

Information for an Industry on the Move

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## Stress and Transportation

By David Thompson, Elizabeth Ferry, Dale Rozeboom, Madonna Benjamin, Michigan State University Extension - Swine Working Group

Raising healthy and productive animals is critical to the commercial success and sustainability of all livestock production systems. There is a growing awareness of the interrelationships between physical health and performance in food animals, and how various forms of stress can adversely affect them. Recent research has demonstrated, for example, that the same molecular mechanisms underlie stress responses in people and livestock animals, including pigs. A stressful stimulus, once recognized, leads to release of adrenaline and cortisol, which can raise heart rate and blood supply to skeletal muscle while shutting down pathways critical to gut barrier and immune system function (Moeser et al, 2007).

The existence and potential importance of stress at various stages in swine production systems has been the subject of considerable research (reviewed by Roldan-Santiago et al, 2013, and Sutherland et al., 2014). This report focuses on some recent findings aimed at quantifying the impacts of shipping stress on pig health and performance, and offers some practical recommendations around how to minimize its impacts. As we look at the transportation practices in the industry, we can surmise that this event can be stressful for the animals due to various factors. The MSU Pork team has reviewed and summarized some of the critical components of transportation for swine producers.

### Change in Season

As the seasons change, market hog handling practices during loading and transport must also change. Estimates show that meat quality defects can cost the U.S. pork industry more than \$213 million per year (National Pork Board 2004). Additionally, transport losses of market hogs creates challenges for the U.S. food chain. Transport losses cause reduced returns to pork producers and pork processors, while compliance with changing rules and regulations regarding market hog transport along with increased animal welfare

scrutiny indirectly impact financial returns to all segments of the pork chain. Pork producers should critically evaluate transportation management practices before each season to reduce transport losses.

Research has demonstrated that the percentage of dead pigs on arrival at packing plants is at its highest during the summer season (Ellis and Ritter, 2006, Sutherland, 2009). However, the rate of non-ambulatory or injured pigs numerically increases and is highest during the late fall and early winter months (Ellis and Ritter, 2006; Rademacher et al., 2005; Sutherland, 2009). Additionally, Fitzgerald et al., 2008 recently reported an experiment evaluating 12,333 loads of market hogs (2,053,945 market pigs) that were transported (May 2005 to April 2006) from 9 different farms to a single processing facility. Conclusions of this experiment supported previous research findings: the second and last week of December incurred the highest percentage of losses per trailer. In comparison, pigs transported to the processing facility in June and July experienced fewer losses than those transported during the months of November and December.

### Use of bedding

The practice of bedding and boarding trailers while transporting pigs to slaughter is commonplace in the industry. Choosing the right amount of bedding and boarding, however, has been the center of many debates.

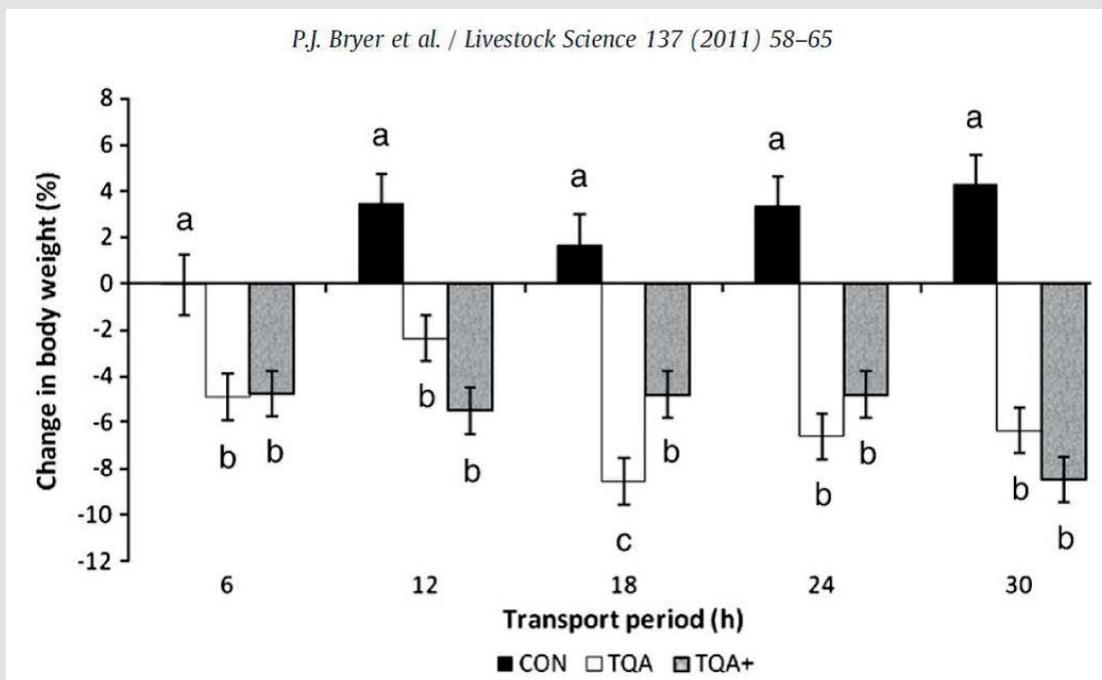
This practice has welfare and consumer viewpoint concerns, along with economic impacts for the producers. Recent research has attempted to define the bedding requirements for swine during transportation during exposure to cold, mild and warm temperatures. Investigators looked at over 700 loads of

