Stanley Curtis
Animal Sciences
University of Illinois

Disease Control in Animals

When cows are tied, fed, and machine milked in the stalls, and the number of cows per worker is no more than 25-35, the rationing of roughages and concentrates can be prepared for the individual. Before milking, the cow's udders can be washed and the foremilk can be inspected for health reasons. Faults in milking machine operation and overmilking can be easily avoided. Lack of appetite and disease can be recognized early and individual treatments given. If antibiotic treatments are given to individual cows, their milk can be excluded from sale for the appropriate time period. Estrus can usually be detected, insemination promptly arranged, and inspections for pregnancies can be readily made. Yield and other records can be well kept, and decisions on breeding, drying off, and culling can be well based. The opportunity for boss cows to bully, and the behavioral effects of the comings and goings of individual cows or small groups can be monitored and minimized, making the atmosphere in the cow shed one of quiet confidence.

LARGE COW HERDS

When cows are loose housed and more than 100 cows are dealt with by one stockman, the same attentions are still essential to biological efficiency. In practice, their provision depends largely on layout, equipment, procedures, skill, and care in the milking parlor, because it is there that cows are controlled and closely seen. Inspection of the foremilk and udder washing are taken care of at this time. In fact,

washing is important for hygiene and acts as a stimulant for cows to let down their milk quickly. The rationing of concentrates is usually done with mechanical aides.

Faults in machine operation can be avoided. Yield records can be kept, but care must be taken to ensure that high-yielding cows have enough opportunity to eat concentrates. Roughages have to be fed elsewhere and cannot be individually rationed. Sufficient time has to be allowed for all the observations and tasks to be done well and special effort needs to be made to maintain a quiet, confident atmosphere.

The method used to identify individual cows and communicate information about them from one stockman to another become especially important in large herds. The effectiveness of a stockman's work also depends largely on tasks outside the milking parlor. Detection of fallen appetites, other than for concentrates and of estrus require careful observations. Veterinary inspections, treatments, and artificial inseminations have to be taken care of, preferably in pens near the exit of the milking parlor. Other important problems concern feeding the cows roughages, keeping the cows reasonably clean, assembling the animals for milking, dispersal after milking, picking out individuals for special attention, and avoiding behavioral difficulties due to boss cows and excessively large groups.

In practice, the maintenance of herd health, reproductive performance, and the job satisfaction of workers are liable to be inadequate when over 60 cows are kept per stockman and the emphasis is on high labor efficiency.

In J.R. Rayburn's simplified scenario of the two kinds of production systems, namely, a smaller scale, as opposed to a larger scale system, there can be trade-offs, as well as slip-ups. Animal well-being can be accommodated, supported, and ensured in either of these hypothetical settings. Much of the success of either system with respect to animal well-being has to do with the attitudes of the people who work directly with the animals, as well as the attitudes of those who design and supervise the operation of the systems.

Again, it is no small matter to get the job done. The critical aspects of dairy cow care emphasize the continuing complexity of animal husbandry at the production level.

ANIMAL NEEDS

When critics of animal farms cite examples of cruelty to animals, they are referring to farms, large or small, intensive or extensive that are run by poor producers. Inhumane treatment leads to unhealthy, unproductive animals, thus poor stockmen tend to be among the first to go out of business. It has been suggested that farm animal suffering falls into one of three categories: abuse, neglect, or deprivation. Abuse refers to obvious, active cruelty and neglect to obvious passive cruelty. State and federal legislation outlawing both abuse and neglect have been passed for many years now.

Progressive animal producers neither condone nor encourage abuse or neglect. Abuse and neglect constitute stress, and are clearly counterproductive, so their intentional practice by farmers would be irrational. Deprivation, however, is a subtle form of cruelty and the most difficult to assess. Deprivation involves the denial of less vital resources, the actual requirements which have yet to be established. Whether animals living in intensive production systems are suffering from deprivation is a major issue being discussed by humane activists, farmers, and scientists. If this is the case, economical and practical means of alleviating the deprivation will need to be discovered and developed. The humane and economic aspects of environmental design and management are best served, when the scientific approach to the identification and fulfillment of needs is taken. When an animal's needs are not being met, its welfare is more or less jeopardized by definition. But, it should be remembered that a particular decrement in welfare does not necessarily place an animal in an ethically unacceptable environment. It has been suggested that agricultural animals have a hierarchy of needs along the lines of Abraham Maslow's scheme for humans, and that an animal's basic needs are being met in most of the intensive production systems.

