fear using the open field (OF) test, a test commonly used to assess fear, and 2) evaluate associations between FP and turkeys’ OF responses. Turkeys (Hybrid Converter) were housed in groups of 20 - 22 in 4 pens and video recorded at 11 days old. Instantaneous scan samples were conducted at 5 min. intervals to identify birds that developed FP (PECK) and birds that did not (NPECK). At 4 and 5 weeks, respectively, males (N=56) and females (N=57) were individually tested in an OF test arena (2.74 x 2.74 m, divided into 81 squares) for 10 min. Behavior was video recorded and analyzed for ambulatory latency, vocalization latency, number of steps taken, defecations, vocalizations produced, and squares entered. Latency measures were compared between sexes and PECK and NPECK birds using the LIFETEST procedure in SAS. Differences in the numbers of steps, squares, vocalizations and defecations were analyzed using the Mann Whitney U test. Mean (± SE) latency to ambulate was longer for males (300.9 ± 29.0 sec) than females (211.3 ± 29.1 sec). Males (156.8 ± 27.2 sec) also took longer to vocalize than females (40.6 ± 10.7 sec). All other OF responses (median and interquartile range) were higher for females than males (number of steps: 43, 22-115 vs. 20, 0-74, U=2685, P=0.047; number of squares: 9, 3-28 vs. 3, 0-18, U=2851.5, P=0.047; number of vocalizations: 484, 337-638 vs. 229.5, 77-398, U=2369.5, P<0.0001). OF behavior did not differ between PECK and NPECK birds. Results reveal that male and female turkeys differ in vocalization and ambulatory behavior, suggesting that males and females differ in fear responses. However, fear and FP do not appear to be related because no significant differences were found between turkeys that developed FP and turkeys that did not.
Poster 2

We’re all in this together: A multi-species look at lameness assessment

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Lameness is an issue of both reduced animal welfare and significant economic cost to the producer. Gait and posture scoring systems are among the most popular methods of lameness assessment across agricultural species. Their popularity is due in part to their low cost and ease of implementation on-farm and in research settings. However, these systems have been criticized for their subjective nature and low reliability. Additionally, scoring systems are often limited in their ability to detect lameness at an early stage and their categorical arrangement does not account for individual behavioral variation. Inclusion of quantitative measures, such as force or stride characteristics, can help address these concerns while increasing objectivity. We review methods of lameness assessment used across species, highlight areas where detection of lameness could be enhanced, and discuss how increased information sharing among researchers can lead to improvements in lameness assessment methodologies. For example, while they are not commonly used in poultry, kinematic measurements, such as the measurement of differences in body center of mass movement, have been proposed as possible means of lameness detection in equine. Recent advances in kinematic technology may allow for similar types of measurements to be used in poultry, thereby contributing to the growing body of information on lameness assessment in this species.

Graduate Student Competition
Neonatal piglets can differentiate more productive from less productive teats

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This study aimed to determine whether piglets have the capacity to detect their dam’s most productive teats. Eight first-parity sows had over half of their teats blocked with tape (Blocked) so that only 6 were functional (Functional) during the first lactation. During the second lactation, all teats of the same sows were available to a litter standardised to 8 piglets. In second lactation, piglets were weighed at 2, 4, 7, 14, 21 (weaning), 35 and 56 days of age and nursing bouts were observed on day 2 for 24 h. For each teat, frequency and duration of fights, occupation rate (% of time occupied during nursing), and number of piglets using the teat were recorded. A preference for a teat was defined as suckling it for more than 50% of ejections over 24 h. The effect of the type of teat (Functional vs. Blocked) on their use during the second lactation was analysed using the MIXED procedure of SAS. Considering productive nursings only, the number of fights per day (mean ± SEM; Functional: 8.4 ±1.4; Blocked: 4.0 ±1.3; P=0.006), average duration of fights (Functional: 19.7 ±2.9; Blocked: 11.7 ±2.5 sec; P=0.08), occupation rate (Functional: 59.8 ±2.2; Blocked: 43.3 ±1.9 %; P<0.001) and number of piglets using the teat per day (Functional: 1.9 ±0.1; Blocked: 1.6 ±0.1; P=0.05) were greater for teats that had been suckled previously. The treatment of preferred teat was Functional for 37.5% and Blocked for 37.5% of the piglets. Piglets preferring a Functional teat were heavier on days 7 (231 ±62 g; P=0.01), 14 (686 ±170 g; P=0.007), 21 (890 ±188 g; P=0.003), 35 (1153 ±358 g; P=0.02) and 56 (2242 ±680 g; P=0.02) compared with piglets preferring a Blocked teat. These data show that piglets were able to distinguish between previously used and unused teats, and that they competed for access to previously used teats. Published results using the same experimental design demonstrated that use of a teat in first lactation increases its milk production during the second lactation. It can therefore be concluded that piglets are able to detect and prefer more productive teats.
Poster 4

Effect of high dietary fiber fed to pregnant sows on aggressive behavior during mixing

