



**Diversified Farming – Where Agriculture Meets Tomorrow**  
**By**  
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Nestled in the hills of Strafford County, New Hampshire, New England Ovis, LLC, (NEO) is a Diversified Farm Operation which has the highest health of commercially available sheep in the United States, probably the world. Drs. Julie and Richard Hurley, both veterinarians, founded this unique operation in 2005 to prove that, with special management, a flock's risk of disease could be controlled. Their motivation to develop a "specific pathogen free" or "SPF" sheep flock came from the need of the scientific research community to have a source of animals available where stress and disease was minimized.

Dr. Richard Hurley, board-certified in Laboratory Animal Medicine, provides veterinary care to animals in research. Dr. Julie Hurley is board-certified in Veterinary Preventive Medicine and a retired, large animal veterinarian. Before starting NEO, both served the Center for Research Animal Resources at Cornell University in Ithaca, New York. At Cornell, one of the largest animal research institutions in the world, they worked hand-in-hand with USDA-APHIS personnel to provide the very best in animal care for animals used in both agricultural and biomedical research. In 1998, Julie, diagnosed with multiple sclerosis, left Cornell with her family. They found their way back to Julie's home state of New Hampshire where they would eventually found New England Ovis.

In 2003, Dr. Richard (Dick) Hurley became the Senior Clinician at the Center for Comparative Medicine at Massachusetts General Hospital in Boston. There he saw there was a definite need to improve the health of sheep available to scientists. Although not always a problem on sheep farms, animals with underlying disease can interfere with research results and the health of animal workers. Even with quarantine periods and disease screening, some sheep go undiagnosed. Health issues which included shipping fever, abscesses, foot rot, pinkeye, and sore mouth resulted in early termination of experiments, delays in projects, human exposure to zoonotic diseases, more animals required to complete projects, unreliable results and increased costs.

In 2005, heart and lung studies at Mass General were being greatly hindered; normal baselines for lung values couldn't be obtained because of subclinical pneumonia. Mass General searched for sheep vendors that were free of shipping fever to no avail. With these issues in mind, Dick and Julie brainstormed ideas on how to create a sheep flock without pneumonia pathogens. Dick talked with Julie about the possibility of producing a flock of sheep that would be pathogen free to serve both agricultural and biomedical research community needs. They thought that, possibly, the way to go was to develop an SPF flock of sheep. SPF or "specific pathogen free" animals are animals that have had certain or "specific" disease producing agents or "pathogens" eliminated from them. Sometimes pathogens can be eliminated by test and removal schemes where if an animal has a positive test result they are sold to slaughter or put down. Another strategy is that, immediately after they are born, they are raised in isolation from other animals. Subsequently, SPF animals must be maintained in ways to prevent re-introduction of the specific diseases they are free of and ongoing evaluation should be conducted to ensure biosecure measures are working.

In the case of NEO, the chosen solution was to hand-rear lambs isolated from all other sheep including their dams. The real challenge was how would sheep who are ruminants raised in isolation obtain the required bacteria and protozoa in order to digest cellulose, that is, become ruminants, without transmitting disease agents as well.

Dick and Julie set out to accomplish their mission. A single source, closed flock of Polypay sheep in Vermont was located and 135 ewes and 2 rams were purchased in October 2005. In August 2006, they delivered their first specific pathogen free lambs and isolated them and raised them at a separate location. They successfully found a way for developing a ruminant sheep without passing disease which is undergoing the patenting process. Finally, in November 2006, they offered their first lambs for sale.

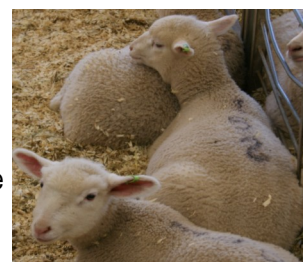
Dick and Julie chose the Polypay because that breed has many excellent characteristics: great mothers with the ability to breed out-of-season and have multiple births, great milkers with excellent fleece and meat, and a calm, easy to handle breed. In 1983 as a senior veterinary student attending Ohio State, Julie was first introduced to the Polypay breed at the USDA Sheep Experiment Station in Dubois, Idaho. The USDA initially developed the Polypay by crossing four established breeds: Finnsheep, Dorset, Targhee (also developed by the USDA Sheep Experiment Station in Dubois), and Rambouillet. Currently, the NEO SPF flock consists of the Polypay and Finn breeds and their crosses.