First and most basic, are the farm animal's physiological needs; the needs for feed, for physical biological elements of the environment, and for health care. These are already relatively well understood, and for the most part are being adequately met and fulfilled at the farm level.

Intermediate to an animal's physiological needs are the animals' safety needs. Though protection from harmful environmental elements is important, safety needs are somewhat less rigorously tended

to than physiological needs are. Accidents, predation, poorly designed, manufactured, and operated equipment and facilities still exact tolls that can be reduced.

Last in the hierarchy are the animal's behavioral needs. The question among most scientists today, is, whether there is reasonable evidence supporting the existence of behavioral needs in agricultural animals. No such need has been established, although many scientists believe that behavioral needs might exist, however difficult they may be to elucidate and document.

WELFARE ASSESSMENT

Of course, fundamental to assessing the welfare of a farm animal are the answers to two questions. First, does an animal have subjective feelings and second, what indicators reveal these feelings? Although the question of subjective feelings has not been dealt with seriously until about ten years ago, the conclusion is that animals do have feelings and mental experiences that ultimately need to be taken into account.

The indicators that reveal these feelings, are exceedingly difficult to interpret. Knowledge of an animal's mental activities at this time, can only be understood by indirect experimental evidence, so conclusions must be considered tentative. Attempts to quantitatively evaluate suffering or the welfare of animals residing in various farm environments has proved futile so far. There is a consensus that the eventual welfare of farm animals will be assessed by an integrated system of indicators from four categories: reproductive and productive performance, pathological and immunological traits, physiological and biochemical characteristics, and behavioral patterns.

The behavioral, ethical, and psychological needs of farm animals has not yet been determined. This breakdown of needs does not yet exist in the science of ethology. At present, health, reproductive, and productive traits continue to be the most measurable, and the most practical indicators of fitness between agricultural animals and production environments.

More has to be learned about the fundamental psychological and behavioral process before progress can be made in describing and fulfilling an animal's holistic needs. The cognitive and motivational processes have to be better understood before it will be possible to answer

questions concerning animal suffering resulting from a lack of adequate housing. In other words, does a hog that has never seen a mud hole ever dream of one, ever want one, or ever need one? The cognitive processes in farm animals are beginning to be understood and seem to suggest that the old saying, "out of sight, out of mind" really applies to these animals.

ANIMAL SUFFERING

Does an animal suffer when it lives in an environment where it confronts a frustrating or frightening situation? Ian Duncan and Marian Dawkins have observed through careful experimentation, that indirect evidence about an animal's subjective feelings can be accumulated.

Theoretical frameworks have been suggested to help investigate the role of behavior in an agricultural animal's adaptability and overall well-being. In reference to the Edinburough Hog Park, Ian Duncan points out:

> "States of suffering such as frustration and fear can be recognized when the behavioral indicators are known. This approach has been successful with domestic fowl in that the husbandry conditions and procedures likely to lead to frustration and fear are now known, allowing steps to be taken to reduce them. Behavior can be observed in an enriched environment in order to understand its function and development. This approach has been successful with hogs and has enabled a husbandry system to be designed which almost certainly safeguards welfare."

Unfortunately, theory in this area of science still greatly outweighs the tangible evidence. Nevertheless, it would be imprudent to study the evidence from one category, be it behavior, health, physiology, or productivity without including information from the other categories. Attempts should be made to further identify and quantify correlates among traits in the various categories. Overall well-being presumably occurs if desirable traits from each category are met.

For example, if food is being delivered to a hungry hog too slowly for the hog's taste, the resulting frustration can increase the rate of secretion of glucocorticoid hormones, and could have negative consequences on the hog's health and welfare. Providing a device, such as a chain to nibble on, will enable a hungry hog to control its food intake, reduce frustration, and cause the rate of glucocorticoid secretion to return to normal.