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Increased dietary fiber could increase the level of satiety and reduce aggressive behavior of pregnant sows when they are mixed. Sows (parity 1-6) were moved into individual crates (0.61m×2.13m) 7-14 d post-breeding and fed treatment diets (Control, Resistant Starch, Beet Pulp, Increased Feed Intake, and Soy Hulls+Fat diets). The control diet and other diets contained 184.7 g/d and ~350 g/d neutral detergent fiber, respectively obtained from different sources. A total of 100 sows (5 sows/treatment/replication×5 treatments×4 replications) were used. After 21 d in crates, sows were group-housed in pens (2.13m×3.05m mixing area and five 0.61m×2.13m crates) for 3 days and videotaped. Later, recorded videos were analyzed to calculate the duration of aggression every hour for 4 h after mixing (at ~1200 PM) and every hour for 4 h after the sows were fed (at ~0715 AM) on d 2 of mixing, considering each pen as an experimental unit. Duration of aggression was the time from when a sow initiated fighting by biting, head knocking or pushing another sow until sows separated and stopped fighting. Duration of aggression was analyzed for effect of diet and hour of mixing using PROC GLM and LSMEANS in SAS 9.3. On d 1, duration of aggression was not affected by diet or diet×hour interaction (all P>0.05). However, through the LSMeans separation, sows fed the Control treatment tended (P<0.10) to spend more than twice as much time in aggressive interactions compared to sows fed Resistant Starch and Soybean Hulls+Fat diets. Sows exhibited a longest duration of aggressive behavior during the first hour after mixing in comparison to the 2nd, 3rd and 4th hours post-mixing (328.6, 59.4, 69.0 and 15.1 seconds, respectively, SE=37.2, P<0.0001). On d 2, duration of aggressive behavior 4 h post-feeding was not affected by diet, hour nor diet×hour interaction. In small groups of 5 sows per pen, most of the aggression due to mixing may occur within the first 4 h post-mixing. There may be some effect of diet on the duration of aggressive interactions during mixing, however, more data are required to validate this possibility.
Poster 5

University/zoo collaborations: applied ethological research improves the welfare of captive animals and the academic experience for students

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Applied ethology is often associated with improving the health, safety and well-being of companion, laboratory and/or farm animals. Ethological research can also help zoos improve the welfare of captive exotic animals. While zookeepers have intimate knowledge of animal management and care, they may lack the time and/or expertise to develop and carry out large-scale behavioral research. On the other hand, local universities may have students interested in ethological research, but these students may not be able to afford field schools and may not be interested in studying farm or lab animals. This poster highlights potential benefits of collaborative research for zoos and university students, exemplified by brief discussions of three on-going projects in which Sonoma State University students are integral members of applied ethology research teams at the San Francisco Zoo and Safari West Wildlife Preserve, including: a comparison of mandrill behavior pre- and post-enrichment to gauge effects on social interactions, hair-plucking, and enclosure use; observations of aggression in an all-male group of ex-laboratory squirrel monkeys; and research on the effects of cross-fostering in African antelope. Since the Sonoma State University Primate Ethology Research Lab shifted to an applied focus in the summer 2011, undergraduate participation in ethological research has increased more than 10-fold (from one student in fall 2011 to 13 students in spring 2014). When asked, students indicate that they are more interested in ethological research when they feel their participation directly benefits their study subjects. In the case of the squirrel monkeys, our research shows that aggression decreases after initial introductions and is much lower than initially feared (2%-4% of the activity budget). These results may reassure other zoos that housing all-male groups of ex-lab squirrel monkeys is possible, making retirement to zoos a viable option to euthanasia. Lastly, students gain valuable research experience that they cannot obtain in a classroom, including learning data collection techniques, performing analyses, and writing up and presenting their results. These experiences make them attractive candidates for graduate school. Of the six undergraduates in the lab from January-December 2013, three of the four who applied have been accepted into graduate programs.
Poster 6

What about the other 90%? - A look at working equids (horses, donkeys, mules & hinnies)

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There are ~ 59 million horses worldwide and 54 million donkeys/mules/hinnies. To the surprise of many North American owners, approximately 90% of these equids perform essential work in developing areas of the world, often laboring under difficult conditions. Due to concerns about the welfare of working equids and interest in enhancing their welfare, the authors have assessed welfare parameters in over 1000 working equids in Brazil, Mali and Mexico. Detailed welfare/behavioral assessments (e.g. body condition score, an equid’s response to a person’s approach) have been made on ~25% of these animals. Welfare challenges across these locations have been surprisingly similar. Animal based measures: low body condition scores, insufficient hydration, harness/saddle/tethering lesions, and lameness are all commonly seen in these locations. In southern Brazil, we observed that 74% of surveyed horses were “thin” or “very thin” (≤ 3 on the Henneke 1-9 scale); in Mali 41% of surveyed donkeys were “thin” or “very thin”. Work-related lesions (e.g. harness lesions, knee lesions from falling when overburdened) are frequently observed (ranging from 40% in Malian donkeys to 96% in Brazilian cart horses). A recent trip to rural villages in Mexico found open lesions on 50% of equids: lips (due to bit fit or misuse), chin groove (due to metal, prong style curb straps), forerib area (due to harsh cinch materials, poor saddle fit) and withers (due to poorly fitted harness/saddle or overloading). Noticeable lameness is another problem (≥ Grade 3 on AAEP lameness scoring system; 30% in Brazilian cart horses, 17% in Malian donkeys). Resource based measures: lack of nutrients, water, parasite control, vaccination protocols and poorly designed carts/harnesses are all common issues (e.g. 0% of surveyed owners of Brazilian cart horses were providing salt, dewormer or vaccines). In many cases, reactive care has been the common intervention strategy; i.e. NGOs working to help treat wounds, deworm, provide vaccines. Only recently have proactive intervention strategies started gaining a foothold; e.g. providing educational programs on proper feeding, behavior, humane training, and fostering local community harness makers and farriers. Implementation research is needed to assess the efficacy of various welfare enhancement protocols.
Poster 7

