

~~Thesis statement: Swine nutrition has long been an important part of the research done at the University of Illinois, and thus our project will give a thorough explanation of the means by which swine nutrition research is done at the U of I as well as possible ethical dilemmas that researchers face and how regulations and protocols within the LSR deal with these dilemmas.~~

History

Pork production is a key industry in the United States, especially in the Midwest. As such, there is extensive research done involving live subject research at the University of Illinois as well as other major universities to resolve problems that can arise from large-scale pork production. For our project, we explored the Swine Research Center (SRC) at the U of I to learn what role it plays in the pork industry and how researchers work to resolve problems in an ethical manner. To facilitate our research, we interviewed two people who work at the SRC. The first person we interviewed was Mr. Bill Fisher who is the head supervisor of the farm. We had the opportunity to speak to him at the SRC. He covered topics on the regulations and protocols of the farm as well as the approval processes that researchers have to go through before an experiment is approved. Our second interview was with Prof. Mike Ellis at his office. He is a Professor at the University of Illinois at Urbana-Champaign in the Department of Animal Sciences. Prof. Ellis spoke about the experiments he has done at the SRC and the ethical issues that he has faced with his research.

Swine nutrition has long been an important part of the research done at the University of Illinois. Our report gives a detailed explanation of the means by which swine nutrition research is done, possible ethical dilemmas that researchers face and how regulations and protocols within the Live Subject Research deal with these dilemmas. Swine nutrition has long been an important part of the research done at the University of Illinois, and thus our project

~~will give a thorough explanation of the means by which swine nutrition research is done at the U of I as well as possible ethical dilemmas that researchers face and how regulations and protocols within the LSR deal with these dilemmas.~~ Most of the prominent professional nutritionists who made names for themselves in the 1950, 60s and 70s came through the U of I. Development of using soybeans as supplementary feed for pigs was developed at the U of I in the 1950s. The Swine Research Center (SRC) at the U of I was developed in the 1960s. It has been changed and upgraded over time.

True to its tradition of nutrition-oriented study, during the mid-1970s, much experimentation at the Swine Research Center was done to measure the impact of different feeds on swine weight. "Feed 'em & weigh 'em" experiments, as they were called, involved putting different kinds of feed in front of the animal and seeing which one promoted the most weight gain. During the 1980s, a different kind of nutritional experiment was done. In this time period, swine research focused on how lean the feed made the animal and what other impacts feed had on the animal besides how fast/slow it made the animal grow. The 1990s saw an increased importance given to the linkage with the consumer, and so the farm then began looking at how a pig's diet could be tailored in order to improve the quality of pork produced by the pigs. This type of research is still done today to a large extent, and many of the pigs now go through carcass quality analysis and to tray & taste analysis at the meat lab. Trained panelists look at color, quality and taste to judge the quality of the pork produced. According to Mike Ellis, the professor of the Department of Animal Science, he believes researchers are getting more precise understanding of what the requirements are. For example, they are able to more accurately measure what nutrients are in the feed than they were able to in the past. They have also increased their awareness of some strategic effects of the nutrition like high fat

levels to the swine. Nobody had thought of it ten years ago. The development and the application of research processes make the quality of the research content improve.

Over the last 20 years, the role of documentation in the LSR has changed. Nowadays, much more is recorded and the level of governance by the Department of Animal Resources has increased. In our interview, Bill Fisher told us that in the past, the farm would sometimes do experiments "simply because they could.", but nowadays things are much different. If an experiment or practice put the animal in pain or has its life put in jeopardy, then the farm won't do it.