pigs, totaling 128,686 pigs, transported during various types of weather conditions, and looked at the amount of bedding used, along with the condition of the animals (number of dead on arrival or injured/non-ambulatory) after transport. After reviewing the effects of bedding density during times of cold, mild and warm weather, the following recommendations were made (Sapkota, 2012):

- Cold weather < 32° F – No advantage beyond 6 bales of bedding
- Mild weather 32°- 70° F – No advantage beyond 3 bales of bedding
- Warm weather 70 – Utilizing more than 3 bales of bedding had a negative effect on DOAs

### Breeding Gilt Stress at Transport

Should we be concerned about how we transport breeding gilts? Probably, but we have too little research to guide us presently. Bryer and coworkers (2011) studied replacement gilts and the effects of transport duration and the amount of space provided during the trip. Gilts, weighing about 200 pounds, were transported for 6, 12, 18, 24, or 30 hours in a straight-deck livestock trailer that had been modified to create compartments which held four gilts in two different space allowances; either TQA (3.6 ft<sup>2</sup> per gilts) or TQA+20% (4.4 ft<sup>2</sup>



per gilts) additional space. The research took place in temperate weather of October 2007 in or near Lubbock, Texas. Stress indicators and weight were measured. The changes in metabolites, enzymes, and (or) hormones were inconclusive. Percent change in body weight of gilts, as shown in the figure on the previous page, suggested that most weight loss occurs in the first 6 hours, and that there was no difference from 30 hours of transport, irrespective of the amount of space provided gilts. (See figures on page 2)

The few differences could not lead the authors to conclude that one duration of transport or space was preferential. The conclusion they did report was that gilts transported for a period of up to 30 hours experience stress and changes in homeostasis, likely due to dehydration and fasting. A note about this study is that prior to transport gilts had been moved into their treatment groups and given 72 hours to acclimate to their pen-mates. Thus, the study does not provide information about the impact of mixing and social interactions among gilts occurring during transport, such as those that would normally occur in a commercial setting where gilts are not acclimated to pen-mates before transport. These interactions, combined with duration of transport and space provided, may give different results. More information in the area of commercially common practices of gilt transport are needed.

### **Take Home Message**

Continued research regarding transportation management of market hogs and breeding gilts is needed to identify the factors associated with transportation losses. The goals of this research are to develop industry recommendations for internal trailer environment management protocols that will optimize internal trailer temperature, maintain pig comfort and core body temperature and minimize transport losses. Educational programs such as the National Pork Board's

Transport Quality Assurance program are also available to help pork producers improve their knowledge about the handling and management of loading and transporting market hogs. Lastly, it is absolutely imperative that animal handlers' evaluate/re-evaluate transportation management practices for every season of the year.

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# Weaning Woes, An Overview of Weaning Stress in Piglets

By: Dr. Madonna Benjamin, MSU Extension Swine Veterinarian, Contribution: Dr. Adam Moeser, DVM PhD, Michigan State University, College of Veterinary Medicine, Student Contribution: Sarah LaTrendesse, CVM 2019, MSU.