The Impact of Stall Stocking Rate on Cow Behavior and Production in an Automatic Milking System

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The number of stalls provided per cow (stocking rate) on dairy farms is important because overstocking may have impacts on animal welfare if there are not enough comfortable lying spaces. Research has shown the impact of high stall stocking rates on cows in parlor-milked systems; however no studies have examined stocking rate for cows milked with automatic milking systems (AMS). Though cow behavior is no longer synchronized by a fixed milking routine in AMS, cows may still wish to sleep synchronously. Therefore, it is important to examine the impact of stall stocking rate on dairy cows in AMS to determine effects on production and behavior. This experiment examined the effect of reducing the number of stalls available per cow on displacement behavior at an AMS dairy farm. Each of two pens contained 60 cows/pen and 58 free-stalls. The impact of stocking rate was examined using 3 treatments: 1) 1:1 treatment with 58 stalls available for 60 cows, 2) 1:1.2 treatment with 50 stalls available for 60 cows, and 3) 1:1.5 treatment with 40 stalls available for 60 cows. Each treatment was applied for one week in a randomized order that was different for each pen, with a one-week washout period between treatments. Observations from video recordings of displacement behavior were made on the last two days of each treatment week to examine whether cows were displaced from stalls. The effect of stocking rate on displacement of cows in each pen was analyzed using PROC MIXED (SAS 9.4). Results revealed significantly more displacements (mean ± SE) in the 1:1.5 treatment (38.25±3.4) than during other treatments (1:1.2 treatment: 23.9167±3.3974 displacements; 1:1 treatment: 27.08±3.4 displacements; t₁₇=8.38; P<0.0001). This study is the first to examine the impact of stall stocking rate on displacement from stalls in an AMS, and shows that reducing the stocking rate to 1:1.5 (stalls:cows) may not be optimal for cow behavior. Results may help producers determine optimal stocking rates, allowing them to optimize facility design and management in ways that maintain good welfare and production without wasting space or resources.

Graduate Student Competition
Using Zoo Studbooks to Analyze the Life History Events of Captive Elephants: Potential Applications for Management and Welfare

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Studbooks contain demographic information for zoo species, and have traditionally been used to manage captive breeding programs. Because they can contain decades of information, they can also be valuable tools for assessing past experiences of long-lived animals. We used studbook data to examine life history events of 250 Asian and African elephants kept in 72 North American zoos. For each individual, we calculated the numbers of times per year of studbook records for that individual that they: 1) were transferred between facilities; 2) sired offspring or calved; 3) experienced births or deaths in the herd. For each captive-born animal, we also determined the proportion of its life spent at the same facility as its mother before transfer of either (N=65). Mann-Whitney tests were used to assess the effects of sex and species on these variables. The only effect of sex was on exposures to births (W=6302.5, P=0.003), with more exposure of males (male: median=0.253, IQR=0.282, CI[0.170,0.391]; female: median=0.142, IQR=0.145, CI[0.113,0.180]). This could indicate that the few zoos that house males do so for breeding purposes. African elephants were transferred more often than Asians (W=8953.5, P=0.04; African: median=0.098, IQR=0.071, CI[0.090,0.110]; Asian: median=0.082, IQR=0.074, CI[0.071,0.094]). Since transfers can occur for breeding purposes and Asians experienced more siring/calving events than Africans (W=6799.5, P=0.027; Asian: median=0.068, IQR=0.033, CI[0.052,0.083]; African: median=0.053, IQR=0, CI[0.041,0.063]), the difference in transfers may reflect zoos’ attempts to increase breeding success of Africans. Asians also experienced more deaths than Africans (W=6563.5, P=0.032; Asian: median=0.187, IQR=0.236, CI[0.156,0.217]; African: median=0.118, IQR=0.133, CI[0.100]). This may reflect a demographic skew in the captive Asian population (i.e. more older Asian elephants). While there were no sex or species effects on time spent with mother, only 60% (21/35) of captive-born females are currently at the same facilities as their mothers, whereas in the wild females remain with their natal herd for life. These descriptive analyses provide a glimpse into how captive elephants have been managed in North American zoos. Because potentially stressful events (e.g. facility transfers) can have long-lasting impacts on the welfare of individuals, analysis of studbook data can assist zoos in making future management decisions.

Graduate Student Competition
The effects of chilled perches on body surface temperature of laying hens exposed to an acute heat episode

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Heat stress can have detrimental impacts on the biological functioning and production of laying hens. The effect of chilled perches on the body temperature of hens exposed to an acute heat stress episode was evaluated. White Leghorn hens were assigned in groups of nine hens per cage to one of three housing treatments: cages with no perches (NP), cages with standard perches (SP), and cages with perches cooled by chilled circulating water (CP). Each treatment was assigned to a bank of six (three rows of two) cages (76 x 52 x 48 cm). At 27 weeks of age the hens were exposed to an acute heat stress episode (AHSE), which lasted from 10:30 h until 14:30 h. Infrared (IR) images of each cage were taken between 14:30 h and 14:50 h three days prior to and on the day of the AHSE. The average room temperatures at the time of data collection were 26.8°C and 33.6°C, respectively. Minimum, maximum, and average comb temperatures were recorded from one hen per cage. Rectal temperatures were additionally collected from two hens per cage during the AHSE. Data were analyzed using ANOVA in SAS. Hens had higher comb temperatures (F1,22 = 148, P<0.0001) after the AHSE than 3 days prior. For example, the maximum comb temperature averages (± SE) were 41.4°C (± 0.16) and 39.3°C (± 0.15), respectively. Treatment had no effects on the minimum, maximum, or average comb temperatures. However, there was a treatment effect on rectal temperatures (F2,6 = 5.36, P=0.046). NP had higher rectal temperatures (42.4 ± 0.08) than SP (42.1 ± 0.08) and CP (42.1 ± 0.08). A possible reason for the discrepancy between the measures is that combs are not covered by plumage and are likely to be more sensitive to environmental temperature changes than rectal temperatures. Additionally, evaluating combs at the end of the 4 h AHSE may have been too late to observe treatment differences. Future evaluations will focus on changes in comb temperatures before, during, as well as after the AHSE.

