Rabies: A Rare But Important Disease

Michelle Kopcha
Dept. of Large Animal Clinical Sciences

Introduction

Many diseases affect Michigan dairy cattle more often than rabies. However, rabies is all but 100% fatal in humans and animals, and it can be transmitted from animals to humans, making it a very important disease to recognize.

Rabies is caused by a virus, that attacks the nervous system (brain, spinal cord and nerves) and it affects all warm-blooded mammals. It is an ancient disease whose first descriptions can be traced to the 23rd century BC. Epidemics of rabies ravaged many countries over the centuries, frequently originating from rabid dogs biting humans and other animals. At some point, it was recognized that the saliva of infected dogs held the “poison” (derived from the Latin word virus). This led to the standard treatment of sucking the bite wounds to remove the poison. Needless to say, this was a dangerous practice, but nothing else was available to fight this horrible disease until Louis Pasteur’s rabies vaccine was introduced in 1883.

Spread of Infection

In the United States, dogs were the most important animal host of rabies until the 1960’s. The gradual decline in domestic animal cases resulted from rabies control programs that included mandatory vaccination for dogs, stray animal removal and leash ordinances. Currently, in the United States, the majority of cases reported are found in bats, foxes, raccoons and skunks. In Michigan, the bat is the number one wildlife species reported (see Table on page 2).

The rabies virus is shed in high concentration in the saliva of infected animals and the infection is spread most commonly through a bite inflicted by the rabid animal. Unlike many other viruses that...
spread through the body by way of the blood stream, the rabies virus travels along nerves to the spinal cord where it incubates for several weeks to months and even longer. During the incubation period, clinical signs of rabies are not usually observed and the animal appears normal. Eventually, the virus moves into the brain and salivary glands, and typically, clinical signs appear once the brain and salivary glands are infected.

Although uncommon, the virus can also enter the body through open wounds, or mucous membranes including the mouth and eyes, if these areas are exposed to virus laden saliva. For example, opening a cow’s mouth to examine it, administer medication or pass a stomach tube without wearing protective gloves can expose the handler to a cow’s saliva. This is frequently performed in cattle that are ill for reasons other than rabies. Cautious handling of cattle with undetermined illnesses, especially if neurologic signs are observed, is recommended to avoiding exposure to saliva.

**Clinical Signs**

Rabies usually presents as an individual animal disease rather than as a herd outbreak. However, because cattle are naturally curious and explore their world with their noses, several animals in a herd may be bitten when they gather to investigate a rabid skunk or racoon displaying unusual behavior. In such situations, the length of time to the development of clinical signs is shortened when compared to an animal bitten on a hind leg because the virus has a shorter distance to travel to infect the brain.

The early clinical signs of rabies can be subtle, variable, vague, and easily missed. Milk production and feed intake may decrease gradually, before dropping dramatically. Cattle may appear very alert and stare intently at objects. A cow may become excitable and display exaggerated movement. She may become aggressive, charge objects and people and produce loud, distinctive bellowing. Aggressive

---

**TABLE 1: Reported rabies cases in Michigan 1999 through 2008***

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>All animals</strong></td>
<td>79</td>
<td>210</td>
<td>50</td>
<td>39</td>
<td>42</td>
<td>48</td>
<td>46</td>
<td>47</td>
<td>68</td>
<td>91</td>
</tr>
<tr>
<td><strong>Domestic</strong></td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td><strong>Wild</strong></td>
<td>78</td>
<td>206</td>
<td>44</td>
<td>34</td>
<td>41</td>
<td>47</td>
<td>45</td>
<td>43</td>
<td>66</td>
<td>88</td>
</tr>
<tr>
<td><strong>Cats</strong></td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td><strong>Cattle</strong></td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Dogs</strong></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Horses/Mules</strong></td>
<td>0</td>
<td>1</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td><strong>Sheep/Goats</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Raccoons</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Bats</strong></td>
<td>70</td>
<td>199</td>
<td>39</td>
<td>28</td>
<td>37</td>
<td>45</td>
<td>43</td>
<td>41</td>
<td>62</td>
<td>67</td>
</tr>
<tr>
<td><strong>Skunks</strong></td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>21</td>
</tr>
<tr>
<td><strong>Fox</strong></td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td><strong>Rodents/Rabbits</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Humans</strong></td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>


“In Michigan, animal rabies testing is performed by the Michigan Department of Community Health’s Bureau of Laboratories located in Lansing and Houghton.”
behavior may be expressed as increased sexual activity, including vigorous mounting behavior. Bulls may have a persistent erection or prolapsed penis. Some cattle strain quite forcibly as if they are in labor, or trying to urinate and/or defecate.

As paralysis of the face and throat muscles develops, an animal’s face may appear expressionless. Because she is unable to swallow, she may drool, her tongue may protrude and uneaten food may hang from her mouth. These signs mimic choke (blockage in the throat or esophagus) and may prompt a caretaker to examine the mouth, often with bare hands. After such an examination fails to find an obstruction, the handler may think about rabies and his/her possible exposure to virus laden saliva.

Once clinical signs appear, the progression is rapid with increasing paralysis leading to the inability to rise, followed by death. In some cases, incoordination of the hind quarters appears before any others signs. In such cases, a cow will appear bright, alert, with normal facial expressions and eat habits. She may exhibit a swaying, unsteady gait, and her tail and anus may appear flaccid. As the paralysis ascends toward the head, she will become recumbent, lose her facial expression, drool, and eventually die.

Observations of the above signs are suggestive of several other diseases that are much more commonly encountered than rabies, including lead or organophosphate toxicity, nervous ketosis, milk fever, polioencephalomalacia, botulism, pseudorabies, listeriosis, brain tumor or abscess, and indigestion. Because rabies is so uncommon, it may rarely be thought of in cattle with signs associated with neurological disease. However, it should always be on the list of possibilities when an animal with an ill-defined problem, especially if neurological signs are noticed and the animal has had contact with a bat, skunk or racoon that displayed unusual behavior. It is very important to limit the number of people and other animals that come in contact with the rabies suspect, and, if possible, the animal should be isolated. Enlist the assistance of a veterinarian who is familiar with livestock diseases to help determine the cause of an animal’s illness.

**Testing for Virus**

There are no tests for rabies in a live animal. Determination of whether or not an animal has rabies requires a post-mortem examination of specific parts of an animals’ brain. In Michigan, animal rabies testing is performed by the Michigan Department of Community Health’s Bureau of Laboratories located in Lansing and Houghton. Confirmed cases of rabies are reported to the state veterinarian and public health officials.

**Vaccination/Prevention**

Currently, there are three companies, Pfizer (Defensor 3®), Schering-Plough (Rabdomun®) and Merial (Imrab 3° and Imrab Large Animal®) that produce rabies vaccines licensed for use in cattle. All of these are inactivated or killed vaccines that will not cause the disease, but will stimulate the formation of antibodies protective against the rabies virus. It is important to use only those vaccines that have been tested and approved for use in cattle. The efficacy of non-approved products has not been determined and may not provide adequate protection. In Michigan, routine vaccination of production-type animals is uncommon because the cost of vaccination outweighs the risk of exposure to rabies. The exceptions include very valuable purebred animals, cattle that are used in exhibits such as petting zoos because of their greater exposure to humans, and animals that are pastured in areas that have an abundance of bats, skunks or...
Bovine Leukosis Virus Update II: Impact on Immunity and Disease Resistance

Lorraine Sordillo & Ron Erskine
Dept. of Large Animal Clinical Sciences

Dairy Herd Health

Bovine Leukosis Virus (BLV) causes leukemia and alters the normal immune defenses of cattle. This article describes how the virus infects cattle and the potential impact BLV may have on susceptibility to other infectious diseases.

Bovine Leukosis Virus (BLV) is a retroviral infection that causes leukemia in cattle by targeting white blood cells and causing them to grow uncontrollably. Most BLV-infected cattle seldom present with outward clinical signs. Approximately 30% of infected animals, however, will have abnormally high white blood cell counts and up to 5% will develop malignant tumors or lymphosarcomas. The most severe cases of BLV will exhibit enlarged lymph nodes, weight loss, loss of appetite, infertility and decreased milk production. The virus is transferred from cow to cow by BLV-laden white blood cells found in blood, saliva, semen and milk.

Certain management practices that expose uninfected animals to contaminated blood, such as the use of common needles, contaminated surgical instruments and multiple use of rectal palpation sleeves, can dramatically increase the prevalence of BLV within a herd. There is also evidence to suggest that BLV-infected dams may transmit the virus to offspring via colostrum or placental transfer.