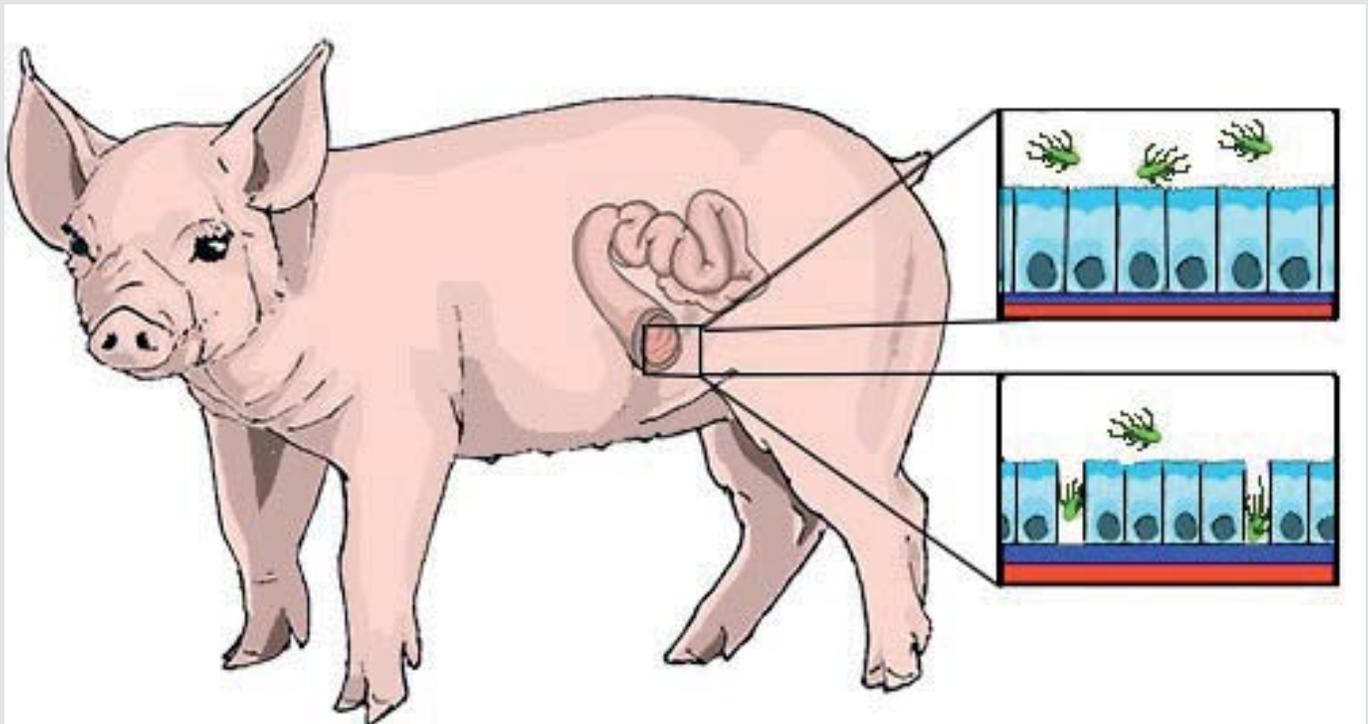
Let's start with a question. What is stress? It's a word commonly used to describe the feeling people experience when they're undergoing strain, which can be physiological (such as prolonged exposure to intense heat) or emotional (for example, loss of a loved one) or a combination of both. But what is happening in the body when someone experiences stress?

To keep it simple, when stress inducing events are short lived, stress is a protective mechanism. Examples of short term stress events include slamming on the breaks when driving to avoid hitting another car or being attacked by an animal or person. During short lived stress episodes chemical mediators, such as adrenaline, are released to promote muscle tenseness and increases in respiration and heart rate to effectively prepare the body for possible incoming pain or injury. This is a normal function.

However, when stress is prolonged, those responses negatively impact individuals and can decrease functional capabilities of all body systems.

Stress can negatively impact young animals faster than adult animals. It is well known that weaning is an intensely stressful event that young animals face, due to reduced contact with mothers and siblings and physiological stress as the young animals experience considerable dietary changes. This stress can result in increased susceptibility to diarrhea, infection and less growth.

Gastrointestinal (GI) disorders are of particular concern when weaning piglets. One of the main defenses of the intestines is the gastrointestinal epithelium, which lines the inside of the intestines and is composed of a cell type which absorbs nutrients from digested feed while



*Diagram 1: Normal (top box) versus compromised (bottom box) gastrointestinal epithelium in piglets. Top box: In normal piglets, disease causing agents have a hard time getting past the gastrointestinal epithelium. Bottom box: Gaps form in the gastrointestinal epithelium when piglets are weaned at an early age (ex: less than 22 days of age) making it easier for disease causing agents to cause disease.*

providing a protective barrier against disease-inducing agents, like bacteria and viruses. However, in very early weaned piglets, the GI epithelium is not yet fully formed, and when compromised, results in disruption of tight junctions between the cells and predisposes neonates to GI diseases, like edema disease caused by *Escherichia coli* infections (Masri et al, 2015).

