

## Swine Intensive Studies Laboratory at Iowa State University

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### Summary

The Iowa State University Swine Intensive Studies Laboratory was created in the summer of 2009, as a collaborative effort between the Veterinary Diagnostic and Production Animal Medicine and the Animal Science Departments. The primary investigators were Drs. L. Karriker, A. Johnson and K. Stalder. More than a dozen students have contributed to research in the laboratory. The laboratory was developed to study issues related to sow longevity by collecting comprehensive physiologic, behavioral and performance data simultaneously. This research facility is unique in its capabilities and in its location of close proximity to several helpful resources applicable to swine research. Future studies are focused on developing objective assessments of pain.

### Introduction

The Swine Intensive Studies Laboratory is a state-of-the-art research facility that is a joint collaboration of the College of Veterinary Medicine and the Department of Animal Science at Iowa State University. This facility can accommodate any age of pig and any type of research question that the swine industry needs to have addressed. A website providing additional details on the laboratory can be located at: <http://vetmed.iastate.edu/research/labs/SwineLab> The Swine Intensive Studies Laboratory solves several former research limitations. Technology from different fields including animal science, veterinary medicine, agricultural engineering were combined on site. This facility offers several types of state-of-the-art equipment allowing researchers to control the experiment/data collection and broaden the scope of their studies. In addition a multi-disciplinary approach can occur which may encompass swine health, behavior, physiology and performance simultaneously.

### Stations

Three main research stations are currently housed within the laboratory; these are the home pen (Figure 1), the Prototype Embedded Microcomputer-based force plate system and the GAITFour® Pressure mat and course.

**Home pen:** A centralized housing system of 14 pens (two rows of seven pens; Figure 2) each measuring 3.72 m length x 1.36 m width x 1.24 m height. A rubber mat (2.36 m length x 2 cm height x 1.36 m width) is provided for pig comfort. Pigs have ad libitum access to water via one nipple waterer that is positioned over a grate. Metal fences (1.18 m height x 76 cm width) are affixed at the end of each home pen and light cycle can be adjusted to meet the needs of the experiment. Each pen is outfitted with a nipple and an area of removable floor grates, which make home pen clean up easier. Gated fronts allow for nose to nose contact and flexibility in pen configuration. Pens across from one another are a mirror image, which can provide the opportunity for conducting preference tests.

Figure 1. Home pen.



Figure 2. Pen configuration.



**Prototype Embedded Microcomputer-based force plate system:** The Prototype Embedded Microcomputer-based force plate system was developed by via collaborative efforts between Dr.s K. Stalder, R. Fitzgerald (Department of Animal Science) and Dr.s, S. Hoff and G. Sun (Department of Agricultural & Biosystems Engineering).

The Prototype Embedded Microcomputer-based force plate system is equipped with four separate load cells measuring the pressure the sow exerts on each limb while standing (Figure 3). A separation bar divides the area in half to limit the sow from placing more than one foot per load cell. It is coated with non-slip epoxy and is accurate to 0.45 kg. Data can be collected for a set time while the sow has free access to feed (Figure 4). The Prototype Embedded Microcomputer-based force plate system fits standard gestation stalls and farrowing crates and the Sow Force Plate Monitoring System software can be easily integrated into feed management systems.

**Figure 3. The Embedded Microcomputer-based force plate system.**



**Figure 4. Data being collected on a sow.**



**GAITFour® Pressure mat and course:** The GAITFour pressure mat is a floor installed, portable walkway system which enables measurements of vertical foot pressure, stride length and stance time in a walking animal (Figure 5). The sensory surface is covered with low pile indoor/outdoor carpet to prevent damage and to facilitate cleaning of the surface. A 3 m entry and exit area immediately adjacent to the walkway is covered with the same material to prevent gait changes as pigs walk across the sensory apparatus.

**Figure 5. The GAITFour® pressure mat.**



Pigs are walked in a continuous closed loop across the pressure mat (4.3 m with 13,824 sensors) to acclimate the animals to the desired speed and pattern of movement

needed for footfall analysis. Each pig is required to complete three to five quality readings each day of data collection. A reading is considered acceptable if the pig does not hesitate, stop, or run across the walkway and if at least two complete footfall cycles (all four feet) register in the software. The quality footfall data is saved to the GaitFour software program for later analysis and validation. The walkway system is connected to a laptop computer and a two web cameras installed 45 cm above floor level capture the pigs entry and exit of the walkway (Figure 6). The video is saved in the software for comparative, synchronized analysis with the footfall output.

**Figure 6. The Gait Evaluation Course.**



### Well-being Measures

The lab offers many tools and methods for assessing swine well-being.

- 1. Behavior Data Recording:** Panasonic WV-CP484 cameras, capable of recording in black and white or color, are mounted above each pen. Directly connected to the cameras, the Darium DVR-RECO 204 allows for continuous recording. The Infrared LED array emits a light source that is detectable only to the cameras, giving the ability to record nocturnal behavior.
- 2. Animal Ambulation Recording:** Four high definition cameras are used to record sow movement through the Gait Evaluation Course. These recordings allow for real time analysis and creation of a sow ambulation data base.
- 3. Climate:** The environment for the lab is both controllable and recordable. Temperature is controllable through use of a heating system, fans, and two large adjustable doors allowing changes in ventilation. Twelve HOBO data loggers are available for temperature and relative humidity recording.
- 4. Physiology:** Physiology tests available to the lab include plasma cortisol and disease detection tests.
  - a. Plasma cortisol concentrations:** Plasma cortisol concentration values, and indicator of stress, are attainable by using solid-phase competitive chemiluminescent enzyme immunoassay and an automated analyzer system (Immulite® 1000 Cortisol, DPS, Los Angeles, CA).
- 5. Performance and health:** Performance and health are measured in the lab through monitoring feed intake and

efficiency; and through daily bright, alert, and responsive assessments of the individual pigs.

**6.. Feet First™ Chute:** The hydraulic lift crate, donated by Zinpro® Corporation, is used to give access to the animal's feet (Figure 7).

**Figure 7. The hydraulic lift crate.**



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