Research done at the farm

Many different experiments involving the feed given to pigs are conducted on campus. In our interview with Bill Fisher, we learned that research is being done into how pigs can digest fiber found in cereal grains. He told us that the increasing role of ethanol production for fuel, especially in the state of Illinois, is a big factor for why they are doing this type of research. ~~The reason for this is that a~~ by-product of ethanol production is called distiller-dried grain solubles (DDGS) (Bernick, 2003)s, and there will potentially be a lot of it for use as ~~a possible~~ feed when ethanol production ramps up. This kind of material has not traditionally used ~~for~~ pig feed because the technology has not been available to refine the DDGS, so there needs to obviously be a better understanding of how it interacts in their bodies before it can be widely used. ~~Rice, oats and barley are being studied and considered as possible substitutes for the traditional corn and soybeans~~ Preliminary studies at this school and at various other Midwestern Universities such as the University of Minnesota have shown that DDGS may provide several benefits to swine when introduced into their diet. (Bernick, 2003).

There are many additional benefits to corn and swine producers from feeding DDGS to pigs, which make this topic seem like a potential ethical conflict. Through our research, we

found that DDGS is a cheaper protein source for swine producers when compared to corn (Bernick, 2003). Additionally, for corn producers, feeding DDGS to pigs in place of corn will free up more corn for use in ethanol production, which would increase their bottom line as well. Therefore, we are concerned that the relationship between the pig researchers and the ethanol manufacturers may not be a natural one in terms of the pig's welfare, but rather one brought about in the effort for all parties to make more money.

Since animals are being fed corn and soybean meal it raises some concern about feeding them genetically modified crops. Approximately 70% of the genetically modified soybeans produced in the world and 80% of the genetically modified corn produced in the United States are used as animal feed (Levey). This leads some to wonder if these modified crops may enter the food chain and effect humans or animals. Over the 23 experiments conducted in the past 4 years and reviewed by Jimmy Clark a professor in Animal Sciences at the University of Illinois concluded that there was no difference in the animals' ability to digest the genetically modified crops and no significant difference in the weight gain, milk production, milk composition, and overall health of the animals when compared to animals fed the traditional crops. "Since these genetically modified crops were grown beginning in 1996, they have been fed to livestock and no detrimental effects have been reported," Clark said (Levey).

In these experiments the modified corn had a gene from Bacillus thuringiensis (Bt), a bacteria found in soil that kills the European corn borer and soybeans used had a gene that made them resistant to glyphosate (better know as Roundup®) this allows the farmers kill the weeds without killing soybeans. With no effects to animals and to humans after such a long use has led many researchers to believe that future of GMO's looks good.

Looking at the global picture, 51% of the global area of soybeans, as well as 12% of canola and 9% of maize (used as whole maize and by-products such as maize gluten feed) is

genetically modified (Green Facts). This article goes on to say that major concerns are whether the DNA from GMO's can be passed on from plants to animals. Evidence suggests that more than 95 percent of DNA and RNA is completely broken down within the digestive system (Green Facts). Several experiments conducted showed that there were no adverse effects of feeding GMO's to animals. On both articles science has shown that there are no risks to human and animal health from the use of GMO's in animal feed.

We learned that another possible area of alternative feed for pigs is from salmon and other fish remains. At the fish research institute in Alaska, there are vast collections of by-products from the salmon & pollack industries. Essentially, the researchers are looking at whether the by-products of this fish production such as their viscera and cartilage tissues pose any nutritional value to the swine when incorporated into their diets. Some people may think that there is a potential of unbroken disease by feeding these products to the swine. However, these foods are processed at high temperatures, and therefore there is no scientific evidence of yet to suggest that this is an issue.