Using a stress model whereby pigs were mixed 7 days after weaning and higher density than control pigs, these chronically stressed pigs had damage of the gut barrier and reduced nutrient uptake, resulting in lower body weight gain and feed efficiency (Li et al, 2017). This research led by Dr. Adam Moeser, an endowed chair and associate professor in the College of Veterinary Medicine (Michigan State University) focus investigates how the process of weaning can promote GI disorders or diseases. When comparing early weaning age to a later age at weaning, there was less mast cell degranulation (typically associated with allergies—think of swelling after a wasp sting). Early weaning resulted in increased mucosal permeability and enhanced mast cell degranulation compared to late weaned mucosa. Early weaned pigs (16 d and 18 d weaning age) exhibited a more rapid onset and severity of diarrhea and reductions in weight gain in response to ETEC challenge compared with late weaned pigs. In a separate publication authored by Pohl et al, (2017), early weaned female piglets expressed more mast cell mediators and had more intestinal permeability and diarrhea than early weaned male pigs. Interestingly, women are 4 times more likely to have stress-related gastrointestinal disorders such as Irritable Bowel Syndrome (IBS).

Other research support these results and found that

weaning piglets prior to 28 days of age results in massive changes to the structure of the gastrointestinal epithelium and as such, loss of protective functions. Interestingly, and importantly, it was found that there were nearly no negative changes in the gastrointestinal epithelium when weaning was delayed to 35-day of age (Masri et al, 2015).

Stress is never enjoyable, and may prove to increase sickness to bacteria and virus when experienced too early in life. Later weaning may benefit both piglets and producers by reducing the prevalence of GI diseases in piglets, thus improving piglet welfare and increasing profit margins. We also wonder what we might be overlooking when we compare weaning age and gender in production data.

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Pohl CS, Medland JE, Mackey E, Edwards LL, Bagley KD, DeWilde MP, Williams KJ, Moeser AJ. Early weaning stress induces chronic functional diarrhea, intestinal barrier defects, and increased mast cell activity in a porcine model of early life adversity. *Neurogastroenterol Motil.* Jun 2017 <https://doi: 10.1111/nmo.13118>. 

## Meet Dave Thompson and Melissa Millerick-May, newest members of the MSU Extension Pork Workgroup

### Dave Thompson

Dave Thompson joined the MSU Pork Extension Working Group in July, 2017. He will be working out of the Branch County Michigan State University Extension office in Coldwater, MI. Dave is returning to his academic roots at MSU after a 32-year career in the pharmaceutical/biopharmaceutical industry, where he held several positions in research and development.

Dave's educational background includes a PhD in Neurobiology from MSU, where he studied the physiology and pharmacology of endo-parasites, including liver flukes and roundworms, and concluded with postdoctoral studies in the pharmacology of calcium binding proteins in parasites. In 1984, he joined Parasitic Diseases Research at The Upjohn Company in Kalamazoo, MI, where he conducted basic and applied research on endo- and



ecto-parasites that infect animals and humans. His research there focused on the identification of new molecular targets and screening systems for novel anti-parasitics.

Dave joined Pfizer Animal Health in 2003, where he directed discovery research teams in the areas of livestock performance and wellness. In that capacity, he built relationships with researchers globally, and with industry leaders at all levels of the pork production and marketing chain in north America. He is looking forward to applying lessons learned through that experience to support the growing pork production business in Michigan. His dual proximity to MSU and the new Clemens facility in Coldwater as well as current and forthcoming industry relationships should facilitate that.

Dave will be participating in several of the educational programs offered by the MSU Extension Swine Working Group. Areas of special interest to him include parasitic diseases of swine, biosecurity and zoonoses, performance and agronomics. He is also developing an interest in 4H programs in swine husbandry and showmanship, especially the roles they serve in preparing future contributors to Michigan's agriculture industry, and looks forward to participating more in this area.

### **Melissa Millerick-May**

Dr. Millerick-May has over 20 years of practical experience as a toxicologist, industrial hygienist, and epidemiologist in both the automotive industry and now in an academic setting. Her goal is to leverage her expertise as an exposure scientist to conduct field-based research centered on occupational and environmental exposures related to disease development – both human and animal. Her current research is focused on the determination of prior occupational exposures related to the development of cancer, as well as the identification of sentinel event and subsequent environmental/occupational exposures relevant to development of disease in individuals with hypersensitivity pneumonitis. Recently, and amidst concerns over transport of highly pathogenic microorganisms such as enteropathogenic viruses and influenza affecting food animal production, Dr. Millerick-May has been collaborating with colleagues in extension, animal science and veterinary medicine to identify risk factors for disease transmission with an aim to create a paradigm shift toward implementation of source-based control strategies rather than those currently focused at the level of the receiver.