Once infected with BLV, cattle become lifetime carriers. There are no vaccines or treatments that can eliminate the infection. Indeed, a recent survey of the US dairy cattle farms suggest that over 80% of all dairy farms have cows that have BLV infection (http://nahms.aphis.usda.gov/dairy/dairy07/Dairy2007_BLV.pdf). Economic losses associated with BLV and management practices that can reduce or eliminate transmission of BLV from infected carriers to future replacement animals was covered in a previous article (Michigan Dairy Review, January 2009). This article will focus on how the virus attacks important host defense mechanisms and the potential impact on susceptibility to other infectious diseases.

Bovine Immunity and BLV Pathogenesis

Cattle are protected by a variety of immune defense mechanisms, which can be separated into two distinct categories: innate immunity and acquired immunity. Innate immunity, also known as nonspecific responsiveness, includes a set of resistance mechanisms that are not specific to a particular pathogen. Innate immunity is present or activated quickly at the site of infection by numerous stimuli; however, they are not augmented by repeated exposure to the same insult.

Conversely, the specific or acquired immune system recognizes specific pathogens (antigens) that activate selective elimination of that pathogen. Recognition of antigens is mediated by antibody molecules, cytokines, and a specialized group of white blood cells (lymphocytes). Lymphocytes are the only cells of the immune system that recognize antigens through membrane receptors that are specific for invading pathogens.

There are two distinct subsets of lymphocytes, which differ in function and protein products, T and B lymphocytes. Because of the “memory” of certain lymphocytes, acquired immune responses can be augmented by repeated exposure to a particular pathogen.

Vaccination of cattle against certain pathogens can occur if acquired immune mechanisms are effectively activated. Whereas it is convenient to discuss the highly complex nature of the bovine immune system in terms of nonspecific and specific responses, it should be emphasized that innate and acquired immunity does not operate independent of each other. Deficiencies in any one aspect of the immune response could greatly impact the ability of cattle to resist infectious diseases.

The primary cellular targets of BLV infection are B-lymphocytes. Once infected, B-lymphocyte populations increase significantly due to abnormal growth resulting in a persistent lymphocytosis and eventually malignant lymphomas. The primary roles of B-lymphocytes are to help recognize invading pathogens and then produce specific antibodies needed to eliminate the pathogen.

BLV infection impairs B-lymphocyte functions, especially in persistently lymphocytic animals. The progression of BLV also is known to affect other aspects of host defense.
As B-lymphocyte numbers increase in BLV-infected cattle, there are significant decreases in the percentages of the T-lymphocytes. T-lymphocytes are needed to recognize pathogens and then secrete a repertoire of soluble factors (cytokines) that regulate essentially all aspects of innate and acquired immunity. The development of bovine leukemia is clearly a complex process involving altered regulation of both the numbers and function of bovine immune cell populations. Therefore, essential components of the acquired immune response are impaired in BLV-infected cattle.

**Effects of BLV on Health and Productivity**

The appearance of lymphomas in BLV-infected dairy cows has a direct economic impact on the industry due to increased replacement costs, loss of income from condemned carcasses of cull cows, and the inability to export cattle, semen and embryos to countries that maintain BLV control programs. Other losses may include reduced reproductive efficiency and decreased milk production.

The impact of BLV infection on herd health and economy may be more extensive, however, because of the pronounced effect of BLV on the immune system. Indeed, the dramatic shift in the distribution and functional capabilities of bovine lymphocyte populations was suggested to have a detrimental impact on the ability of cattle to resist the development of other infectious diseases. For example, epidemiological reports show significant association between BLV infection and the occurrence of both clinical and subclinical mastitis. BLV-infected herds also were found to have a higher risk of hoof problems, gastrointestinal, pneumonia, and culling when compared with BLV-free herds. Whereas these observational studies do not necessarily prove that BLV causes these other health disorders, the potential impact on the ability of cows to resist the development of other health disorders is worth a closer examination.

One area of investigation that has received very little attention is the potential impact of BLV status and altered immune function on vaccine efficacy. Vaccine trials have been performed in attempts to vaccinate against BLV with some promising results. However, there are limited published reports on how cows may respond to non-BLV related immunization protocols based on BLV status. Unfortunately, the impact of BLV status on other vaccine programs has not been investigated.

The possibility that BLV infection may alter the efficacy of vaccine programs and decrease host resistance to other diseases is an intriguing hypothesis. The J5 Escherichia coli bacterin is extensively used in cattle to enhance immune resistance against gram-negative bacteria, including mastitis-causing coliforms. Studies are underway at Michigan State University to determine if altered immune status in BLV infected dairy cattle may influence the effectiveness of J5 vaccination protocols. Our initial results confirm that lymphocyte homeostasis is disrupted in BLV-infected cattle and changes in immune cell functions are related to the severity and duration of lymphocytosis.

The dramatic shifts in both T- and B-lymphocyte populations was accompanied by significant changes in the expression of cytokines that are involved in enhancing the immune response during vaccination. We are now evaluating antibody responses to the J5 bacterin with respect to BLV status. If these initial studies suggest a link between BLV status and responsiveness to vaccine protocols, larger field studies will be designed to examine in more detail how BLV infection may impact herd vaccine programs.

The implications of this research on the health and disease resistance in dairy cattle reach beyond increasing our knowledge of the effects of BLV on the bovine immune system. The prevailing belief is that BLV is not a major health issue in most herds as only a small group (<5%) succumb to lymphosarcoma. However, if we determine that BLV infection alters the ability of the bovine immune system to respond to immunization, the implications for maintaining the health and well being of dairy cattle in the face of infectious challenge from mastitis pathogens, and potentially other infectious diseases, could provide more economic incentive to implement management practices that would minimize the risk of spread within the herd.

Acknowledgements
The authors acknowledge the Elwood Kirkpatrick Dairy Research Fund for the generous research support.

References are available upon request at the Web site (but not in print version).

“Vaccination of cattle against certain pathogens can occur if acquired immune mechanisms are effectively activated ..”
Comprehensive Manure and Milking Parlor Wastewater Management

Steven Safferman, Hope Croskey, and Dawn Reinhold
Dept. of Biosystems and Agricultural Engineering

Manure & Nutrient Management

Two significant problems facing dairy farmers with herds of less than 200 cows are managing impacted storm water runoff and milking center wastewater. Often the use of large storage lagoons and manure storage structures are not available to serve as collection sites for impacted water and expensive engineered treatment systems are not economically feasible. Yet improper discharge of impacted water to surface and ground water may result in health risks and environmental harm. Effective, economical technologies need to be researched and developed.

The need to identify water treatment solutions is equally applicable to larger farms as impacted storm water runoff must be properly managed to prevent discharges. The other common practice of storing milking parlor wastewater in manure storage lagoon results in the need to increase its size by 20 to 50% (Livestock Wastes Subcommittee, 1985), increases hauling costs, dilutes manure nutritional value, and negatively impacts nutrient balancing (Safferman, 2008).

Project in the Making
An ongoing demonstration project by MSU researchers is examining a novel small farm storm water runoff filter strip and milking parlor wastewater treatment system. The research is sponsored by the Michigan Milk Producers Association and Aqua Technologies, Ontario, Canada. Specifically, the runoff technology is based on the USDA Michigan Natural Resources Conservation Service (NRCS) Wastewater Treatment Strip Practice Standard 635 with some modifications that may enhance treatment.

This technology collects impacted runoff in a small sedimentation basin where more dense materials settle by gravity. The collected water then travels through a bioretention basin, one of the modifications to the original standard that provides some treatment and storage when needed so that the filter strip is not overloaded. Water exits the basin through a flow controlling hydraulic structure into vegetated filter strips. As water flows through the slightly sloped filter strip, the vegetation and soil remove pollutants.

Treatment of the milking parlor wastewater in a vertically constructed wetland, designed by Aqua Technologies, is also being researched. The water first enters a septic tank where larger materials settle and fats, oils, and grease float. From the tank, clarified water is dosed into the wetland which contains three equally sized cells. The first cell aerobically removes the bulk of soluble pollutants and includes a recirculation loop. Next, the water enters the second cell, which is anaerobic so that nitrate is converted to nitrogen gas. The third cell is aerobic and removes most of the remaining organic, soluble pollutants from the water. All cells are filled with pea gravel to a depth of approximately 4 ft and planted with pollutant-tolerant vegetation. The design is unique because in the summer water is distributed above the surface directly into the vegetation. To prevent freezing in winter, water enters approximately 2 ft below the surface. Upon exiting the wetland, water is subsurface discharged through a drain field.