There are several methods to determine the availability of the nutrients to the pigs provided by these new feed. One method is to collect the feces and urine from the pigs, to measure the amount of nutrients absorbed by it. However, this gives a imprecise result since in the hind-gut of the pigs, there is a lot of bacterial fermentation that would change the amino acid profile of the feces. According to Professor Ellis, he is able to measure the absorption of amino acids before the feed gets to the stage at which fermentation occurs. After finding out what is being absorbed from the new feed, the value of the product is determined in terms of amino acid content and the availability of the amino acids. The next step that the Professor would want to find out is the effect of feeding the new product to the pigs besides its nutritive value. For example, the fishmeal - there could be a high sodium content which could reduce the

animal's feed intake because they do not like food with high sodium. Therefore, he would do a standard feeding study where he would reformulate their diets based upon the test products and a control product. Normally, a lot of milk products are placed in diets for young pigs since their digestive systems are set up to digest the milk proteins and not complex carbohydrates. The fish product is compared with milk products or with a commercially-available fish product and in that study, he would measure how much the pigs ate, how much weight they gained, their growth rate and to keep watch of signs of abnormal response. Theoretically, if the animals became sick, he would then reduce the intake. Another interesting experiment is the new feed being placed into a mixed diet and observations are made to see if this have any negative effects on the animal.

Of course, traditional nutrition techniques are what the researchers use the most at the SRC when working with the swine. Understanding the basics of nutrition is therefore key to understanding the majority of what happens at the SRC. First, swine consume feed containing essential nutrients such as protein, fat, vitamins, and minerals. After consumption, this feed is digested and eventually broken down into individual nutrients for absorption within the animal's body. After absorption, these nutrients are processed through different metabolic pathways where they are used first to meet daily maintenance requirements. All nutrients available to an animal after these maintenance requirements are met are primarily used to support lean tissue gain, especially in young growing animals. One of the first requirements that must be met in the animals' body is energy (National Pork Producer Council Website). All feeding standards and ration formulations are based on some measure of energy with additional inputs on protein and amino acids, essential fatty acids, vitamins, and minerals.

Proper nutrition is essential to correct care of swine and thus it is a topic that has been researched extensively. While it is true that most pigs receive approximately the same diet,

studies have shown that amino acid requirements are not the same for all pigs and can vary with changes in genetic strain, gender, health, temperature, stocking density and other factors (Nutrient 31). For example the amino acid lysine, an essential amino acid, has been shown to be needed in larger amounts by younger pigs. The increase in lysine requirements for younger pigs is explained by their genetic capacity to deposit body protein which apparently decreases with age. In other words, pigs tend to create and maintain more protein at younger ages than when they are older. Lysine is an amino acid that aids in protein creation and thus its need is proportional to the pigs' inherent protein creation aptitude.

While cereal grains, such as corn, sorghum, barley or wheat provide between 30 and 60 percent of the total amino acid requirements of pigs, other sources of protein such as soybean meal are typically provided to pigs in order to ensure that they receive proper balance among all the amino acids (Nutrient 17).

There is a project called Soy Swine Nutrition Research Program in U of I and is funded by Illinois Council on Food and Agricultural Research (National Soybean Research Laboratory Website). The goal of this program is to find ways to optimize the use of soybean products in swine diets. Soybean meal is a superior diet for swine. The reason is that the amino acids found in its protein offsets the deficiencies in other commercial oilseed meal.

Looking at how the pigs' behavior affects his or her body immunology is another area of research done at this LSR. One factor that contributes towards the good health of a pig is being in a good environment and being comfortable in its surroundings. Gauging a pig's stress levels and taking environmental factors into consideration is done to ensure that a pig is performing at his or her full ability. In fact, this kind of behavioral physiology was developed at the U of I before many other places.

~~Other~~ Other areas of research ~~involving pig reproduction are~~ include reproductive physiology and growth-promoting drugs. Being able to get animals to be fertile & to raise litters that grow fast has always been and is still a big concern to researchers. Feed additives and growth-promoting drugs are also used to try and enhance the pig's growth.