Since 2005, the Hurley's have participated in several USDA programs. The Hurley's enrolled in the Farm Service Agency's Loan Deficiency Program which supports the price of wool when prices fall below the national price. Wool shorn from the sheep is weighed and either sold or used by the owners. With the decreased demand for unprocessed or "raw", ungraded wool, much of the wool has been donated to non-profits for fundraising projects like the sale of stadium blankets woven from NEO wool. Dick and Julie also participate in the Natural Resource Conservation Service, Environmental Quality Incentives Program to install buffer strips, fences for pasture rotation, roads for access, and heavy use area protection to protect water sources on their property and nearby.

The NEO facility is considered a "clean" area because it has been free of sheep for several years. To protect the NEO SPF sheep flock from exposure to diseases, all purchased sheep are housed at a separate location, Spruce Tree Farm. An intensive breeding program allows lambing to be condensed into one weekend at a time. At Spruce Tree, a team of family, friends and volunteers, deliver lambs from purchased ewes and each lamb is taken immediately from the mother and isolated in a mobile intensive care unit. The colostrum the lambs receive after birth is heat-treated to inactivate any bacteria or viruses. Once newborns are stable they are transported to the NEO SPF facility where they continue to be cared for by a separate team. The target disease to be eliminated was pneumonia or "shipping fever" which is transmitted from dam to offspring by nose to nose contact. By preventing contact with the mother ewes, lambs are not exposed to the usual disease producing agents. Thus, they are free of an unprecedented number of diseases including shipping fever or agents that produce respiratory disease, intestinal worms, OPP (Ovine Progressive Pneumonia) Johnes, foot rot, pinkeye, abscesses, toxoplasmosis and Q fever (Coxiella burnetii) to name a few.

A true family farm, Julie, Dick, their three children, and Julie's parents are all involved. The project has also turned out to be a training ground for a variety of people who love animals: students at Somersworth High School, Ag students from Norfolk County Agricultural High School in Walpole, Massachusetts, pre-veterinary students at the University of New Hampshire, Mass General animal caretakers and technicians, Tufts University veterinary students, and graduate veterinarians in the Laboratory Animal Medicine training program at Massachusetts Institute of Technology (MIT).

The NEO SPF flock is housed under conventional conditions. That is, they are not kept in climate-controlled rooms, but in a barn open to the south with pasture and paddock areas. Once the NEO SPF flock matured to breeding age, they are allowed to lamb naturally and raise their own lambs. Controlled monthly breeding assures lambs are consistently available to fill the demand and size of lambs for research projects. Summer breeding is successful and the one exception to conventional housing is that the rams are kept in air-conditioning to maintain fertility through the summer heat. Ewes are exposed to rams for 24-48 hours and a marking harness is used to indicate when each ewe has been serviced. Ewes are brought in one month prior to lambing to be nutritionally managed and put under video-camera observation for lambing. Each lamb is tracked from birth with a numbering system and records are maintained on every animal. Lambs are weaned at 2 months of age and ewes go back into the breeding program as soon as their body condition is appropriate. After weaning, the lambs are grouped by bodyweight and fed locally purchased grain and organic hay. Good nutrition is central to the success of this accelerated lambing program. Because of years of careful management, New England Ovis can now supply uniform sheep by age and size, without health concerns year round. New England Ovis has ewes, rams, and wethers as well as time-dated pregnant ewes available for purchase.