Demo Site with a Purpose
The objective of this project is to document all aspects of designing, constructing, and operating both technologies and determine the life-cycle costs and performance with the goal of providing technology transfer materials. A small farm in mid-Michigan was selected for the demonstration site. The filtration strip generally only treats water that has the potential to be impacted from feed and manure during storm events and therefore, is designed specifically to the farm’s layout. For the demonstration farm, this resulted in a collection area of approximately 0.15 acres. Designing the wetland depends on the number of cows and the number of times they are milked each day. For this farm, 50 cows are milked up to 3 times a day.

Installation of both systems at the demonstration farm is nearly complete. Monitoring is scheduled to begin as soon as plants are established and is to continue through 2010. Figure 1 shows the bioretention channel under construction. The geotextile running down the...
middle covers a gravel filled trench with a tile that drains the basin between storm events. Figure 2 shows the constructed wetland nearing completion. The PVC pipes distribute wastewater onto the surface during the summer. Pollutant-tolerant plants will be grown in the wetland.

Critical Design Decisions
Important design considerations documented during the planning and construction of the system included the following:

1. Technologies require a minimum depth between the water discharge level and ground water table elevation. Consequently, the seasonal high ground water elevations must be accurately determined.

2. Coordination with NRCS technical service providers is crucial as other conservation practices planned for a farm, such as barn guttering, milking facility wastewater storage, and manure stacking, greatly impact the design and layout of the settling basin, wastewater treatment, strip and the constructed wetland.

3. Designs must account for farm operational and management changes. Examples include, increasing milkings from 2 to 3 times a day, increasing the herd size, and relocating feeding operation and silo storage.

4. Layout of treatment technologies should maximize gravity fluid flow and minimize disruption of day-to-day farm activities. However, set back distances are required from protected features, such as creeks, regulated natural wetlands, and water supply wells.

5. Clean water should be kept clean by keeping it away from manure and feed impacted surfaces so that the filter strip size can be minimized. This often requires the installation of diversion structures such as barn gutters and physical curbs and barriers around manure storage locations.

6. Financial planning, including grant opportunities, needs to be fully explored in advance of design.
Proper Disposal of Dead Animals in Michigan Farms

Dale Rozeboom
Dept. of Animal Science

The Bodies of Dead Animals Act (BODA; Act 239 of 1982, as amended) regulates the management of dead animals in Michigan. The intent of this law is to:

1. Protect human and animal health;
2. Reduce risk of disease transmission;
3. Control problems with vermin and other scavenging animals; and,
4. Protect ground and surface waters and air quality.

A person violating BODA is guilty of a misdemeanor punishable by a minimum fine of $300 or imprisonment for a minimum of 30 days, or both. Three or more convictions for violating BODA is a felony punishable by imprisonment for up to 1 year or a fine of up to $2,000, or both.

Under this act, there are currently six alternatives for dead animal disposal in Michigan: burial, incineration, rendering, land-fill, composting, and, anaerobic digestion (pending promulgation of rules).

The Michigan Department of Agriculture (MDA) may require an additional alternative disposal method, at the owner’s expense, if all of the current disposition methods for dead animals inadequately address potential toxicological contamination threats to human or animal health, or to the environment.

Regardless of which method of disposal is being used, all mortalities must be disposed of within 24 hours after death. The three exceptions to this rule are: 1) dead animals stored secure at less than 40º F for no more than 7 days or at less than 0º F for no more than 30 days; 2) small mammals, deer, and birds taken under the authority of a damage and nuisance animal control permit issued by the Michigan Department of Natural Resources (Part 401, NREPA, 1994 PA 451, MCL 324.40101 to 324.40119); and, 3) road kill.

Mortality must only be those animals “intrinsic to an operation under common ownership or management.” Carcasses may originate from multiple farm sites and be a mixture of livestock species, if all are owned by the same person or firm. Dead animals may be transported from several sites as long as BODA rules for transport are followed. Vehicles and (or) container(s) cannot leak or spill, and must be covered to prevent public viewing of the dead animals.

Burial

Burial sites must have no contact with bodies of water, either surface and ground, and must be at least 200 ft from wells. Frozen ground makes burial difficult in winter.

Nutrient & Energy Management

Individual graves must be:
1) at least 2 ft beneath the natural surface; 2) limited to 100 graves/acre or 5 tons of tissue/acre; 3) separated by a minimum of 2.5 ft; and, 4) closed within 24 hours of opening.

Common graves must:
1) be limited to 2.5 tons of tissue per acre; 2) be separated by a minimum of 100 ft; 3) have each day’s mortality covered with a minimum of 1 ft of soil; 4) not remain open for longer than 30 days; and, 5) have at least 2 ft of soil as final cover.

Incineration

Burning must not cause a public nuisance. Act 451, Part 55 “sources of air pollution” states that incinerators must be permitted by Air Quality Division of Michigan Department of Environmental Quality (MDEQ). Residues from the burning process must be buried as outlined above, land-applied at agronomic rates, or properly disposed of in a landfill licensed by the MDEQ.

Rendering

Rendering services must be provided by a licensed dead animal dealer, rendering plant or animal food manufacturing plant. As of April 27, 2009, rendering facilities are required to remove the brain and spinal cord of all cattle ages 30 months and older if by-products are to be used for animal feed. The FDA is trying to lessen the chance of bovine spongiform encephalopathy getting into the human food supply. The rule presents new challenges for renderers and farmers, including documenting and identifying such animals.
Landfill
Farmers should contact local landfills to learn if they will take delivery or pick-up farm mortality. The number of Michigan landfills which take dead animals has been decreasing and may currently be 10 or less. Arrangements can be made for carcass pick-up by the waste management firms, but they must comply with provisions for transportation as written in BODA. If a farmer delivers to the landfill, BODA rules for transport must be followed and the risks of transporting disease from the landfill site back to production facilities need to be addressed in the farm’s biosecurity plan.

Composting
This is the biological decomposition of animal tissues under controlled or managed conditions. After composting, soft tissues should not be recognizable, bones should be broken in small pieces, and the compost should be aesthetically acceptable to other people.

All composting rules under BODA must be followed. A comprehensive document named the Michigan Animal Tissue Compost Operational Standard (MATCOS) was written to explain in detail the composting options provided to farmers in BODA. These may be found on-line at: https://www.msu.edu/~rozeboom/catrn.html.

Under BODA, mortality composting on-farm may be done in piles or in-vessel. Piles may take shape: in bins, in open piles, in overlapping piles, or in windrows. With any of these methods, aeration of the compost material may be forced (mechanized with fan and ductwork), active (mechanical turning of material), or passive (air exchange within the composting material as fresh air is pulled into the lower portion of the pile as heat takes gases out of the upper portion of piles).

For smaller farms with 20,000 lb or less of mortality annually, composting may be done in piles on bare soil without floor or roof (a.k.a. “open”). The soil must be land used for crop production. Collection of compost leachate is not required, but it must not cause a violation of any other federal, state, or local laws.

For larger farms, with more than 20,000 lb of mortality annually, open piles or windrows may also be used, but they must be on a concrete pad or liner which is laid down according to the NRCS 313 practice standard. Using a concrete pad or liner with open pile and windrow compost ensures adequate environmental protection and provides a solid surface year-round for driving of large equipment even in freezing, thawing, and precipitation conditions.

Site selection is important. On-farm traffic patterns, equipment access, animal housing, feedstuff movement, and adequate space around the compost materials for loading, unloading, and mixing should be considered. All composting sites must meet the following criteria:

- well-drained soil with a minimum setback of 200 ft from waters of the state such as lakes, streams, wetlands, sinkholes, seasonal seeps, or other “hydrologically-sensitive” areas;
- a minimum of 2 ft above the seasonal high water table;
- a minimum of 200 ft from any well; and,
- a minimum of 200 ft from the nearest non-farm residence.

Management of active composting is required to be done under the following conditions: 1) carbon-to-nitrogen ratio 15:1 to 40:1; 2) moisture content, range of 40 to 60%; and, 3) oxygen concentration of greater than 5% which accompanies a compost density in the range of 800 to 1200 pounds/cubic yard.