Undergraduate Student Competition
Heat abatement on commercial dry lots: Managing resources to improve cattle welfare

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Dry-lots or open-lots systems are the primary housing system for 20% of US lactating dairy cows. In this housing system, common in hot and arid areas, cows are directly exposed to environmental conditions. Despite that, little is known about how different cooling methods can mitigate heat load and improve welfare in dairy cattle housed in lots. During summer 2013, nine commercial dairy dry lots were assessed in California aiming to describe how cooling strategies (shade, water, fans) affect cattle responses to heat load using behavioral (shade use, feeding) and physiological (respiratory rates, panting scores) measures. On each dairy, the high-producing group [160±60 cows (80–260), 37.7±4.7 kg milk/day (30.8–47.5); mean±SD (range)] was observed for 6 hours between 1100 to 1900 h for 3 consecutive days; air temperature and humidity averaged 34.3±1.8ºC (33.6–37.8) and 23.8±4.1% (19.2–78.9), respectively. Dry-lot dairies used diverse cooling methods. Shade availability varied in terms of placement (both corral and feed bunk or only in the corral) and amount per cow (2.6 to 6.8 m²/cow). The amount of water used by the soakers over the feed bunk ranged from 0 to 0.7 l/min per cow. Distance between shade to drinking water (perhaps a factor affecting water consumption) and water trough space per cow also varied across dairies (0–33.7 m and 4.9–21.7 cm/cow, respectively). Cattle responses also varied among dairies. During the observation period, 91±16% of cows used the shaded areas (51–99%) and 16±8% of the herd was observed feeding (7–33%). On average, 22±10% of cows panted with drool, open mouth or a visible tongue (5–41%). Respiratory rates averaged 82±10 breaths/min (65–95). Future analyses will examine how management factors affect milk production and these other responses to heat. Given that some dairies achieved better animal-based outcomes than others [e.g., respiratory rates within a normal range (i.e., less than 80 breaths/min), nearly 100% use of shade and a relatively low percentage of animals exhibiting signs of moderate-severe panting], our results indicate that there are likely opportunities to improve cooling and, consequently, aspects of cattle welfare in dry lots.
How do veterinarians recognize and manage their patients’ fear?

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Although veterinary care is an important component of maintaining animal health, certain aspects of visiting a veterinary clinic may negatively impact patient welfare. In order to receive veterinary care, cats and dogs are commonly brought into a novel environment, where they interact with unfamiliar animals and new people, often in unusual ways. As such, most cats and dogs exhibit behavioural signs of fear in the clinic setting. To explore animal welfare in the veterinary clinic setting, all companion and mixed animal veterinary clinics within a 100km radius of Guelph, Ontario were invited to participate in a larger study. As part of this study, in person interviews were conducted with 22 veterinarians, each employed at a different clinic, during which participants were asked to describe how they recognize fear in their canine and feline patients. All questions were open-ended and content analysis was performed on all responses. Aggression, body position, and ear position were the three most commonly cited signs of fear (68%, 59%, and 32% for cats; 45%, 36%, and 32% for dogs, respectively). Most veterinarians (95%) listed other fear-related behaviours (e.g. hiding, freezing, avoiding interaction) independent of or in addition to aggression; however, few veterinarians identified more subtle signs of fear, such as yawning (9%) and lip licking (14%). Within their responses, eight veterinarians (36%) suggested that the majority of the aggression exhibited by cats and dogs during routine veterinary visits is fear-based. Those surveyed also suggested the approaches and strategies they use to minimize and manage fear in their patients, such as offering treats, administering pheromones, and using towels. Overall, our results suggest that veterinarians typically recognize and appropriately manage overt indicators of fear in their patients; however, they might not observe or correctly interpret more subtle signals. The ability to recognize and manage fear, particularly at an early stage of the patient’s visit, has implications for ensuring that veterinary visits are a positive experience for pets, owners, and veterinary staff members alike.
Poster 12

Evaluation of the efficacy of a new pheromone product versus placebo in the management of feline aggression in multi-cat households