There is considerable and rapidly-increasing evidence that an animal's nervous, endocrine, and immune systems engage in crosstalk in all possible avenues. Keith Kelley has said that certain activities in the lymphoid cells may be behaviorally conditioned. Changes in the endocrine system may affect lymphoid cells, and likewise, products of the immune system may affect the endocrine system.

Infectious diseases may alter the behavior of an animal, and vice versa. Benjamin Hart, says,

> "It is quite logical to expect animals, and people to also have evolved non-immunologic disease-fighting strategies, including behavior patterns, that might serve as a first line of defense before the non-specific and specific immunologic systems are activated, and that would complement and potentiate immunologic processes. The possible permutations of interrelationships among etiologic factors contributing to specific infectious diseases of agricultural animals are innumerable, but at present, these possibilities are mostly theoretical."

In the growing chicken, however, there is recent evidence that as many as six stressors—namely, ammonia, beak trimming, toxicidiosis, electrical shock, heat stress, and noise stress—do combine in additive fashion, to affect feed intake, growth, and several other pertinent physiological, immunological, and pathological traits. This linear additivity of multiple stressor effects on such a wide variety of traits, strongly suggests that some single process is acting as a clearinghouse for many or all of the stresses that simultaneously act upon an animal.

STRESS INDICATORS

Gary Moberg has suggested that the best indicator of an animal suffering stress is the development of what he calls a pre-pathological state. That is, a stress-related change in biological function that threatens the animal's well-being. His very first example of pre-pathological states was suppression of the immune system. Several critical phenomena associated with neurological and physiological immunomodulation have been characterized. A stressor's influences on immune responses are complex, and depend not only on stressor characteristics, such as intensity, frequency, and duration of the stress, but also on the time when the stressor impinges in relation to the course of the immune response. Stress however, is not always immunosuppressive.

Some stressors can actually increase host-resistance to pathogenic microbes and enhance certain immune responses. An animal's ability to control and predict the occurrence of stressors is another critical factor in the influence of stress on behavior and function.

The possibility that changes in the activities of mononuclear cells caused by stress can deleteriously affect host-resistance to disease and thus serve as indicators of animal well-being, has not yet been settled. Recent emphasis has been on describing the consequences of stressors on specific aspects of immunocompetence. The complexity and discrepancies among the observed effects does not permit a functional interpretation of the results at this time. It is reasonable however, to postulate that immune traits are sensitive reflectors of the overall well-being of an animal.

GROWTH PROMOTANTS

The pork industry is interested in using repartitioning agents to affect hog growth, which would make pork products more acceptable to consumers and the pork business more profitable for producers and processors. Not much is known yet about the effects and side effects of these new agents on the health of hogs, but it would be wise to anticipate possible problems when integrating these technologies into existing systems of pork production. Swine management regimens may need to be changed in order for these new agents and procedures to be implemented in the industry.

Two important aspects of the hog's life that might be affected by transgenic manipulation, beta adrenergic agonists, and porcine somatotropin happen to be thermoregulation and certain behavioral patterns. For example, the combined effects of somatotropin treatment would be on the cool end of the scale. A 12 degree Celsius increase in the lower critical temperature would be partly offset by a six degree Celsius decrease due to a higher heat production rate. The net effect would be six degree Celsius decrease in the upper critical temperature due to higher heat production rate and a six degree increase in the lower critical temperature of a 75 kg hog due to somatotropin treatment. The treated hog would be considerably more sensitive to cool or cold environments. At the other end of the temperature scale, the hogs would also be more sensitive to high temperatures.

Casual observations of hogs being fed a beta adrenergic agonist have led to the conclusion that the treated hogs may be more active than

normal, more alert, more excitable, and up more often and for longer periods, because the agents mimic the effects of the sympathetic nervous system. This tentative conclusion needs to be confirmed in carefully controlled experiments. If the results of this research confirm this conclusion, then the hog's environmental requirements would warrant investigation.

This is an example of the potential effects of the products of biotechnology and how they may affect implementation at the production level.