Regulations and Protocols

The level of regulation at the ~~swine research farm~~ SRC is substantial. According to Bill Fisher, "everything that happens is recorded. Even animals that aren't on a specific research trial are on a general protocol that serves for the whole farm." Before an experiment is performed, an approval process that involves groups of researchers from the Department of Animal Sciences and the UIUC Institutional Animal Care and Use Committee (IACUC) takes place to make sure that the proposed experiment is consistent with animal care standards. IACUC has been established in accordance with the Animal Welfare Act and Public Health Service Policy on the Humane Care and Use of Animals. The role of IACUC is to provide oversight and assistance in ensuring compliance to all laws, regulations, and policies governing the care and use of research and teaching animals (IACUC, 2006). There are several important responsibilities the IACUC has which include reviewing the ~~Swine Research Farms~~ SRC at least once every six months. During these inspections, IACUC would check for the humane treatment of animals at the facility and a report would be handed over to the Vice Chancellor for Research. IACUC is also authorized to suspend any activity involving the pigs if the activity does not meet the organization's protocols. ~~After~~ From reviewing the IACUC website, we learned that there are a few forms that need to be submitted before a research is approved by U.S. federal law. Some of these forms include a protocol review form, a Standard Operating Procedure form and a Veterinary Care Plan form. All these forms cover the ethical issues that concern the treatment of the animals like their living conditions and medical assistance.

In our interview with him, Mike Ellis confirmed that this process was indeed the standard protocol for getting a research project started. Mr. Ellis told us that the researchers' nutrition work generally tries to answer one of two questions: What is the nutrient value of the feedstuff and what is the value of the food when put into a mixed diet in terms of if it has a negative effect on the animal? Before attempting to answer these questions, the researchers must first submit a proposal of what they intend to do to IACUC, where it would be "looked at by experts who regulate our research and if they were uncomfortable with it they would ask us to change it and if approved, we would have to adhere to their decision and would be monitored. (Ellis, 2006)"

In addition to this standard, Mr. Ellis told us that the final check on the appropriateness of their work is that all studies wind up in the public domain. All of the completed research winds up being documented in published reports, many of which Mr. Ellis shared with us and helped us with our research. In one of the studies that we looked at, the researchers compared two breeds of pigs' feeding habits. These types of studies are done to increase the overall body of information on different pig breeds and to determine potential causes of disparity in weight gain between the two breeds (Hyun, Walter, Ellis, 2005).

Among the primary safety concerns of researchers is making sure that proper Bio-security protocol is followed. Access to the farm where the pigs are kept is limited in order to prevent the transmittal of infectious disease to and from the pigs. When persons are allowed to come in close quarters with the pigs, they must have clean cover-alls and clean boots. Additionally, a log book is kept in order to track when and which individuals go to the farm (Fisher, 2006).

With regards to making sure that what the pigs eat won't affect humans who later consume them, there is a protocol known as the Generally Recommended As Safe (GRAS) that

the researchers follow. This GRAS guideline is similar to an FDA-approval process for a vitamin or medicine because the GRAS falls under the FDA's oversight and because only GRAS-approved products are allowed to be fed to the swine ~~which that~~ eventually reach the market. In order to get products GRAS-approved, Mike Ellis told us that the company who manufactures them must submit "a lot of information about ethicality and a lot of toxicology to determine what levels of the product wind up in the swine's tissues and what effect they could have if a human were to consume the swine." Therefore, in order to reach the market, the pig's diet must consist of only GRAS-approved products where there is a substantial body of evidence showing that the feed is safe to be given to swine.

Sometimes, in the course of conducting research, the experiments call for the use of products that are not GRAS-approved. ~~Mike Ellis told us about A~~an example of what the operating protocol calls for when ~~happened when~~ the researchers had to feed the pigs a non GRAS-approved product was when. ~~He said that although~~ a very similar product to one that the one they were using had been GRAS-approved was given to the pigs.; ~~A~~ and even though it had a substantial amount of toxicology behind it showing that it was safe, the product they were using on the pigs was still not suitable for feeding to pigs that would wind up in the market. As a result of this, the pigs that they were feeding this product to were incinerated after being slaughtered and after the appropriate tests were performed on them. As an additional oversight, there were IACUC representatives who monitored the incineration in order to verify that these pigs had indeed not entered the food supply of humans (Ellis, 2006).