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Aggression and social tension amongst housemate cats is common and puts cats at risk for injury or relinquishment. In this pilot study, a new pheromone product by Ceva Santé Animale² was evaluated for efficacy to reduce aggression between housemate cats by randomized double-blind placebo-controlled trial in 45 multi-cat households [Pheromone (n=20), placebo (n=25)] that reported aggression for at least 2 weeks (range 17-3,931 days, average=822 days). Each household included 2-5 cats. Volunteers attended a group meeting on Day -7 (D-7) and the veterinary behaviorist* described behaviors to be monitored for 7 weeks using the Oakland Feline Social Interaction Scale (OFSIS) which assessed the frequency and intensity of 12 aggressive interactions (e.g. bite, swat, stare, block, hiss or scream). Participants were provided directions for safely handling aggressive events. Punishment techniques were discouraged. Plug-in diffusers with new pheromone product or placebo were utilized from D0 to D28. Participants completed daily diary of aggressive events and weekly OFSIS. The OFSIS scores (possible 0 to 360) were similar at baseline (mean±SE pheromone, 105.1±11.1 vs. placebo, 109.6±8.5 at D-7 and 83.4±10.4 vs. 83.5±8.3 at D0). The pheromone group showed a lower mean OFSIS score than placebo at D7 (47.8±6.3 vs. 61.8±7.7), D14 (30.8±4.9 vs. 48.0±8.3), D21 (21.8±3.9 vs. 40.7±7.4), D28 (33.2±9.7 vs. 47.0±9.7) which continued post treatment D35 (32.5±8.0 vs. 55.0±10.5) and D42 (31.2±8.1 vs. 59.0±9.0) [Repeated measures ANOVA F₁, 43 = 4.34, P=0.0431]. This study suggests this new pheromone is a promising treatment for the management of aggression between housemate cats.

* American College of Veterinary Behaviorist (www.dacvb.org)
Poster 13

**Location of dead and compromised laying hens in an aviary-colony style housing system**

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An important component of laying hen welfare is inspection and removal of compromised and dead hens. This may be a challenge in alternative housing systems, such as in aviary-colony systems, due to difficulty viewing individual birds within large groups and within tiers. In addition, hens that are ill or injured may exhibit avoidance behavior and seek resting areas not easily visible. The objective of this study was to identify areas in an aviary-colony system where compromised and dead hens are likely to be found. Caregivers at a commercial egg facility in Iowa were asked to document the locations where dead and compromised hens were found during routine inspections in 4 aviary-colony style houses. Each house measured 167.6 m x 15.2 m and comprised six rows of tiers, divided into ten 14.6 m pens along the length direction, with a capacity of 50,000 hens. Each row comprised 3 tiers, with nest boxes in the top tier, perches in the middle and lower tiers and an open litter area available daily to the hens for a portion of each day. Caregivers were provided with standardized inspection data sheets to complete one day per week for each house throughout the laying cycle, which included the row, pen and location within pen (tier, nest, or litter) where dead and compromised hens were found. Data were analyzed utilizing Kruskal-Wallis test with Wilcoxon ranked sums in SAS®, with significance level of 0.05. Daily mortality differed over the production cycle, with median 44 (27 min, 89 max) hens found during peak lay, 50.5 (21, 79) hens during mid-lay and 168 (100, 228) hens during end-of-lay (K=33.5, df=2; P<0.0001). Although rows and pens did not differ, dead hens were more frequently found in the middle tiers (31.9%, K=73.5, df=4; P<0.0001). Further investigation is needed to determine if associations result from ease of observation or behavior of compromised birds. Data for compromised hens was not reliably reported, hence was not analyzed. Understanding locations where dead or disadvantaged hens are likely to be found provides opportunity for refined inspection techniques.
Poster 14

Development of a pig grimace scale for evaluation of pain and analgesia efficacy in neonatal pigs

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In North America, a number of procedures are conducted on neonatal pigs, including iron injection, teeth clipping, ear notching/tagging, and castration. Given that over 200 million pigs are slaughtered in North America annually, at least 50% of which are male, developing and validating cost-effective procedures to minimize pain and distress associated with castration and processing will have a significant and positive impact on animal welfare. The objectives of this study were to develop and validate a Pig Grimace Scale (PGS) in association with behavioural scoring techniques to assess pain in castrated neonatal pigs and to assess the analgesic efficacy of meloxicam and EMLA (topical anesthetic cream) given prior to castration. Castration was performed on 4 litters of 5 day old pigs (n=19) with treatments randomized across litters: meloxicam + EMLA, meloxicam + non-medicated cream, saline + EMLA, and saline + non-medicated cream (4-5 pigs/group). Pens were video recorded for 1h 24h prior to castration, immediately after castration for 7h, and for 1h at 24h post-procedure. Thirty behaviours or postures were scored continuously for the first 15min at -24, 0, 1, 2, 3, 4, 5, 6, 7, and 24h by an observer blinded as to pig treatment. For PGS scoring, an observer blinded as to pig treatment captured 627 facial images across the 9 timepoints. Facial action units and an associated scale were developed including ear position, orbital tightening, and cheek bulge. Two individuals blinded as to pig treatment scored each photo separately. Baseline PGS scores from -24h pigs were subtracted from scores obtained post-castration. Data was analyzed using a linear model ANOVA with post hoc Bonferroni tests. Pigs demonstrated significant behavioural changes up to 7h post-castration and the use of meloxicam and EMLA were not associated with a reduction in painful behaviours or postures. No litter-associated differences were noted and data was combined across litters. There were no treatment differences in PGS scores and PGS scores at 0, 3, 4, and 5 were significantly higher than those at 7h post-castration (F₄,₁₅>3.06, p<0.05). These findings indicate that the PGS may have utility for evaluating pain in baby pigs.