All composting systems require the controlled formation, identification, and management of compost batches. Bodies of Dead Animals Act requires that each batch undergoes a minimum of three heat cycles over 130º F before final utilization as “finished” compost. Timely aeration and moisture additions will allow active composting to continue in repeated heat cycles for months and minimize total composting time.

Bulking agents (a.k.a. feedstocks, amendments, carbon sources) are organic materials placed around carcasses to provide nutrients, desirable density, and aeration. An approved list of bulking agents is given in BODA.

Flies, rodents, pests, and other scavengers or predators must be controlled so as not to disrupt the compost or constitute a risk or health hazard to human or animal populations. A biofilter, or layer of fresh, bulking agent, placed over a pile after each addition or each aeration, reduces odors and discourages pests. Carbon-rich materials such as chopped bean stover, chopped corn stover, chopped straw, dried grass, grain hulls, chopped dried hay, and sawdust or shavings should be used as biofilter materials. Animal manure solids, partially-decomposed feedstocks,
green grass clippings, fresh hay, green leaves, and litter cake are less effective in controlling odors, insects, and other vermin and should not be used as a biofilter.

Finished compost should have no visible pieces of soft tissue when reused in new compost batches or spread on cropland. Large bones of mature animals generally take 2 to 3 times as much time as soft tissues to compost. Bones should be placed in a new batch of compost for further decomposition until easily crumbled during the mechanical spreading process. Finished compost need not be fully cured.

Records containing all of the following information must be kept by the owner or operator of the composting facility for a minimum of 5 years and must be made available to MDA immediately upon request:
- the start date of each compost batch;
- date of and approximate weight of dead animal additions to new compost batches. Animal tissue additions to a new pile should be concluded in 2 months or less to facilitate proper management of the compost batches;
- the internal temperature of each actively composting batch measured weekly, except twice per week for a rotating drum, continuous flow, in-vessel system. The internal temperature of curing material measured once each week;
- the date compost material is aerated if done with loader or turning equipment; and,
- the final use or distribution of finished compost, including the method, location, date, and volume for the batch.

Cooperative or Commercial Composting
Michigan currently does not have language in its regulations allowing for cooperative and (or) commercial animal tissue composting. Michigan Department Agriculture, MDEQ and MSU are currently giving consideration to the regulation of both options.

Anaerobic Digestion
Anaerobic digestion was approved as an alternative in the last year (BODA, Amended 2008, Act 311, effective December 18, 2008), but is not currently allowed to be used as Part 665, Sub 15 states that the MDA shall promulgate rules for the “methodology for the anaerobic digestion of organic materials.” This process has not been completed.

Mass Carcass Disposal in a Major Animal Health Emergency
A memorandum between MDA, MDEQ, and the Michigan Department of Natural Resources was entered into in September of 2004, to define their respective roles and responsibilities when mass carcass disposal is needed because of a major animal health emergency (e.g. a foreign animal disease or a natural disaster). Work with your veterinarian quickly when you become aware of the potential for disease. The Bodies of Dead Animals Act addresses only the normal and natural mortality occurring on a farm. Sub rule 5 in section 19 of BODA says that any increase in normal natural daily mortality, due to any cause known or unknown, shall be reported to the MDA immediately. This is a biosecurity measure intended to protect our state’s and nation’s animal agriculture industry. A document entitled Standard Operating Procedures for Michigan Mass Carcass Disposal is available at: http://www.michigan.gov/mda/0,1607,7-125-48096_48404---,00.html.
Dairy Students Awarded Over $90,000 in Scholarships

Miriam Weber Nielsen  
Dept. of Animal Science

Industry & University

The Michigan Dairy Memorial and Scholarship Foundation continues to be the largest scholarship program in the College of Agriculture and Natural Resources. In the last decade, the endowment has grown by more than 50% to a principal account of nearly $800,000 and increased by over 40% to 170 the number of individuals recognized as Honorees of the Foundation. Individuals and organizations in the Michigan dairy industry have been the primary contributors to this growth and the increased amount of scholarship funds available to dairy students.

New Honorees of the Foundation this year, recognized through a minimum of $1,000 contribution to the Foundation, include Randy BeVier, Kenneth Dunn, Dr. Kirk Heinze, Terry and Jean Nugent, Carleton Wilson, Red and Edna Cotter, Ralph Frahm, Dr. Ernest Anthony, Dr. Bill Bickert and Velmar Green.

The Foundation awarded $90,000 in scholarships this year. Scholarships are awarded on the basis of academic performance, extracurricular involvement, and interest in a career in the dairy industry.

Glenn & Anne Lake Scholarship
The Glenn and Anne Lake Scholarship pays all tuition and fees for an academic year. This year’s recipient is Nicole Schaendorf, a senior pursuing a bachelor’s degree in agriculture and natural resources communications. Nicole is the daughter of John and Connie Schaendorf, and plans to work in the dairy industry in public relations and event management. Nicole is the 2009 Michigan Dairy Ambassador, and also remains active on her family’s farm.

Russel Erickson Scholarship
The Russel Erickson Scholarship of $5,000 is awarded to Greta Koebel. Greta, a senior in agribusiness management from Three Oaks, is the daughter of Terry and Jennie Koebel. She has been very active in the dairy industry, receiving state and national awards for her involvement. She is active in the MSU Dairy Club, Collegiate Farm Bureau and Michigan Junior Holstein Association. Upon graduation, Greta plans to work for a company in the dairy industry or on a farm with registered cattle.

Donald & Valera Murray Scholarship
The Donald and Valera Murray Scholarship of $4,000 is awarded to Andrew Rupprecht. Andrew is the son of Nathan and Vickie Rupprecht from Vassar. Andrew has worked on his family’s farm for many years, and plans to eventually return to the farm. He has been active in MSU Dairy Club as President, Michigan Junior Jersey Club, MSU National Agri-Marketing Association, and MSU Collegiate Farm Bureau.

Continued on Page 20
Outreach and Education Opportunities at the KBS Pasture-Robotic Milking Dairy

Mat Haan
MSU Kellogg Biological Station

Outreach

In the summer of 2009 the Michigan State University W.K. Kellogg Biological Station (KBS) Dairy began the transition to a pasture-based dairy facility utilizing robotic milking system. The transition to this new state-of-the-art facility was made possible with a $3.5 million grant from the W.K. Kellogg Foundation and additional support from MSU Extension, Michigan Agricultural Experiment Station, and the MSU Office of the Provost and College of Agriculture and Natural Resources (Michigan Dairy Review, July 2009 or online at www.msu.edu/user/mdr/vol14no3/KBS.html).

A New Center

As part of the project, KBS also founded the Pasture Dairy Research and Education Center with the mission to support research, education, and outreach programs focusing on the needs of Michigan dairies in the areas of animal health and welfare, dairy and pasture management, environmental quality, processing, and marketing of dairy products. In the October 2009 issue of the Michigan Dairy Review (or online at www.msu.edu/user.mdr/vol14no4/comfort.html) Dr. Janice Siegford, Department of Animal Science, reported on the first research at the new dairy facility.

Past, On-going & Future Programs

Several education and outreach programs have either already occurred, are underway, or are being planned at KBS. In August the Southwest Michigan and Central Michigan grazing groups participated in a pasture walk at the dairy to learn about the facilities, pasture management, and research being conducted. Two dairy workshops are scheduled at KBS this winter, the first was Value Added Dairy Marketing (December 15, 2009) and a second will be Nutrient Management for Small and Mid-Sized Dairies (February 2, 2010). In addition to pasture walks and workshops KBS has initiated a Cooperator Farmer Contract, CFC, program to provide financial support to dairy farmers for on-farm, farmer-driven research and demonstration projects.

The CFC program was developed to help meet the education needs of pasture-based dairy producers by supporting farmers that wish to conduct applied research and demonstration projects on their own farm. During the summer 2009 the Pasture Dairy Research and Education Center funded projects on three dairy farms in Michigan. Participating farmers received up to $3,000 to help address questions about improving the productivity of their pastures or the management of their dairy. Participants in the CFP in 2009 were Doug Covert, Seth Rondeau, and Howard Straub.