Approval Processes for Research

The approval process by the IACUC is something the researchers have become familiar with over time, and thus they know what kind of experiments would likely be approved and which would not. While speaking with Mike Ellis, we asked him if any of their proposals had

been rejected by the IACUC or the Department of Animal Sciences. He told us that none had, and that they have always been able to justify that what they were proposing was worth the time and effort. Since the final goals of any research are to improve swine production and/or to improve the environment of swine production, there are many ways to achieve progress and consequently many different kinds of experiments to perform. IACUC requires researchers to fill up a protocol review form before any projects are allowed to be carried out. The protocol review form is very comprehensive and covers a wide range of topics pertaining to the welfare and care of animals. The first few sections of the form highlights what animals and species are used in the experiment, where are the animals housed and the personnel responsible for providing veterinary clinical medical care. Another section of the form requires the researcher to give a description of the experiment and its intended benefits. A rationale for involving animal subjects and the number of animals must be indicated as well. A complete description of the proposed use of the animals, surgical operations, clinical outcomes are to be stated as well. Also, the researchers have to consider minimal pain and distress on the animal, and explain to IACUC what are the procedures or methods designed to address these issues. Once the form has been completed and approved, projects are automatically given a 3-year approval period.

We feel that the fact that none of the proposals for research had been rejected by the IACUC posed a possible ethical dilemma. While it is certainly possible that the reason for this is because the researchers, over time, have become familiar with the expectations and rules that the IACUC imposes on them and thus they have a general idea of what they can and cannot do, another possibility is that the relationship between researchers and the IACUC is such that the checks and balances that are supposed to exist have been worn away. It would not be possible

for us to determine whether either possibility is in fact the case, but we did see a potential ethical conflict here.

Feed Research

(Side Effect of Abundance of Protein)

Scientists at the U of I reported that the production of inflammatory cytokines by immune cells appears to be responsible for decline of both protein accretion and weight gain in swine infected with Porcine Reproductive and Respiratory Syndrome Virus (PRRSV) (Jim Barlow, 2004). The study also suggests that myostatin, a protein that limits muscle growth, is overproduced during infection, thereby reducing the growth of skeletal muscle. During the pivotal growing stage, pigs are at the most risk and suffer from cough, fevers, and depressed appetite. Reduced market weight or increased time for pigs to reach a desired market weight can be a substantial cost to producers.

PRRSV infects macrophages, a type of white blood cell that attacks pathogens. The virus is spread from the lungs as the macrophages migrate to other tissues. Before infected macrophages die from the virus, they produce inflammatory cytokines, hormone-like molecules that enable the immune system to influence other parts of the body. One part affected is the brain, which is why animals have reduced appetite when they are sick.

(Feeding Swine with By-product)

———Traditionally, swine are feed by soy bean and corn. There is a change in the feeding of swine by using by product, such as fish and salmon. Some people may think that there is a potential of unbroken disease by feeding products from the same species to swine. However, the food are processed at a high temperatures. There is no scientific evidence to suggest that this is an issue.

(Genetically Modified Organisms (GMO's))

Since animals are being fed corn and soybean meal it raises some concern about feeding them genetically modified crops. Approximately 70% of the genetically modified soybeans produced in the world and 80% of the genetically modified corn produced in the United States are used as animal feed (Levey). This leads some to wonder if these modified crops may enter the food chain and effect humans or animals. Over the 23 experiments conducted in the past 4 years and reviewed by Jimmy Clark a professor in Animal Sciences at the University of Illinois concluded that there was no difference in the animals' ability to digest the genetically modified crops and no significant difference in the weight gain, milk production, milk composition, and overall health of the animals when compared to animals fed the traditional crops. "Since these genetically modified crops were grown beginning in 1996, they have been fed to livestock and no detrimental effects have been reported," Clark said (Levey).