6 month old lambs

Quality control is an essential part of the process; consequently, standard operating procedures (SOPs) exist for everything including equipment sanitation, heat-treatment of colostrum, newborn lamb processing, weaning ration formulation, prenatal care of ewes, and socialization of lambs. Socialization includes daily handling of newborn lambs, affectionately referred to as "baby lamb lap time", and sound desensitization through the use of intermittent music of varying volumes and genres. Julie and Dick counsel research institutions on biosecurity and streamlining the sheep's transition from the farm to the research setting. Animals are transported to the research institution listening to music in a custom van. Why all the fuss? In fact, any kind of stress, whether it is disease-related, a change in feed, or new environment can adversely affect research results. There are major resource savings as well. NEO SPF sheep require only a short acclimation period, that is, no 14-30 day quarantine is necessary. NEO SPF sheep are spared the discomfort associated with illness, diagnosis and treatment. Animals that do not suffer from illness are less stressed. Costs associated with medicine, diagnosis, treatment, control and the associated labor are *eliminated*. Fewer animals are needed to get good research results. The #1 concern here is to "**MINIMIZE STRESS**" in the sheep and additional benefits are improved safety of animal workers, improved welfare of the animals and the healthiest sheep possible for research.



Biosecurity for the operation is extremely important; visitors are not allowed on the premises without prior approval and any visitor will be asked if they have been on any other farm before their visit. The area is enclosed with a gate and electric fence to keep out unwanted animals and prevent unauthorized entrance. Hand sanitization is required before entering the barn and any person entering the area is required to wear disposable shoe covers provided by New England Ovis. Ongoing evaluation for diseases includes visual inspection, serology, microbiology, histopathology, necropsy, and PCR (Polymerase chain reaction), and fecal testing to document the absence of a wide spectrum of diseases in this single source, truly closed flock.

The Hurley's have a vision for the future. At the farm, they plan to

- expand to 500 sheep for sale to research annually; up from the current 150 sold annually,
- build additional facilities for sheep and feed storage,
- build a larger air-conditioned holding facility to house all rams to ensure year round fertility,
- purchase adjoining land for grazing and feed production,
- find local processing and markets for wool, such as, blankets made entirely in NH, and
- preserve the family farmland as a farming unit that can sustain itself for future generations.

As for New England Ovis, they hope to

- franchise the model as a family farm that could provide high quality, humanely raised animals in other research-dense locations,
- provide assistance to new farmers setting up biosecure farms,
- continue to offer on-site-training for future veterinarians, and
- obtain granting to further explore the benefits of this system in other venues.

Sheep and human biology are similar and sheep make especially good animal models for prenatal research and heart, lung and bone studies. NEO SPF sheep have benefited the development of diagnostic ultrasound techniques, safer anesthetics for surgery, and medical devices like stints for cardiac patients. NEO SPF sheep are helping to tissue engineer ears that won't be rejected by the patient. A cystic fibrosis model is now possible only because NEO SPF sheep exist and have no respiratory pathogens.

The potential for sharing the NEO SPF sheep process as a model farm is great. NEO SPF animals aid agricultural and biomedical research by reducing confounding variables but there are many additional benefits. Raising animals is more humane since the animals are spared the discomfort of illness, diagnosis, treatment, and control. Because NEO SPF sheep are free of so many pathogens, workplace hazards caused by sheep diseases transmitted to people are eliminated for animal care personnel and food processors. Production using the NEO SPF sheep model won't contaminate the food supply with pathogens. Antibiotics are not used in the NEO SPF sheep flock so antibiotic resistance is avoided and the food supply and environment is no longer tainted with pharmaceutical drug or chemical residues. Production is increased and value is added to meat and cheese. Organic sheep production is facilitated because the dilemma of "to treat or not to treat" is totally avoided since there is nothing to treat. Also, this process could be used to conserve rare or heritage breeds of ruminants. The future seems limitless for this family farm and their amazing sheep located in a small town in New Hampshire.



Lap time is an important socialization process.



Clean water is available at all times.





Stadium Blanket made from donated NEO wool.



The open front barn design allows all sheep to enjoy fresh air and a relaxing sunny day in the NEO.



Pasture management is utilized while grazing during the summer.



First lambs born August 2006 at NEO.



February 2010 NEO lambs.