Doug Covert, Hudson, Michigan, wanted to determine which forage species, varieties, and mixes performed best under the soil, climatic, and management conditions on his farm. Doug planted 21 grazing plots in his pasture and evaluated the plots for animal preference, drought tolerance, forage yield, and milk production on a 10-point scale. Forage plots included single species of cool-season and warm-season grasses, legumes, and mixes of these species. Cattle preferred plots containing Timothy grass over non-Timothy plots; however, these plots were lower
yielding and appeared to be less drought tolerant. Orchardgrass and perennial ryegrass plots performed similarly and received higher scores for drought tolerance and yield than did plots not containing these species. Doug held a pasture walk on his farm in September to share the findings from his grazing plots with other farmers. In 2010 Doug will frost seed legumes into his grass plots and continue monitoring the plots.

Seth Rondeau, Spruce, Michigan, was interested in which forage species would allow for good milk production with little or no grain supplementation. Seth’s pastures included sorghum-sudangrass, triticale/ryegrass, oats/field peas/turhins, and corn. The oat/field pea/turhins pastures were planted in April and grazed early in the season. A cool and wet spring delayed planting of sorghum-sudangrass and corn, possibly causing a reduction in yield. Both sorghum-sudangrass and corn pastures were subdivided with temporary fence and strip grazed. Late planting and cool wet conditions decreased ear formation in the corn pasture, this pasture was grazed in late September (see photo, page 12). Even with the poor growing conditions Seth was satisfied with the performance of the different pasture mixes and shared his experience during a pasture walk at his farm.

Howard Straub, St. Johns, Michigan, evaluated how feeding cracked corn and soy hulls to grazing dairy cows affected milk production and economics. Howard compared milk production and economic data from 2009 to historic yield and economic returns at his dairy. Providing supplemental energy in the ration should increase milk yield but Howard is more interested in knowing if the increased milk yield pays for the additional purchased feed. Data

Update on AgJOBS

Vera Bitsch
Dept of Agricultural, Food, & Resource Economics

April 2007, Michigan Dairy Review (MDR) reported on potential legislation affecting dairy farm employers, AgJOBS. Here is an update on the status of this legislation which has since been reintroduced in the 111th Congress.

On May 14, 2009, the Agricultural Job Opportunities, Benefits, and Security Act of 2009 (AgJOBS) was introduced in the Senate (S.1038 sponsored by Feinstein, D-CA) and the House of Representatives (H.R.2414 sponsored by Berman, D-CA and Putnam, R-FL). A complete list of cosponsors and the full text of the proposed legislation is available by bill number at http://thomas.loc.gov. The AgJOBS compromise was originally reached in 2000 after negotiations between the United Farm Workers (UFW), several agricultural employer associations, and federal legislators.

The newly introduced bill is similar to the bill introduced in 2007 and reported on in MDR. The dates have been updated and the cap for earned adjustment of status to temporary immigration status has been lowered to 1.35 million undocumented farm workers. As before, the bill provides for an earned adjustment of status with temporary immigration status in the first step and a path to permanent residency status through continued agricultural work in the second step. AgJOBS also updates the existing H-2A temporary foreign agricultural work program to improve its usability by agricultural employers. Dairy workers continue to be included in the reformed H-2A program. Different from temporary workers in other agricultural professions, these workers would be able to work up to 3 years and be eligible for permanent residency afterwards.

from this project is being analyzed and will be posted at http://www.kbs.msu.edu/research/pasture-dairy/dairy-research/cooperator-farmer-contract, along with information on the other two projects.

In 2010 the CFP will continue and be expanded to include funding two or three projects in each of two areas 1) dairy and pasture management and 2) dairy processing and marketing. Michigan dairy farmers using pasture as part of their management system are eligible to submit proposals for projects. Projects related to pasture fertility, forage variety selection, grazing management, supplemental feeding of dairy cows on pasture, and similar topics will be considered. Michigan dairy farmers and other entrepreneurs interested in developing or expanding an on-farm dairy processing facility or developing alternative marketing strategies for dairy products may apply for the Dairy Processing and Marketing program.

How To Apply

Project proposals should include name and contact information for project participants, a 1 to 2-page description of the project, and a project budget. The project description should include why the project is important, what will be done, who will benefit, and what the final product (pasture walk, project report, etc.) will be. The deadline for submitting proposals is January 31, 2010. MDR

Additional information on submitting a proposal to the CFC program and other outreach activities at the KBS dairy can be found at http://www.kbs.msu.edu/research/pasture-dairy/dairy-events or by calling Mat Haan at (269-671-2360, or emailing him, haanm@msu.edu.
Transition Cow Management Report (DHI-403)

Kathy Lee
Extension Dairy Educator
Northwest Lower Michigan

Information Management

Dairy Herd Information (DHI) records are summarized in a variety of herd performance reports. In 2009 Dairy Records Management Systems (DRMS) introduced a new report designed to evaluate transition cow management.

Dairy producers, veterinarians, dairy nutritionists and other herd consultants can use the Transition Cow Management Report (DHI-403) to monitor seven key measurements that indicate the quality of the dry cow and fresh cow programs in dairy farms.

Information Monitored

The Transition Cow Management Report highlights key indicators related to management of cows during the dry period and early lactation. Each key indicator is given a rating for level of success based on a 100-point scale.

The level of success achieved by the top 10% of herds of a similar size is indicated for each measurement for comparison to a benchmark. Level of success data are graphed while other relevant summary data are listed in tabular format. Data from the past 12 months are provided to show trends for the herd.

A short description of each key indicator follows.

- Dry Periods - Number of days dry influences performance. Dry periods that are too short or too long can result in reduced milk yield in the subsequent lactation. In this report, the percent of dry periods that are between 30 and 70 days long are graphed for two groups - second lactation cows and third and greater lactation cows.

- First Milk - Higher daily milk yield for fresh cows tends to indicates few or no problems during the dry period or at calving. The First Milk graph shows the percentage of fresh cows that produced well on the first test day prior to 40 days in milk. To be considered a “successful” first test day milk yield for Holstein cows, first lactation cows must have a first milk of 40 or more pounds and second and later lactation cows must produce 50 or more pounds.

- Fat Protein Ratio - An abnormal ratio of milk fat percent to protein percent on first test can indicate metabolic problems in fresh cows. In the Transition Cow Management report, milk fat percent to protein percent ratios of 1.0 to 1.6 are considered acceptable.

- Udder Health - The percent of fresh cows without a mastitis infection is calculated for two lactation groups comprised of first lactation cows or second and later lactation cows. Cows are considered not infected if the somatic cell count (SCC) is below 200,000 cells per ml (or SCC score is below 4.0). A high percentage of infected cows early in lactation can indicate problems in the dry cow groups or the maternity area, such as lack of clean bedding.

- Reproduction - Transition cow management can influence how quickly cows are ready for breeding following calving. In this graph, the percent of cows that were bred by the herd’s voluntary waiting period (VWP) plus 30 days are summarized separately for first lactation cows and second or greater lactation cows. For example, if a herd has reported a 60-day VWP, the graph would be based on the percent of cows bred by 90 days in milk.

- Survival - Dairy producers strive to minimize the number of cows that are culled or die in early lactation. This report provides a summary of the percent of cows that survived to 60 days in milk for two lactation groups (first lactation and second and later lactations). A table also lists the percent of cows that left the herd or died in the first 60 days for each of the two lactation groups.

- Distressed Cows - Minimizing stress during the transition period increases the likelihood of optimum performance after calving and throughout the lactation. The percent of cows not distressed during the transition period is graphed in this section of the report.

Cows are considered to have been distressed if one of more of the following occurred:

- mastitis infection based on SCC of 200,000 or greater on the first test day;
- calving ease score of 3, 4 or 5;
- stillborn calf;
- twins; and,
- abortion

In addition to the graphs described above, an overview graph summarizes these 7 key indicators for the most recent time period. The time

Continued on page 15
Genetic Base Changes: January 2010

Kathy Lee
Extension Dairy Educator
Northwest Lower Michigan

The genetic base for U.S. genetic evaluations will be updated in January. Every 5 years the base is changed to adjust the predicted transmitting abilities (PTAs) for dairy animals (bulls, cows, heifers and calves) for the genetic progress that has occurred during the past 5 years. In January the base or reference population will change to cows born in 2005.

The average PTAs within each breed for cows born in 2005 will be zero, except for somatic cell score, calving ease, and stillbirth rate which are centered at breed average.

Genetic base changes do not change the relative ranking of animals or the genetic merit of the animals. Only the reference point for calculating PTAs changes.

The table below lists the expected base change in January 2010 for several traits. These values represent the genetic trend of these traits comparing average PTA of cows born in 2005 with cows born in 2000.

