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Dr. Galligan for more than a year. He has a ration sheet and feeds each cow individually according to her production. The rations formulated for his farm save him about \$400 to \$500 a month. Dr. Galligan visits the farm periodically to check and to revise the feeding program and to discuss other herd related problems that might arise.

The interactive computer program has five subunits: 1. a nutrient requirement section; 2. a feed bank section that stores nutrient composition of available feed; 3. a computational section where rations are evaluated or formulated; 4. a feeding recipe section, which displays or prints grain mix, mineral mix, total mixed ration, or stanchion barn recommendations; and 5. a comparative economic evaluator, which ranks feeds by a nutritional cost and benefits algorithm.

"We can select up to 12 fixed feed ingredients from a bank of up to 100 feeds," explained Dr. Galligan. "The basis of selection is farm availability and nutrient constraints. Selected variable ingredients are used to balance the ration for dry matter, net energy, crude protein, bypass protein, soluble protein, acid detergent fiber, and neutral detergent fiber. Calcium and phosphorus are balanced using a combination of mineral sources. Trace mineral mixes may be either custom formulated or selected from a bank of proprietary supplements on the basis of limited trace elements in the ration."

The spreadsheet allows individual calculations for the various components. "We can determine what kind of hay to feed if soy meal is high in price," said Dr. Galligan. "If soy meal is low in price, then it will make up a greater part of the ration and the

farmer can use first-cutting hay which does not have that great a nutrient value. However, if soy meal is expensive, then we reduce it in the ration formula and recommend that high quality hay be used." This kind of ration formulation requires that farmers change their habits. It used to be that hay was fed in reverse order of harvesting, meaning that the last cut hay was fed first. Now Dr. Galligan recommends that the cuttings be stored separately so the hay can be accurately matched to the other feed ingredients to provide the proper nutrition for the least price.

Other food ingredients are also determined by market prices. If one kind of fiber is high priced, then another may be selected. Further, Dr. Ferguson and Dr. Galligan have encouraged farmers to buy feed in bulk, perhaps as a group. Sholtzberger purchases minerals and other feed ingredients jointly with other producers also enrolled in the Production Medicine Services, obtaining a bulk price. Stoltzfus and his neighbor too combine their orders to get a better purchase price. Stoltzfus has taken an additional step to reduce his feed costs, he has installed a diesel-driven roller mill which allows him to mix and prepare his grain mixes. He estimates that this equipment saves him an additional \$280 a month.

Drs. Galligan and Ferguson and their colleagues are continually refining the program and the service format. "We are looking at inventory control systems and are making calculations as to whether it is advantageous to buy a three months' supply, versus a six weeks' supply when considering the interest the money could earn if invested alternatively." If all this sounds a bit farfetched coming from veterinarians, it really is not as the contemporary veterinarian has moved beyond being a mere healer. "We have to look at the total farm

picture," said Galligan. "While disease prevention is an important part of herd health, management practices also significantly contribute to the cost. The veterinarian can take a look at the overall picture and then advise the client. By increasing the feed efficiency and advising the farmer about ration formulation we can save him more money than through many traditional veterinary services."

The members of the Center for Animal Health and Productivity have been spreading this word at bovine practitioner's meetings and now about 1,000 veterinarians use the program to advise their clients. It costs \$100, this includes the spreadsheet, a tutorial and a user's manual as well as a year's subscription to the University's on-line bulletin board. Here users find out about updates and improved features of the program.

The program is also an important teaching tool for Penn's veterinary students, familiarizing them with feed rations and formulation of the most economic ration without sacrificing production yield.

And what is in the future? "We will be looking at the futures market to see if feed expenses can be reduced further," said Dr. Galligan. "We are employing economic principles and models long used in industry and are applying them to agriculture to help the dairy farmer to remain profitable."

Dr. Galligan is an associate professor in animal health economics and holds an MBA degree from the Wharton School. Dr. Ferguson is an assistant professor in nutrition and is board certified in nutrition and reproduction. The ration formulation program was chosen by *Lotus Magazine* as one of the five best applications of Lotus 123 for 1990. The research to develop the program was funded in part by the Pennsylvania Department of Agriculture.

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scientists can now screen for the efficacy of some potential drugs using the tissue of one animal rather than using hundreds of animals.

Refinement refers to efforts to reduce pain and distress experienced by lab animals. New guidelines from the USDA and NIH are calling for closer scrutiny by researchers in this area, and are encouraging them to investigate additional avenues to measure and reduce pain for animals.