——— In these experiments the modified corn had a gene from *Bacillus thuringiensis* (Bt), a bacteria found in soil that kills the European corn borer and soybeans used had a gene that made them resistant to glyphosate (better know as Rounup®) this allows the farmers kill the weeds without killing soybeans. With no effects to animals and to humans after such a long use has led many researchers to believe that future of GMO's looks good.

——— Looking at the global picture, 51% of the global area of soybeans, as well as 12% of canola and 9% of maize (used as whole maize and by products such as maize gluten feed) is genetically modified (Green Facts). This article goes on to say that major concerns is whether the DNA from GMO's can be passed on from plants to animals. Evidence suggests that more than 95 percent of DNA and RNA is completely broken down within the digestive system (Green Facts). Several experiments conducted showed that there were no adverse effects of feeding

~~GMO's to animals. On both articles science has shown that there is no risks to human and animal health from the use of GMO's in animal feed.~~

Ethics

(Welfare of Swine)

——According to Ellis, the welfare of swine in commercial production systems—where the swine is kept as an individual that it cannot be able to turn around, is a big debate in the swine industry. This production practice raises people's concern in terms of ethical and moral standpoint. Therefore, a lot of people do not feel comfortable with this approach. Therefore, the industry is looking for an alternative approach by keeping the swine in a group and hoping them to exhibit a "normal" behavior among peers.

According to the article of Bridget M. Kuehn, evaluating swine welfare requires veterinarians to make decisions based on science and ethics (2006). Often times, industries can implement changes faster by self-policing, but they have to follow the highest standards to make it work. For instance, government policies, consumer demand, and the drive for more efficient production keep prices low, making it difficult for producers to improve welfare and remain competitive. European farmers have had success in raising prices because consumers are willing to pay more for food that was raised in a humane manner. However, this is not the case in the United States. A change in American attitude about food prices will be necessary to resolve these issues. As Dr. Swanson suggests, "we have to go through a whole social reorganization with this issue—keeping food affordable while allowing people to produce animals in a way that can be efficient, but also guaranteeing a reasonable quality of life for the animals" (2006).

(Ethics Argument by Mike Ellis)

All systems have their own advantages and disadvantages. There is always a simple solution to the welfare issues, such as forcing swine producers to adopt the changes. However, it will always put their business at risk. Thus, a compromise of economics is essential in order to solve the problem efficiently. If the public is willing to give the producers some spaces, changes can be made smoothly. Unfortunately, judgments on whether a system is good or bad are based on perception rather than on science perspectives. During the interview, Ellis suggested that perception wins out if we look at other aspects of life. ~~(situation...)~~. Welfare of swine is hard to measure. There is no right answer on whether animals should be treated in a certain way. For example, passing out the legislation of a country that attempt to increase the welfare of animals, that country most likely wound up importing more pork from other countries where no restrictions existed.

Nutrients

(Basic Nutrition)

~~—————First, swine consume feed containing essential nutrients such as protein, fat, vitamins, and minerals. After consumption, this feed is digested and eventually broken down into individual nutrients for absorption within the animal's body. After absorption, these nutrients are processed through different metabolic pathways where they are used first to meet daily maintenance requirements. All nutrients available to an animal after these maintenance requirements are met are primarily used to support lean tissue gain, especially in young growing animals. One of the first requirements that must be met in the animals' body is energy (National Pork Producer Council Website). All feeding standards and ration formulations are based on some measure of energy with additional inputs on protein and amino acids, essential fatty acids, vitamins, and minerals.~~

(Amino Acids)

Proper nutrition is essential to correct care of swine and thus it is a topic that has been researched extensively. While it is true that most pigs receive approximately the same diet, studies have shown that amino acid requirements are not the same for all pigs and can vary with changes in genetic strain, gender, health, temperature, stocking density and other factors (*Nutrient 31*). For example the amino acid lysine, an essential amino acid, has been shown to be needed in larger amounts by younger pigs. The increase in lysine requirements for younger pigs is explained by their genetic capacity to deposit body protein which apparently decreases with age. In other words, pigs tend to create and maintain more protein at younger ages than when they are older. Lysine is an amino acid that aids in protein creation and thus its need is proportional to the pigs' inherent protein creation aptitude.