For a given trait and breed, PTAs will be reduced by the amount listed in the table when the genetic trend is positive. Conversely, the PTA change due to the base update will increase if the trend over the past 5 years has been negative.

A complete listing of genetic base changes for PTAs for production, health/fitness and type traits can be accessed at: http://aipl.arsusda.gov/reference/base2010.htm

### Genetic Base Changes

<table>
<thead>
<tr>
<th>Trait</th>
<th>Unit</th>
<th>Ayrshire</th>
<th>Brown Swiss</th>
<th>Guernsey</th>
<th>Holstein</th>
<th>Jersey</th>
</tr>
</thead>
<tbody>
<tr>
<td>Net merit</td>
<td>Lifetime$</td>
<td>37</td>
<td>60</td>
<td>50</td>
<td>132</td>
<td>119</td>
</tr>
<tr>
<td>Protein</td>
<td>Pounds</td>
<td>3</td>
<td>10</td>
<td>6</td>
<td>14</td>
<td>12</td>
</tr>
<tr>
<td>Fat</td>
<td>Pounds</td>
<td>3</td>
<td>10</td>
<td>12</td>
<td>15</td>
<td>17</td>
</tr>
<tr>
<td>Milk</td>
<td>Pounds</td>
<td>53</td>
<td>267</td>
<td>231</td>
<td>417</td>
<td>323</td>
</tr>
<tr>
<td>Productive Life</td>
<td>Months</td>
<td>0.3</td>
<td>0.3</td>
<td>0.1</td>
<td>0.6</td>
<td>0.8</td>
</tr>
<tr>
<td>Somatic Cell Score</td>
<td>Log (base 2)</td>
<td>-0.02</td>
<td>0.01</td>
<td>0.02</td>
<td>-0.01</td>
<td>0.00</td>
</tr>
<tr>
<td>Daughter Preg. Rate</td>
<td>Percent</td>
<td>0.1</td>
<td>-0.5</td>
<td>-0.4</td>
<td>0.0</td>
<td>-0.1</td>
</tr>
<tr>
<td>Udder Comp.</td>
<td></td>
<td>0.35</td>
<td>0.25</td>
<td>0.30</td>
<td>0.85</td>
<td>0.40</td>
</tr>
<tr>
<td>Feet &amp; Leg Comp.</td>
<td></td>
<td>0.15</td>
<td>0.10</td>
<td>0.30</td>
<td>0.65</td>
<td>0.20</td>
</tr>
</tbody>
</table>

Cow Management Report ...

Continued from page 14

period includes data from the past 1 to 3 months depending on the number of calvings in the herd each month.

A table also is provided that lists individual cows that had low milk yield or high SCC at calving during the most recent test period.

How to Receive DHI-403 Report

Dairy producers can sign up for the Transition Cow Management Report (DHI-403) through their DHI technician. The report can be received monthly or quarterly.

Veterinarians, dairy nutritionists and other herd consultants can download a copy of the report via the DRMS website at www.drms.org using the new Reports On-Demand feature. They will need to log on using their account number and password. To obtain an account number, dairy industry professionals can contact DRMS (1-515-294-2526).

The cost of the report is 3 cents per cow per test day with a maximum charge of $20 per report. (MDR)
Fat Mobilization & New Ideas about Health Risks in Transition Cows

Andres Contreras  
Nial O’Boyle  
Lorraine Sordillo  
Dept. of Large Animal Clinical Sciences

Introduction

Calving and the onset of lactation lead to a sudden increase in the energy requirements of the dairy cow. This time also is characterized by a drop in feed intake, therefore lowering the amount of energy provided by feed. The imbalance between the energy that the cow consumes and the energy needed for production demands is termed negative energy balance (NEB). Cows adapt to NEB periods by moving body fat reserves through a process known as lipid mobilization. Although this is a normal adjustment common among mammals, lipid mobilization is exacerbated in the dairy cow with the genetic drive for high milk production.

Research in humans has linked elevation of blood lipids to metabolic diseases such as type-2 diabetes, metabolic syndrome, and to inflammatory diseases such as cardiac, hypertension, asthma, and Alzheimer’s disease. In cattle, increases in blood lipid content are known to induce metabolic diseases (fatty liver, ketosis) and predispose dairy cows to inflammatory-based diseases (mastitis, metritis, and lameness) affecting animal welfare and profitability. A better understanding of how elevated blood lipids may affect dairy cow immunity during the transition period may lead to innovative approaches to control increased disease susceptibility.

What Is Lipid Mobilization?

Adipose (or fat) functions as the body’s energy store and is a very dynamic tissue. For example, adipose tissue is constantly storing and releasing energy for bodily functions. The main molecules used as an energy currency are known as triglycerides; these are composed of three fatty acid molecules and a glycerol “backbone”. When energy is required, fatty acids are released into the bloodstream by cleaving off the glycerol backbone, a process called lipolysis. In contrast, lipogenesis is a process that stores energy by reuniting fatty acids to a glycerol molecule. The resulting triglyceride is a stable molecule that is more suitable for storage. Around calving and during periods of NEB, the rate of lipolysis (breakdown) is greater than the rate of lipogenesis (synthesis and storage), resulting in more fatty acids released into the bloodstream.

Ketosis: a Consequence of Lipid Mobilization

The direct outcome of lipid mobilization is the rise in the concentrations of fatty acids in blood. These fatty acids are named non-esterified fatty acids (NEFA), because they are transported in blood unattached to glycerol. The NEFA are converted to more available energy substrates once the liver transforms them into ketone bodies. The most common ketone body in dairy cows is beta hydroxybutyrate (BHB). This ketone body is used by muscle and nervous tissue as an energy substrate, but in excess causes clinical problems, for example, ketosis. Traditionally, NEFA and BHB were used to assess the degree of NEB and lipid mobilization. They also can be used to evaluate the performance of transition cow nutrition programs.
Both NEFA and BHB are measured in micromolar per liter of blood (Table 1). Late lactation cows usually have NEFA values less than 200μM, and concentrations begin to rise as cows approach calving reaching the highest values of 800 to 1200 μM during the first week of lactation. Values return to less than 300 μM by 30 days in milk. Similarly, BHB concentrations increase as calving approaches and start to decrease after 30 days in milk (DIM).

### Table 1: NEFA and BHB measurements

<table>
<thead>
<tr>
<th>Metabolite</th>
<th>Late Lactation</th>
<th>1 week before calving</th>
<th>1 week after calving</th>
<th>30 DIM</th>
</tr>
</thead>
<tbody>
<tr>
<td>NEFA (μM)</td>
<td>&lt;200 μM/L</td>
<td>300 μM/L</td>
<td>800-1200 μM/L</td>
<td>&lt;300 μM/L</td>
</tr>
<tr>
<td>BHB</td>
<td>500 μM/L</td>
<td>800 μM/L</td>
<td>1100 μM/L</td>
<td>900 μM/L</td>
</tr>
</tbody>
</table>

**Elevated Blood Lipid Can Mean More Problems**

Although NEFA and BHB values measure the degree of lipid mobilization, these tests do not describe other changes that occur in blood lipids during the transition period. For example, there are alterations in the fatty acid composition of blood NEFA. These changes also may have consequences on cow health. Research at MSU’s College of Veterinary Medicine recently established some compositional changes in blood NEFA during the transition period. The main alteration is an increase in the concentrations of palmitic and stearic acids. In humans, these two saturated fatty acids are known to damage bodily functions, including energy utilization and immune response that could increase dairy cow’s susceptibility to disease.

**Fatty Acids and Inflammation**

Studies in human medicine demonstrated that high concentrations of NEFA induce low-grade inflammation and affect immune function. Similarly, during the transition period when blood NEFA increase severely, dairy cows experience immune dysfunction that enhances their susceptibility to disease. At the same time, saturated fatty acids such as palmitic acid increase in concentration within the blood NEFA. This fatty acid is capable of activating white blood cells at high concentrations.

As saturated fatty acids increase in blood NEFA, other fatty acids such as mono- and polyunsaturated fatty acids decrease. Some of these fatty acids include arachidonic acid (an Omega-6 fatty acid), eicosapentaenoic acid EPA, and docosahexanoic DHA (both omega-3 fatty acids). These fatty acids are essential for immune function because their products affect different steps of the inflammatory process. Reduction in the availability of these necessary fatty acids may promote immune dysfunction in dairy cows.