According to Dr. Alan Goldberg, head of the Center for Alternatives to Animal Testing at The Johns Hopkins University, the Three R's represent the "common definition of alternatives." He said alternative methods in specific cases are scientifically useful, provide a cleaner and more precise result than animal models, and are more economical.

The success of alternatives can be measured by the surge in their use, Dr. Goldberg said. "Ten years ago there were few tissue culture areas in research facilities. Now, every facility that builds a building adds a tissue culture area."

Alternatives most commonly considered are cell, tissue and organ cultures, computer modeling and the use of minimally invasive procedures that produce less stress, Dr. Goldberg noted. While more toxicological research is being conducted in vitro, the potential of culture method in toxicological protocols and hazard assessment is only beginning to be used and evaluated, he said.

Dr. Goldberg attributed the increase of alternatives to public pressure from the animal protection movement. "They've been responsible for encouraging the scientific understanding and development alternatives," he said. "But if the science hadn't been there, it never would have come about."

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Welcome

Each July VHUP and the Widener Hospital welcome new residents and interns. The new residents at New Bolton are: Dr. Julie Anderson (surgery), Dr. Tony Mogg (medicine), Dr. Pam Wilkins (medicine), Dr. Suad Terzich (poultry pathology). Dr. Rochen Love has joined the Widener Hospital as junior surgery clinician. Dr. Fairfield Bain has been appointed lecturer in cardiology.

The new interns at VHUP are: Dr. Lynn E. Babbitt, V'91, Dr. Elizabeth Berger, MN'91, Dr. Lori W. Cabell, TN'91, Dr. Lillian E. Duda, V'90, Dr. Monika Griot-Wenk, Zurich '89, Dr. Kirk A. Hassinger, V'90, Dr. Richard Ian Haworth, Cambridge '91, Dr. Clare Knowler, Glasgow '91, Dr. Nancy Sander, OH '91, Dr. Elaine J. Tobias, V'91, Dr. Susan Westmoreland, V'91. The new VHUP residents are: Dr. Mark Jamba and Dr. Michelle Sabol-Jones, laboratory animal medicine; Dr. Jean Marie Swingle Greek, WI'90, dermatology; Dr. Mary Wilkes, V'91, anesthesia; Dr. Michael G. Conzemuis, IA'90, orthopedic surgery; Dr. Richard A. Rockar, V'88, soft tissue surgery; Dr. Derek Hughes, Liverpool '90, emergency medicine; Dr. Joan Regan, V'79, radiology; Dr. Jamie Anderson, CA-Davis '89, Dr. Mark Elie, MI'85, Dr. Patricia G. Walters, V'90, medicine; Dr. Margaret L. Casals, Zurich '84, medical genetics.

Dr. Ray Boston, formerly at the University of Murdoch, Australia, has joined the Center for Animal Health and Productivity as professor of applied biomathematics. Dr. Daniel Brockman has joined Clinical Studies, Philadelphia, as lecturer in soft tissue surgery. Dr. Andrew Wood from the University of Sydney, Australia, is here as visiting professor of radiology.

Welcome to all!

Promotions and Appointments

Dr. Meryl Littman was promoted to associate professor of medicine; she is chief, Section of Medicine at VHUP. The following were promoted to assistant professors: Dr. Betsy Dayrell-Hart in neurology; Dr. Lesley King in medicine; Dr. Richard Squires in medicine. Dr. Gert Niebauer was reappointed assistant professor in surgery and Dr. Kevin Shanley was reappointed assistant professor in dermatology. Dr. Charles Pugh joined the radiology department in Philadelphia as assistant professor. Dr. Bennett Hershfeld was appointed research assistant professor of ophthalmology.

At New Bolton Center, Dr. Eric Tulleners was promoted to associate professor of surgery and Dr. David Galligan was promoted to associate professor of animal health economics. Dr. Corinne Sweeney was promoted to associate professor of medicine. The following were promoted to assistant professor: Dr. Sue McDonnell to research assistant professor in reproduction; Dr. Ben Martin to assistant professor of equine sports medicine; Dr. Patricia Sertich to assistant professor of reproduction; Dr. Ray Sweeney to assistant professor of medicine; Dr. Wendy Vaala to assistant professor of medicine/neonatology.

Dr. Alan Ruggles has been appointed lecturer in surgery; Dr. Kim Olson has been appointed lecturer in anesthesia, and Dr. Jeff Rubin has been appointed lecturer in Field Service and Reproduction. Mary Lou Shea has been appointed Director of Nursing at New Bolton Center.