# Protecting and Improving Your On-Farm Investment

## HEALTH *Champions*

### Agenda:

- **Health Talks-Parasite Control for Herds:**  
*Identifying what deworming programs will be effective for your operation and proper use of products*
- **Health Talks- Managing PRRS:**  
*Transmission between and within farm, monitoring, diagnosis, biosecurity, herd management and the impact of vaccination on virus transmission*
- **Gilt Development- What we know, what we think we know and what we have yet to learn:**  
*Heat checking & estrus and gilt development; what factors play a role in getting your gilt to cycle*
- **Can we get rid of the RED TAPE?**  
*Understanding the laws and regulations for transporting and selling animals, quality assurance programs and the Common Swine Industry Audit*
- **Farm Safety:**  
*Who is the biggest risk for accidents and injury?*

### Locations:

Coldwater  
Oct. 10, 6-9 p.m.  
Branch County MSU Extension Office  
570 Marshall Rd., Suite C  
Coldwater, MI 49036

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Mt. Pleasant  
Oct. 11, 6-9 p.m.  
Isabella County MSU Extension Office  
200 N. Main St.  
3rd Floor, Room 340  
Mt. Pleasant, MI 48858

**Dinner provided at 6 p.m.  
Program to start at 6:30 p.m.  
Door prizes!**

**No cost for attending. RSVP to  
Emily Schmitt at  
[schmitt@mipork.org](mailto:schmitt@mipork.org) or  
517-853-3782.**



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All comments and suggestions should be directed to the:

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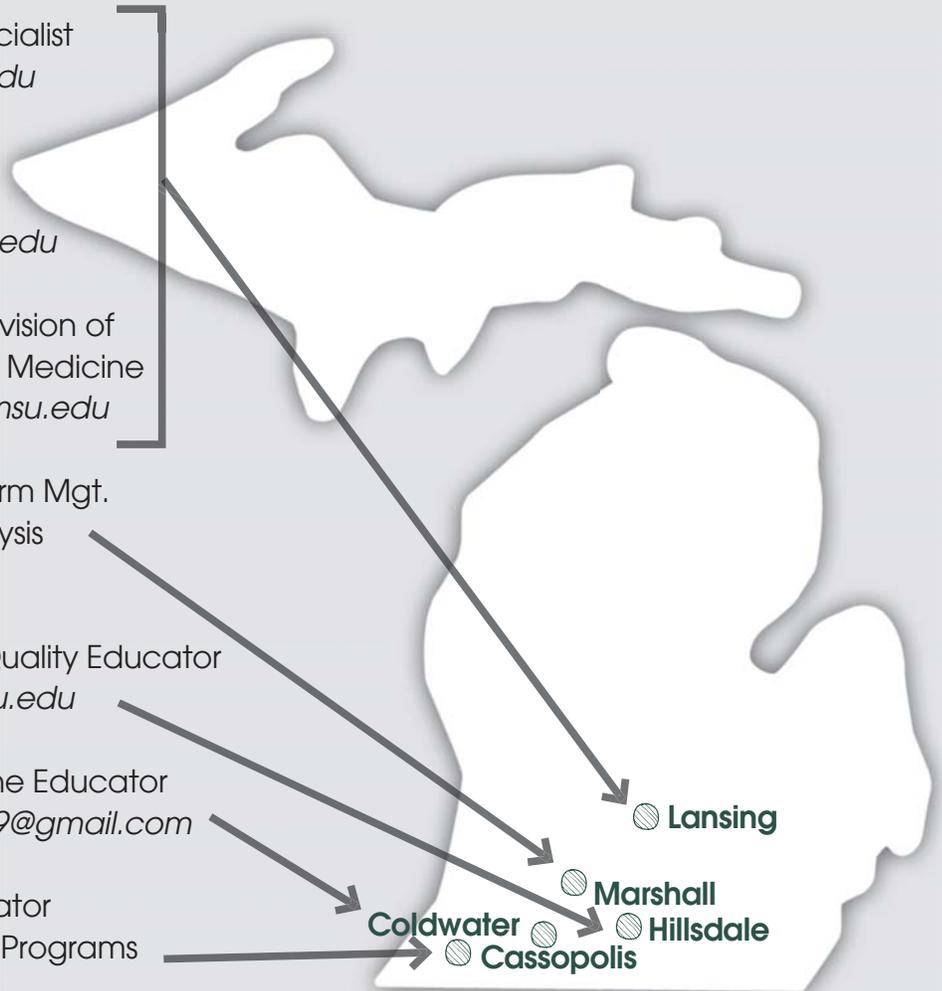
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