**NEFA Effect on Immune Function**

Changes in the concentration and composition of plasma NEFA directly affect white blood cell function. A first way of altering immune function is by changing the composition of the cellular membrane of blood cells. In animal cells, this membrane is composed of phospholipids. These molecules are formed by different kinds of fatty acids including saturated, monounsaturated and polyunsaturated. Fatty acids together with some proteins form a bilayer that surrounds and protects the cells. The fatty acid composition of the cellular membrane is directly affected by the composition of lipids in blood especially NEFA. Therefore any change in the content of blood NEFA will be reflected directly in the phospholipid membrane of white blood cells.

Fatty acids from the cellular membrane are involved in the inflammatory process as they are transformed into lipid mediators. Some examples of lipid mediators are prostaglandins and prostacyclins. These fatty acid-derived molecules can cause damage by inducing changes in blood vessels and altering white blood cell function.

A second way of altering immune function is by altering the internal communication of white blood cells.
In Life’s Harder Moments, Help Is Available

Dawn Contreras
College of Agriculture and Natural Resources

This article continues the MDR series of “tips” following the lead article in the April edition titled “Weathering the Storm.” It is our hope that expanding upon the different aspects of dairy management will benefit the industry especially in the current harsh economic climate.

All of us have times in our lives when we need a little extra help. For some of us, asking for help can be difficult to do. People can have the belief that asking for help is not acceptable. This notion can become a part of the “rule book” in our heads that create a barrier to accessing help when it is needed. However, there are times when the old “rules” can be put aside. The situation has changed to the point where new rules make more sense. That is the case for some farm families. Michigan’s economy has changed to the point where more families may be in need of temporary assistance. Several forms of assistance are available to people struggling to make ends meet through many different community resources. Below is a list of a few of the resources categories for which you and your family may qualify.

Human and Social Services: Several assistance programs, such as Food Stamps, Medical Assistance, and TANF (Temporary Assistance for Needy Families), are coordinated through the Department of Human Services. Your financial resources and family income are used to determine if you are eligible. Call me to find out what records to take with you.

Home Fuels Costs: Help with home fuel costs may be available through a Community Action Agency in your area.

Day Care Subsidies: Your county Department of Human Services may provide payment for child care services if your income and family savings are below certain levels. Child care assistance is available for qualifying families when the parent, legal guardian or substitute parent is unable to provide the child care because of employment, education and/or because of a health/social condition for which treatment is being received.

Food: In addition to food assistance through the county Department of Human Services, emergency food supplies may be available at local food pantries. Some churches and community agencies provide free or low-cost meals. Your children may be eligible for reduced-price or free school lunches. Some schools also provide breakfasts. Contact the school office.

If you have children under age five, you may be eligible for the Women, Infants, and Children (WIC) program. This federal program provides nutrition counseling and food vouchers to parenting, pregnant and breast-feeding women with children under five. United States Department of Agriculture (USDA) surplus food may also be available if your income falls within the guidelines. Contact a Community Action Agency in your area for information on distribution.

Financial Counseling: Managing your household money requires careful planning and/or budgeting. Your local MSU Extension office can provide money management resources and tips for making the most of the money you do have. Local financial institutions, utility company consumer service personnel, or mortgage companies can also help with planning for payment of specific debts.

“Michigan’s economy has changed to the point where more families may be in need of temporary assistance. Several forms of assistance are available to people struggling to make ends meet through many different community resources.”
Health Services: The county Department of Public Health can provide information on free or low-cost preventive health services, such as blood pressure checks and other screening programs. Flu shots and other immunizations may also be available at a minimal cost.

Veterans’ Benefits: Veterans of U.S. military service and their dependents may be entitled to a variety of benefits from the federal government including: 1) monthly pensions to surviving spouses and to dependent children of veterans who have died; 2) monthly payments and/or tuition and books while attending school, receiving training or completing apprenticeships; and, 3) “Veterans’ points” added to examination scores when applying to enter state service and various special employment.

Family Counseling Services: Getting through tough times can be stressful for all members of the family. During these periods of high stress, family members may have difficulty coping with day-to-day situations. In every community, resources such as counselors, mental health professionals, clergy, and support groups exist. They can help you deal with stress and the physical and emotional symptoms that often accompany it.

Fat Mobilization...

Continued from page 17

cells. Saturated fatty acids directly affect cell behavior, making a cell more likely to promote rather than fight inflammation. Therefore, changing the composition of fatty acids within the cellular membrane of white blood cells may be an effective way of altering how a cow responds to infectious and metabolic diseases during the transition period.

Regulating Lipomobilization in the Transition Period
Lipomobilization is related directly to energy balance. Minimizing dry matter intake depression during the transition period will decrease the need for mobilizing fat reserves. Providing adequate housing, minimizing abrupt management changes around calving, and targeting a diet that fulfills energy requirements without dry matter intake depression will reduce excessive mobilization of fats after calving. It is important also to prevent excessive fat deposition during the previous lactation and early dry period, because over-conditioned dairy cows will mobilize fat at a faster rate than properly conditioned animals.

Future Implications
The importance of lipid metabolism to the incidence of human diseases is well established and as a result, this has led to a significant amount of research in this field. In the near future, the dairy industry may be able to use some of the new technologies and treatments developed for human health.

Novel nutritional interventions including supplementation of specific fatty acids during times of increased nutritional requirements and new drugs that will reduce and control lipid mobilization (therefore decreasing its damage), are a couple of examples of what dairy producers may have available in the near future. However, lipidomics (lipid science) is still in its infancy and considerably more information is needed to fully understand how modulation of lipid metabolism can affect dairy cow health.

References


Rabies...
*Continued from Page 3*

raccoon or areas with a higher incidence of reported cases of rabies in wildlife, such as the southeastern and Thumb portions of Michigan.

To further protect cattle, as well as humans, farm dogs and cats should routinely be vaccinated. In fact, there have been more cats diagnosed with rabies in Michigan than raccoons, and cats are more likely to come in contact with cattle, especially dairy cattle, and people more often than wildlife. In addition, although this is a challenge, any measures that can be taken to minimize exposure of your cattle to wildlife will decrease their risk of exposure to potentially rabid animals.

The rabies virus is inactivated by heat and consumption of cooked meat and/or pasteurized milk from a rabies positive animal is not considered a rabies exposure. It is however, theoretically possible for the rabies virus to be shed in milk and there are studies underway to isolate the rabies virus from udders of cattle that have died from rabies. Until that mode of transmission is fully proven or disproven, drinking unpasteurized milk from a rabid cow should be avoided since it is considered a rabies exposure.

**Summary**

Keep in mind that rabies disease in Michigan cattle is rare. Effective and approved vaccines are available for cats, dogs, horses, sheep, ferrets and cattle and their use may be warranted in certain situations. Enlist the assistance of a veterinarian familiar with livestock diseases to help you determine if your sick dairy animal with neurological signs has rabies, or another more commonly occurring disease.

Hopefully, you will never encounter rabies during your lifetime. However, if you do, you will want to be prepared.  

"Although uncommon, the virus can also enter the body through open wounds, or mucous membranes including the mouth and eyes, if these areas are exposed to virus laden saliva."

Milking Parlor Management...
*Continued from Page 7*

This project is part of a research theme relating to milking facility waste-water treatment systems for small to medium sized farms. Progress has been documented in the Michigan Dairy Review. The first article discussed characteristics of milking facility wastewater (Safferman, 2008). Another article examined the utility of aerobic units to treat milking facility wastewater (Larson and Safferman, 2008). A technical article titled “Aerobic Treatment Unit Performance on Milking Parlor Wash Water” by Larson and Safferman was published in Transactions of the ASABE, Volume 53, Number 3, in June 2009. The bark filter mound was the subject of another article (Davis et al., 2009). An additional demonstration project on this technology started during the summer of 2009. Updates on research concerning all of these technologies will continue to be included in the Michigan Dairy Review.

**Acknowledgement**

This project is funded by the Michigan Milk Producers Association. Lloyd Rozema, owner of Aqua Technologies, donated the design and specialty equipment needed for the wetland and his travel expenses and time associated with its construction. Leila Saber Gaughran, Jason Schneemann, Jason Smith, and Adrienne Varney participated in the construction of the systems and Dana Kirk and Rebecca Larson participated in systems design.

References are available upon request at the Web site (but not in print version).

Scholarships...
*Continued from Page 11*

This year’s recipients of $1,200 scholarships were Jillian Holdwick, a junior in Animal Science from Harbor Beach, and Elizabeth Motz, a junior in animal science and agribusiness management from St. Johns.