Undergraduate Student Competition
Poster 15

Which is the best chicken shampoo? Preferred dustbathing substrates for aviary-housed laying hens

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New aviary-style systems are being introduced in commercial laying hen facilities giving hens access to a litter area for expression of behaviors such as dustbathing. Dustbathing removes excess lipids from feathers and dislodges mites and lice, maintaining the functionality of this protective covering. Different litter substrates may vary in their appeal, thus leading to disparity in dustbathing frequency but optimal substrates for aviary enclosures are currently unknown. To test for variation in dustbathing frequency we used Bovans white layer hens populated at a density of 929 sq cm/bird (144 birds/enclosure) in sixteen aviary enclosures at Michigan State University’s Laying Hen Facility. These hens were exposed to one of three litter substrates: Astro-turf, straw, or wood shavings, with bare concrete as a control. Each treatment was replicated four times. Video recordings were taken for two days beginning when aviary doors opened at approximately 10:00 to 20:00 when lights turned off. Four significant times in the hen’s lives were recorded: when aviaries first opened, peak lay, mid lay, and end lay, corresponding to hen ages of 25, 28, 50 and 68 weeks respectively. We observed numbers of hens dustbathing on the litter across a 2-min window every twenty minutes from aviary door opening until lights off for each recorded day. Hen numbers were converted to proportions based on mortality and averaged for each substrate type at each hen age. ANOVAs showed a significant difference in dustbathing proportions at aviary opening with the least dustbathing seen on Astro-turf ($F_{3,12} = 4.50, P=0.02$). But no significant differences at peak lay ($F_{3,12} = 0.50, P=0.69$), mid lay $F_{3,12} = 0.56, P=0.65$) or end lay ($F_{3,12} = .11, P=0.95$). Based on these results, different litter substrates promote varying levels of dustbathing but this effect is most prominent at the beginning of the production cycle before hens contribute to litter build-up. This information can be applied to commercial hen facilities to optimize the resources available to the hens, promoting improved hen welfare.
Methods for measuring fecal cortisol metabolites in domestic ponies (*Equus caballus*) using enzyme immunoassays

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Adrenocorticotropic hormone (ACTH) is released by the anterior pituitary in response to stressful stimuli, resulting in the release of glucocorticoids from the adrenal gland. This physiological stress response in animals is most commonly measured in blood cortisol levels; however potential procedural confounds have led to a preference for non-invasive cortisol metabolite monitoring methods, such as the measurement of fecal cortisol metabolite through radio or enzyme immunoassays. This study investigated the use of three corticosteroid metabolite immunoassays for monitoring adrenal status in horses: CJM cortisol, CJM corticosterone, and MP Biomedicals corticosterone (MP3). Fecal samples were collected twice daily from five weanling pony foals and three adult pony mares for three days prior to an ACTH challenge (0.1 ug/kg body weight), following which fecal samples continued to be collected twice daily for three more days. All three enzyme immunoassays were conducted on the collected fecal samples, which were extracted using an aqueous alcohol solution. The CJM corticosterone assay showed no displacement of the label with serial dilutions. Both the CJM cortisol and MP3 corticosterone assays were successfully validated using serial dilutions. Dose-response curves and physiological relevance of the measured metabolites were confirmed by peaks on day 0.5 post ACTH injection. Peak values of fecal cortisol metabolites were greater than five standard deviations above the baseline mean, suggesting that the assays were capable of measuring adrenal function. Responses to the ACTH challenge varied greatly between individuals and between mare and foal groups. Data continues to be analyzed as to which measure was more sensitive to changes in fecal cortisol metabolites with the hopes of validating an additional immunoassay for measuring fecal cortisol metabolites in horses.

*Graduate Student Competition*
Poster 17

Travel distance and duration of increased locomotion post-weaning in domestic pony foals

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Current weaning practices for domestic horses have been recognized as a source of stress for both mares and foals. Foals react to the physical separation from their mothers in a variety of ways, including increased locomotion, which poses the risk of damage to the musculoskeletal system, possible injury, respiratory stress, dehydration, blood glucose instability, and pain related to muscular lactic acid. Global-positioning devices (GPS; Garmin Forerunner 305) were attached to the halters of four domestic pony foals (174 ± 14 days) to quantify the distance travelled. Foals were group-housed and monitored from 0900-1800h for eight days prior to abrupt separation from their dams; after which the foals continued to be monitored for four additional days. Foals were housed together post-separation with no visual or auditory contact with their dams. GPS devices recorded distance travelled and physical location. Data was exported into Google Earth to examine location. To analyze distance travelled, data was exported from the devices using the myGarmin online data tracker into Excel and average daily distances were calculated. Prior to separation, foals utilized virtually all of their paddock space (140 m²) and did not appear to spend more time in any given area, whereas after separation, there was distinct localization of movement, with some foals running the fenceline while others continued to utilize the entire paddock. On average, foals more than quadrupled their average daily distance on the day they were physically separated (1531.03 ± 337.69m/day pre-separation period average to 7240.15 ± 6702.02 m/day day of separation). Despite this numerical increase, all foals returned to the pre-separation range within two days. Individuality played a pivotal role in how muted or extreme a foal’s response was as expressed by the distance travelled, demonstrated by the large standard deviations. Although the sample size was small, the change in distance travelled illustrates that the weaning process is a stressful event for foals and locomotion is significantly increased upon separation. Although foals quickly returned to the pre-separation travel distance, the large increase during initial separation indicates a welfare concern, both in the area of possible physical injury and emotional stress.
Poster 18

Impact of observer presence on milk and feed intake on tie-stall acclimated dairy cattle: A post-hoc analysis