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(Soy Bean)

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Methods of Research

Most of the research done by Professor Michael Ellis focuses on the applied farm livestock swine production process. The animals are kept in small groups instead of large

groups for observation purposes. A large number of observations areis used to create a statistically valid research. Also, he uses standard diets for the pigs and they are not genetically modified in any way. In fact, most of the observations taken on the animals can be done in a commercial unit. One of the factors that he considers for most of his research is the weight of the animals. ~~A (.....) Toolstool~~ areis used to measure the body composition changes of the research subjects. Most of the procedures of obtaining this information are non-invasive. The Professor follows the guidelines and protocols of IOCUC strictly all the time.

~~For his research in finding nutrients found in alternative feed, he is looking at a range of fish by products. At the fish research institute in Alaska, he collected a pile of by products from the salmon & pollack industries. For example, fish heads, fish skeletons and viscera—things that are potentially of nutritive value. Another potential feed product is DDGS, a by product of what is left after corn is fermented to produce ethanol. There are several methods to determine the availability of the nutrients to the pigs provided by these new feed. One method is to collect the feces and urine from the pigs, to measure the amount of nutrients absorbed by it. However, this gives a imprecise result since in the hind gut of the pigs, there is a lot of bacterial fermentation that would change the amino acid profile of the feces. According to Professor Ellis, a *****canular***** is placed into the terminal *****ellium***, which is where the digester goes into the hind gut. Then, he is able to measure the absorption of amino acids before the feed gets to the stage at which fermentation occurs. After finding out what is being absorbed from the new feed, the value of the product is determined in terms of amino acid content and the availability of the amino acids. The next step that the Professor would want to find out is the effect of feeding the new product to the pigs besides its nutritive value. For example, the fishmeal—there could be a high sodium content which could reduce the animal's feed intake because tthey do not like food with high sodium. Therefore, he would do a standard feeding~~

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Funding

According to Mike Ellis, the funding for swine research comes from many places, most of which are commercial companies with which the department works closely. The nature of the relationship between the Department and these companies is something that Mr Ellis told us has many elements: "some of them are companies who are selling products and we're helping them test their products, some of them are production companies looking to improve the efficiency of their production and so we work with them to try and develop the right designs and projects."

Of course, the Department also receives a substantial amount of funding from government, both USDA and the state. According to Mr Ellis, the kind of projects the Department works on with government money focus on more societal issues, where there is typically no product being supported. These societal issues normally focus on the welfare of the swine and the impact of commercial practices on the immediate environment. As a society, we want to make sure that large companies don't abuse the environment and take into account the well-being of the animals, and so in order for these concerns to be met, the government-funded

research is critical since commercial companies are highly unlikely to want to incur the costs necessary to meet these standards themselves.

Lastly, funding for research can also come from corn and soy producers who want to know the suitability of their crops in pig feed. As we reported earlier in this paper, a new development is the research done to see whether or not the left-overs from ethanol production are suitable for pig feed. This relationship between corn and soy growers and swine producers is a natural one given the proximity each typically has to one another.

In conclusion, the research being done at SRC is critical in solving issues that arise from feeding pigs with alternative new feeds. The regulations and protocols are important in making sure the research is conducted with ethics in mind. As for the Swine Research Center, we also feel that it should be more accessible to the public and allow people to tour its facility. Pictures, videos, or even a pamphlet given to people about the research farm would give future researchers, students, and the general public an idea of how things work in the Swine Research Center. This would clear any misconceptions about the work being done at the farm as at the moment, the ongoing of the farm remains a mystery and is only made known by the good faith we have on the people we interviewed.