**Michigan Dairy Memorial Scholarships**

Seven special $1,000 scholarships were awarded this year through contributions to an expendable fund to compensate for the reduced interest income available from the endowment. Five scholarships were made possible through a contribution by Michigan Milk Producers Association in the name of Velmar Green. Those recipients are Brandon Gingrich, Leroy; Sara Girbach, Saline; Lynnae Slavik, Ashley; Eric Sneller, Sebewaing; and, Gina Varner, Midland, all in animal science. Two additional scholarships
were awarded to Krista Beeker, Constantine, animal science/ag. communication, and Joe Pasch, Weidman, animal science.

**Michigan Dairy Memorial Freshman Scholarships**

Five Freshman Scholarships were awarded to Kelsey Byars, Webberville, animal science; Max Dunneback, Grand Rapids, dairy management; Trent Hooks, Breckenridge, dairy management; Tera Koebel, Three Oaks, agribusiness management; and, Jeffrey Shepherd, Hemlock, animal science.

**Michigan Dairy Memorial Ag Tech Scholarships**

The following students received Michigan Dairy Memorial Ag Tech Scholarships ($2,000): Eric Cole, Bancroft; Dale Dick, McBain; Matthew Spitzley, Pewamo; James Weber, Vassar; and, Eric Westendorp, Nashville, all in dairy management.

**Michigan Dairy Memorial Scholarships**

The following students received Michigan Dairy Memorial Scholarships ($3,500): Joseph Ankley, Imlay City, agriscience; Gail Carpenter, Dansville, animal science; Michelle Dawes, Saranac, animal science; Olivia DeVooght, Marquette, animal science and marketing; Karmen Jackson, Caro, animal science; Elizabeth Motz, St. Johns, animal science and agribusiness management; Kelli Rau, West Branch; Henry Reinart, Hopkins; Rosemary Rice, Filion; Jacquelyn Rowley, Richmond; and, Hannah Tucker, Elsie, all in animal science. (MDR)

For information on making contributions to honor members of the dairy industry or to support student scholarships, please contact College of Agriculture and Natural Resources External Relations at (517) 355-0284. To learn more about the Michigan Dairy Memorial and Scholarship Foundation, contact Dr. Miriam Weber Nielsen in the Department of Animal Science (517-432-5443; msw@msu.edu).

Visit the Michigan Dairy Review web site to read about other valuable dairy news including timely information materials at: www.msu.edu/user/mdr/

**What’s Happening...**

January -- April

**Animal Health: “Tools to Navigate the Fresh Cow Storm”**

Date: February 2 -- March 4
Time: 9:30 a.m. -- 2:30.

Michigan State University Extension Dairy Team holds its 2010 Winter Dairy meeting at the following locations:

For inquiries, contact:
Phil Durst
Phone: 989-826-1160, Cell: 989-387-5346
Fax: 989-826-1125
Email: durstp@msu.edu.
www.dairyteam.msu.edu

**Eighth Annual Great Lakes Regional Dairy Conference**

Date: Feb. 11-13
location: Bavarian Inn Lodge & Conference Center, Frankenmuth, MI.

For more, visit www.glrdc.msu.edu, or contact Megghan Honke, honkemeg@anr.msu.edu 517-432-1555, ext. 229.

**Annie’s Project Geared to Farm Women’s Needs**

Date: January 18 - April 6
Locations: Imlay City, Bad Axe, Upper Peninsula, Central Michigan, Alpena, Benton Harbor, and McBain.

Annie’s Project will be offered at seven locations in Michigan this winter. All programs include six weekly sessions followed by a 3-hour program. Topics include Human Resources and Risk Management.

For more information, call Marilyn Thelen, MSU Extension, at 989-227-6454 or thelen22@msu.edu. Also visit the Annie’s Project website for additional information at www.extension.iastate.edu/annie.
Learning How to Do More with Less in an Ever-Changing Dairy World: 8th Annual Great Lakes Regional Dairy Conference, Feb. 11-13, Frankenmuth

Sara Long
College of Agriculture and Natural Resources Communications

The eighth annual Great Lakes Regional Dairy Conference (GLRDC) will host a wide array of top-notch speakers addressing a myriad challenges facing today’s dairy farmers. From exploring animal welfare issues to implementing effective management teams and learning from last year’s high feed and low milk prices, the two-day conference will touch upon many of today’s hot-button industry issues.

“Each year we seek out topics that are relevant to the current dairy situation and will resonate with producers,” says Faith Cullens, GLRDC program chairperson and Michigan State University (MSU) Extension dairy educator. “I think we have put together one of our best slates of speakers yet. In 2009 we welcomed more than 350 producers and dairy industry representatives. We hope to build on that momentum by delivering another high-impact conference in 2010.”

The 2010 Great Lakes Regional Dairy Conference will be held February 11-13 at the Bavarian Inn Lodge and Conference Center in Frankenmuth. The conference includes two days of educational sessions, one half-day of breed association and youth meetings and an industry-wide awards banquet honoring a host of industry winners including the MSU Dairy Farmer of the Year.

Keynoting on the first day of the 2010 conference is Charlie Arnot, CEO of the Center for Food Integrity. Arnot will address the gap between public expectations of the dairy industry and the reality of today’s industry. He will help dairy farmers understand what consumers expect and how to build public trust.

Also headlining the event is Dr. David Kohl, president of Agri-visions, LLC, and professor emeritus of agricultural finance and small business management, Virginia Polytechnic Institute and State University. Dr. Kohl will present his high-energy perspective on how producers should position their businesses for tomorrow and beyond. His talk concludes the Friday morning schedule.

Other speakers presenting at the annual event include: Dr. Michael Hutjens, University of Illinois dairy extension specialist; Dr. Adam Lock, MSU assistant professor of animal science; Dr. Michael Allen, University Distinguished Professor, MSU Department of Animal Science; Jamie Jonker, Director of Regulatory Affairs, National Milk Producers Federation and Roger Thomson, D.V.M., Team Management Concepts.

Michigan dairy farmers will take part in two producer panels during the conference. On Thursday afternoon, Jorge Estrada, employee management expert with Estrada, Simmonds & Associates, will moderate the panel discussion on effectively managing high performance teams. Friday’s panel discussion, led by Roger Thomson, D.V.M., will focus on fresh cow management strategies.

Estrada will also conduct a bilingual herdsmen session on Thursday evening called “Closing the Cultural Gap with My Employees.”

“We pack in as much information as we can in two days,” Cullens says. “We pull together a wide range of speakers that can appeal to all dairy farmers at some level.”

Four in-depth workshops will be offered Friday afternoon:

- The Good, Bad and Ugly of Sand Separation: Years of Experience From Four Farms (will feature a producer panel and update);
- Strategies for Achieving Successful Family Business Succession;
- Environmental Updates on Land, Air and Sea: A National Environmental Roundup; and,
- Telling the Dairy Farming Story: Communicating and Connecting with Consumers, Media and Other Audiences (held in conjunction with the Partners Program).

Registration forms are available online at www.glrdc.msu.edu or by calling 517-353-3173, ext. 229. Registrations received before Jan. 29 will receive a $50 early bird discount. Online registration closes Feb. 8, 2010. For more go to http://anrcom.msu.edu/press/120109/120309_overview.htm.
We live in a world that is increasingly globally interdependent. This has been especially true in the dairy market for US producers in recent years. For many decades the US, along with the European Union (EU), interfered with farm milk price. The resulting surplus production was exported with subsidies. In the past couple of decades both the US and EU have retreated from those policies which resulted in a great deal more price volatility as national and international markets determined milk price.

The growth in US dairy exports began in earnest in 2004 (Figure 1). For many years, the total amount of dairy product exported was less than 5% of production on a total solids basis. In 2004, about 7.5% of total dairy solids were exported at a total value of $1.36 billion. Growth was fairly steady for 2005 through the middle of 2008 with 11% of total dairy solids exported in 2008. The total value of US dairy exports was $3.5 billion in 2008.

The global economic crisis that began in the fall of 2008 shrank the demand for dairy products worldwide. Demand for US exports, with the exception of dry whey, fell off sharply. The result was that both the quantity and price of exports collapsed (Figure 1).

World prices for dairy products dropped by 50% or more between late summer and the end of 2008. Figure 2 displays the international cheddar cheese price which is representative of the decline in milk price.

The recovery in the international cheese price that began in September 2009 has been lending support to domestic cheese prices. If the export markets can recover, the US farm price will follow suit.