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The objective was to determine the impact of human observation (OB) on milk production Kg/d (MILK) and AF feed intake Kg/d (FEED) of dairy cattle. We hypothesized OB would impact MILK and FEED. Post-hoc analysis was conducted using data from a study of 4 mid-lactation, multiparous Holsteins enrolled on a 48 hr. observation trial examining the impact of water intake on ruminal temperature. The original study moved cows from free-stall to tie-stall housing on d1 at 4:00 hrs and provided a 4d acclimation to novel housing. Day1 through d4 served as baseline acclimation to novel housing parameters for MILK and FEED. On d5 and d6, 2 observers positioned behind the cows recorded individual water intake by continuously observing water meters located adjacent to each cow. Day impact on MILK and FEED was evaluated using Proc MIXED procedure of SAS. Day was significantly associated with MILK and FEED (P<0.05). MILK on d1-6 was 16.1±1.0, 17.2±1.0, 18.8±1.0, 21.4±1.0, 18.4±1.0 and 20.5±1.0, kg (P<0.01), respectively. MILK on d5 was 4.47±1.29 lower than MILK on d4, (P<0.03). The average FEED intake for d1-6 was 14.8±1.1, 22.9±1.1, 23.6±1.1, 21.2±1.1, 18.1±1.1 and 21.3±1.1 kg, (P<0.01), respectively. FEED on d5 tended to be lower than FEED on d4 (P=0.05) and was 4.8±1.6 and 5.5±1.5 kg lower than FEED on d2 and d3, respectively (P<0.001). MILK and FEED on d6 were not significantly different than from d2, 3, and 4 (P>0.10). MILK and FEED on d1 was significantly different than d2-4 and were not considered part of the baseline as animals were experiencing tie-stall housing for the first time and both MILK and FEED were significantly lower than the following days (P<0.001), (P<0.01), respectively. Days 2-4 were considered baseline measures for evaluating the impact of observer as they were not significantly different from each other indicating MILK and FEED were consistent for 3d prior to exposure to OB (P>0.10). These findings demonstrate OB is associated with decreased MILK and FEED for the first 24 hours of observation. This has implications for cow welfare and the impact of observer presence when measuring MILK and FEED.

Graduate Student Competition
Are mules or donkeys better adapted for Egyptian brick kiln work? (Until we can change the kilns)

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Several researchers, including the first author, have identified the working conditions of donkeys and mules in the Egyptian brick kilns as very challenging. Common problems for these equids include: overloading, overworking, heat stress, harness lesions, poor body condition scores, and poor treatment by handlers. However, mechanization of the Egyptian brick kilns is not yet realistic without entirely renovating all kilns for additional space requirements, which would be cost prohibitive at this juncture. In the Helwan area brick kilns (approx. 185, supplying all bricks for the cities of Cairo and Giza) over 2000 donkeys and 400 mules produce ~200 million bricks/month year round. From July 2012-December 2013, the first author assessed 1140 donkeys and 250 mules to hypothesize a conclusion of whether donkeys or mules are better suited for brick kiln work. Health parameters were assessed (e.g. pulse, respiratory rate, rectal temperature, mucous membranes, skin tent test and capillary refill time), body lesions, and body condition scoring (BCS) assessed on a five-point scale from 1 (poor) to 5 (obese). Several behavior parameters (e.g. animal demeanor and human animal interaction) were also assessed. The data were analyzed using SPSS 17.1. There were (mean ± standard error) 8.50%±0.65 of kiln mules and 24.50%±0.82 of kiln donkeys scoring as a BCS ≤ 2 (F₁,₁₃₇=80.25; P<0.001). Heat stress and fever indicators were separated from each other for each measure and then respective scores aggregated. Again, mules showed more favorable scores with the average aggregate heat stress score (AAHSS) of mules being 16.86±0.89 and of donkeys being 28.33 ± 0.95 (F₁,₁₃₇=29.2; P<0.001). Mules also showed fewer work-related body lesions (4.41±0.34) than donkeys (17.52±0.58) (F₁,₁₃₇=106.75; P<0.001). When all health parameters were considered, it was apparent that mules are faring better than donkeys in the brick kiln environment. Should the kiln owners decide to replace donkeys with mules, one problem will need to be addressed: mules more frequently showed aggressive behaviors and avoidance behaviors to both familiar and unfamiliar handlers, (19.16%±1.48 aggressive mules vs. 3%±0.10 aggressive donkeys, (F₁,₁₃₇=504.65; P<0.001). Educational programs to assist with proper training and handling of mules should be implemented and then assessed for outcomes.

Graduate Student Competition
Poster 20

Welfare assessment program for gathering wild horses

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Programs for assessment of welfare in livestock and poultry have increased in response to consumers’ demand for humane care. A few certification welfare programs have gained a market advantage in the food supply but most are voluntary in North America. Some programs are intended as self-assessment tools, whereas others implement third-party audits mandated by management or corporate directives to demonstrate compliance with welfare policies. Welfare assessment programs for domestic horses have been introduced in Europe and Canada but in the US only a few states have developed minimum standards of care for horses based on state statutes. The topics in assessment programs are similar across all species including nutrition, health, euthanasia, facilities and environment, handling, and transportation. Specific criteria to objectively evaluate welfare in these programs are often characterized as input/engineering or output/animal-based measures. Education and training of employees are considered key components of the programs, which promotes continual improvement and implementation of evidence-based practices. Recently, the US Bureau of Land Management’s Wild Horse and Burro Program requested the development of a comprehensive animal welfare assessment program for the handling and care of wild equines during helicopter gathers and removal from federal lands. The assessment criteria for wild equines closely resemble production livestock programs because wild horses are handled in large numbers on the range and have limited training and exposure to humans. Thus, an assessment program using both engineering and animal-based measures was developed to objectively assess the outcome for horses during gathers, implement educational modules for all employees, and provide a reporting mechanism for public outreach.
Poster 21

