

Nutrition Calorimeter Popular Museum at PSU

Modern day concepts of a laboratory bring to mind shiny, sophisticated equipment of the atomic age, located in the most modern of buildings. But one of the most famous laboratories, now a museum at The Pennsylvania State University, is in a seldom-noticed brick structure at the rear of Armsby Building on the College of Agriculture campus.

This laboratory, housing

the renowned Armsby respiration calorimeter, was a forerunner of today's modern laboratories and helped lay the foundation for present-day experiments and feeding practices in animal nutrition.

From about 1902 to the mid 1950's, the calorimeter at Penn State contributed valuable research findings in animal and human nutrition. Now it has been restored and preserved as a museum and

memorial to the Penn State pioneers in animal nutrition research, including the man who conceived it, Henry Prentiss Armsby, who became director of the Agricultural Experiment Station at Penn State in 1887.

The year 1975 marks the Centennial for the agricultural experiment stations at land-grant universities such as Penn State.

It was Dr. Armsby's belief

that the total breakdown of energy (calories) as utilized by the animal would be a much better measure of the real value of the feed than the simple measure of digestibility that was common used at the turn of the century.

With the calorimeter, Dr. Armsby conducted his historic work, much of which led to the basic principles involved in energy metabolism of farm animals. He demonstrated that a large portion of the calories eaten, sometimes more than half, was lost from the animal's body as heat. By accounting for this

loss, as well as the energy lost in excreta and gases, he determined the "net or useful energy of a ration which could be used by the animal to produce meat, milk, etc.

Dr. Armsby wanted to measure the complete intake and outgo of the experimental animals, in all forms, and account for the final disposition and distribution of all food eaten. To permit such measurements, Armsby's calorimeter was built large enough to hold livestock, particularly large farm animals such as cattle.

The experiments, were carried out in cooperation with the Bureau of Animal Industry of the U.S. Department of Agriculture. While Dr. Armsby lived and during the years after his death, visitors came from other countries to see the laboratory and unique apparatus. Many of the visitors were at first unaware of the existence and location of the Pennsylvania State College, except as the location of the Armsby Calorimeter.

The cost of the apparatus and the small brick building to house it was about \$20,000 in 1896. The ceiling of the structure is 15 feet high and the windows are hung with double sashes to reduce the influence of outside temperatures on the calorimeter.

The respiration chamber itself measures 10 feet 4 inches long, 8 feet high, and 6 feet wide, with three double walls - one of metal and two of wood, with air spaces within and between these walls. Within the chamber, the animal stall was constructed so a steer or cow had room to lie down on a soft rubber mat. Sealed windows enabled the operator to see inside.

The operator of the respiration calorimeter was stationed at a table near the chamber windows. Within his reach were thermometers, water valves, switches to control heat, gauges, and a panel of indicator lights. The experimental work was timed by a master clock. Every four minutes a light flashed indicating it was time to take a series of readings. Every half hour a bell would ring to indicate a new series of observations should begin.

Dr. E. B. Forbes, head of the Institute of Animal Nutrition, carried on the work and experiments in the years following Dr. Armsby's death in 1921. Dr. Raymond Swift and associates continued the research efforts in his capacity as head of the Department of Animal Nutrition, succeeding Dr. Forbes.

Dr. Swift said recently of Armsby's work, "He supplied a broader and more substantial basis for intelligent feeding practices and the foundation for a sound agricultural policy. He demonstrated the means for measuring animal feed on the basis of its energy supply."

About 1939, the last steer was run through tests in the chamber. Following World War II, the respiration apparatus was used with sheep. Humans were studied in the 1950's as a joint venture between the Department of Animal Nutrition and the College of Home Economics, now the College of Human Development.

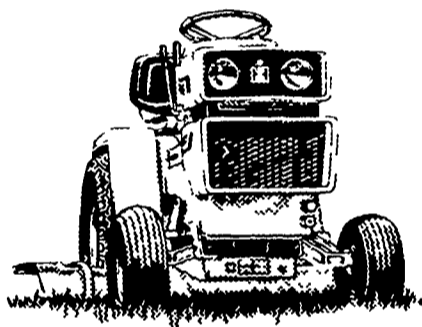
Male students were used in the human studies to determine the effects of the level of protein in the diet. The men were fed diets containing the same number of calories but variable protein levels. The scientists found that the level of protein in the diet did not influence the overall utilization of the calories.

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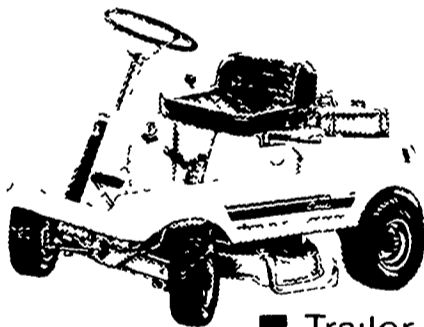
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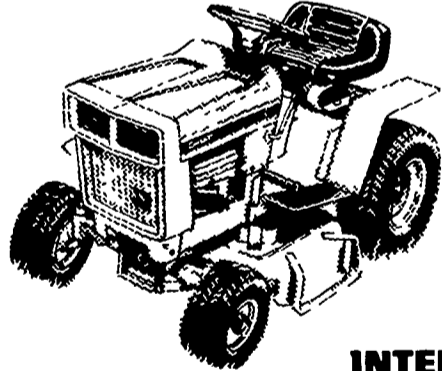


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