Using behavioral and genomic tools to identify pigs suited for group living

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Increased interest in animal welfare by United States consumers has encouraged the pork industry to move away from using gestation stalls to group housing management systems for breeding sows. While the transfer to group housing has provided benefits including increased space and social interaction it has also generated negative consequences. Consequences to sow welfare include increased aggression, stress, injury, and infection—any of which could lead to culling. Consequences to the producer include decreased production efficiency and an increased culling rate. This ongoing project will address these concerns by examining 560 purebred Yorkshire sows divided across 7 replications. Over the course of two years, the study will attempt to identify linkages between behavioral and genetic measures. Behavioral measures will include aggressive and affiliative acts between individuals and quantification of skin lesions as an indicator of aggression. Sows will be mixed and observed at weaning, finishing, and 90 kg bodyweight when they would enter a breeding group. Observations will be video recorded for 24 hours after mixing and again three weeks post mixing to evaluate initial and stable responses to their social group. Lesion scores will be recorded pre- and post-mixing to determine the extent and type of aggressive behaviors. Video recordings will be used to provide a detailed look at individual sow behavior. In addition to behavioral measures, sows will be genotyped using a low density SNP panel (8K) and imputed to obtain higher density genotypes (60K) for analysis. Analysis of genotypic data will consist of calculating the heritabilities and the associated variance components, which can be used to determine the minimum sample size needed for genome wide association, as well as for predicting genome-wide breeding values. Genome-wide association will be performed to identify genotypic variants that have a significant association with a selected behavioral trait. If significant associations are discovered, breeding programs may be adjusted to contain this information, thus allowing breeders to select for sows that perform well in group housing systems, and to eliminate sows with high levels of aggression from their breeding population. These factors combined should reduce production losses and improve sow welfare.

Graduate Student Competition
Involving undergraduate students in behavioral research: A possible way to improve understanding and disseminate knowledge

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Courses and educational opportunities for students to learn about animal behavior are limited at universities, although students express interest in this field. Engaging future animal professionals in applied animal behavior during college could be an avenue for promoting incorporation of behavior more fully into animal-related industries. One way to engage students in applied animal behavior at universities is through their participation in research. These experiences encourage students to think explicitly about animal behavior when managing animals, treating animals, and designing animal housing systems. Michigan State University’s Department of Animal Science provides undergraduate research opportunities in a diverse range of disciplines including all aspects of animal science; the department has over seventy students involved in research at any given time. These research opportunities offer students unique experiences in active learning environments, including animal handling and data collection techniques, prospects of building long-term relationships with faculty members, and grasping scientific research practices, which include learning to adapt. The department’s Animal Behavior and Welfare Group regularly involves students from a diverse range of backgrounds. Such experiences are not only beneficial for students, but for the common well-being of the animal industry. Although the students may have contrasting future career goals, each will carry applied ethology knowledge on to their future professions. For students continuing on to veterinary medicine or graduate programs, this exposure to applied animal behavior may be the limit of their experience. Despite widespread belief that participating in research in applied animal behavior is valuable to the students and to animal-related professions, these assumptions have not been studied. A potential way to assign value to these experiences would be to create pre- and post-participation surveys to understand how much students are learning while participating in research. Such survey results could be used to quantify how much students have learned about applied animal behavior and whether attitudes about animal behavior change as a result of their research experience. Another approach would be to implement ethology-based discussions that would allow students to give feedback about what they are learning through research that applies to their area of study.

Undergraduate Student Competition
Age cohort behavioral differences in captive reticulated giraffe (Giraffa camelopardalis reticulata) at the Brookfield Zoo, Brookfield, IL

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As husbandry and veterinary care continue to improve, animals in zoos and aquariums are living longer. These older populations create new challenges with respect to their welfare needs. Special accommodations such as softened diet or springier substrate can be made for aging animals, but only if we know what changes are required. A first step in discerning these requirements is to collect specific data on how behaviors change as animals age. I observed a herd of seven reticulated giraffe (Giraffa camelopardalis reticulata) at Brookfield Zoo in Brookfield, IL. The herd consisted of one adult male, two juvenile males, and four adult females. Ages ranged from one week to twenty-three years old. I collected data for eighteen days totaling ten observation hours between July and August 2013. Each observation period consisted of thirty minutes of all-animal continuous sampling. Behaviors of interest for my analyses included walking, running, eating, rumination, non-food licking, and oral play (manipulation of the mouth and tongue without interacting with an object). Time budget analyses were conducted to compare frequencies of occurrences of these behaviors. Results indicated several significant behavioral differences between older and younger animals. Older animals (n=2) were 22 and 23 years old; younger animals (n=4; the week old calf was excluded as an outlier) ranged from 8 years to 7 months old. Specifically, older animals locomoted significantly less often ($F_{1,124} = 15.38, P=0.0001$), with a mean occurrence proportion of 0.05 (SE=0.01) and 0.11 (SE=0.009) for older and younger animals respectively. Non-food oriented oral behavior (oral play or non-food licking) occurred significantly more often in older animals ($F_{1,124} = 17.64, P<0.0001$), with mean occurrence proportion for older and younger animals of 0.27 (SE=0.03) and 0.11 (SE=0.02) respectively. Changes in locomotion patterns have well documented causes, including arthrosis and spondylarthropathy. Some potential factors in the differences in oral behavior may include abnormal tooth wear, insufficient fiber consumption, acid indigestion, or a manifestation of stereotypic behavior. While this study had some significant results, it is only one herd of animals with varying histories, so further research is required to generalize these findings to other populations.

Undergraduate Student Competition
# LIST OF PARTICIPANTS

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