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"Stress in Farm Animals"

PROCEEDINGS OF JOINT SYMPOSIUM WITH THE ROYAL SOCIETY FOR THE PREVENTION OF CRUELTY TO ANIMALS

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Introductory Address. *By Professor John Napier, University of London*

I welcome all delegates to this first Symposium on Stress in Farm Animals organized jointly by the Society for Veterinary Ethology and the Farm Livestock Advisory Committee of the R.S.P.C.A. I would like particularly to welcome the representatives from Norway, Sweden, Holland, Germany, Finland, Switzerland, Canada, Mexico and Singapore who are here today. This is a rather momentous occasion for the R.S.P.C.A. As far as I am aware it is the first time that the Society has held, or co-operated in promoting, a purely scientific meeting since its foundation in 1824. I say this, of course, with no criticism of the wonderful work of the Society in animal welfare during the last 150 years, a record which I believe is the envy of the world. My observation simply indicates that under its present chairman, John Hobhouse, the R.S.P.C.A. has begun to move towards a more scientifically oriented approach to the problems of animal welfare. For example, in the last two years three special committees have been set up by the Society to examine (1) farm livestock welfare; (2) laboratory animal welfare and particularly the "overkill" in animal experimentation; and (3) wildlife problems including indigenous wildlife and exotic animals in private ownership—zoos, safari parks and so on.

It was from the Farm Livestock Advisory Committee (F.L.A.C., which by a happy coincidence spells "calf" backwards) that the idea of this joint symposium emerged. This advisory committee of which I am chairman was built up to represent most of the interests involved—practising farmers, veterinarians, ethologists, a representative from the British Horse Society (Richard Meade) and a lawyer specializing in animal jurisprudence (Rosemary Everton).

As I saw it when the F.L.A.C. was first set up, the role of the Committee was not simply to advise the R.S.P.C.A. as to what was going on in the field of extensive and intensive farming practices, and to make representations to the National Farmers' Union and the Ministry of Agriculture in respect of flagrant non-observation of the Codes of Practice on the part of producers, and so on; but also to take an active role in promoting the relatively new sub-discipline of farm livestock ethology. In support of this approach I would like to quote from p. 10 of the Brambell Report.*

"Scientific information on behaviour could be of great economic value to the industry. We consider that this is a field of scientific research . . . which has not attracted the attention which it deserves and that opportunies should be sought to encourage its development in this country."

It was for this reason that the Committee decided to set up an Awards scheme in which grants would be made to support research in farm livestock behaviour, with the object of building up "ethograms" or repertoires of the nature and context of every classifiable action, fixed motor patterns, performed by farm animals. This proposal was not wholly philanthropic and disinterested. It had become clear to us that in order to interpret the meaning of "unnecessary suffering", the key phrase in the 1911 *Protection of Animals Act* and all subsequent legislation, some form of

* M.A.F.F. (1965) Report of the Technical Committee to inquire into the Welfare of Animals kept under the Intensive Livestock Husbandry System. Cmd 2836. H.M.S.O.

objective assessment of unnecessary suffering needed to be developed to the pitch where ethological evidence could be used as an indicator that intensively reared animals were subject to an abnormal degree of stress.

"Stress," it has been said, "cannot be measured directly and to that extent is not a truly scientific term." My comment on this bit of sophistry is "Neither can schizophrenia be measured directly, but that doesn't mean that the condition does not exist, nor that it cannot be treated." Behaviour under stress can be studied, identified and treated, but whether it can be measured in units of stress from purely observational studies is debatable, although we know that qualification of intensity of animal calls, for instance, is possible by means of sonograms.

So operating from an initial premise that abnormal stress equals unnecessary suffering, F.L.A.C. decided to set up the R.S.P.C.A. Awards for the encouragement of ethological research. The principles of the Society, however, make it obligatory that such projects are limited to observational studies. The R.S.P.C.A. cannot endorse experimental procedures in which animals are placed under abnormal stress even if other animals are the benefactors.

I am all in favour of a modicum of anthropomorphism in the assessment of stress, not only does it leaven the indigestible dumpling of scientific objectivity but also has positive value. As Professor Thorpe has said: "Since we ourselves are animals, a properly critical anthropocentric approach has often proved of great interim value." The keyword here is interim. It shows that animal behaviourists are aware of the ultimate weakness of an anthropocentric approach. (This is more than can be said of some members of the factory farming lobby, who ought to know better, and who are still arguing in favour of the fallacious premise that "if the pig is not happy, it does not make bacon." *They* do not refer to such an anthropomorphic argument as an interim measure, but rather as the final judgment of a closed mind.)

However, no good ethologist would regard even a modicum of anthropomorphism as the proper way to present a case in the long run. Nevertheless, in the face of the lack of information on the issue of pain in animals, if a degree of anthropomorphism gives the animals the benefit of the doubt then I, speaking as an individual, am all for it.

But I am getting a long way away from my theme, which is to tell you what measures the R.S.P.C.A. has taken, to date, to further ethological research into the welfare of farm livestock.

Last year we appointed Mr Peter Lattin, whom some of you will have met, to inquire into the state of animal behaviour research in the United Kingdom. Since then he has visited most agricultural and veterinary institutions and talked with many people about their past, present and future plans in this field. His report, which is now completed, has given us a splendid insight into the tremendous range of work that is going on in the British Isles today. One of the facts emerging from his review is the importance of encouraging two aspects of the subject in particular: firstly, theoretical work from trained ethologists in zoology departments, and secondly, field work in agricultural and veterinary colleges. In the area that I know best—primate ethology—there is no doubt that the most significant advances have stemmed from field studies based on theoretical concepts devised in zoological and anthropological departments, and I see no reason why farm animal ethological research should not go in the same well-tried and tested direction.

We hope that our first Awards will be made during the next two or three months. Our intention is to provide a "block" grant to the Department or Institution concerned, in the Rothschild pattern. We hope thereby to finance postdoctoral and predoctoral research and also vacation-studentships. However I think it would be fair to say at this stage that preference will be given to postdoctoral fellowships, associated with vacation-studentships.

We have an interesting morning in front of us during which I hope we will reach a clearer understanding of what we mean by stress in the context of farm animals. In fact I hope that a definition of stress will emerge. . . . "Science is measurement", but I think it is equally valid to say that "Science is definition."

I think that at this meeting we are fulfilling Robert Hinde's dictum that "animal behaviour not only provides a meeting ground for psychologists, zoologists, physiologists, anatomists, geneticists, ecologists and many others, but *demands* their co-operation."

The Concept of Stress

By T. K. Ewer, University of Bristol School of Veterinary Science, Langford, Bristol

The difference between short-term, transitory stresses, with their self-protective physiological phenomen that they bring into play, and the prolonged or repeated stressors that

modern intensive production systems generate were described. The nature of some of these stress-producing situations in each of the main species of farm animals was delineated. It was shown that some of the factors of stress may be measurable, and encouragement must be given to the extension of objective detection methods. The fact, however, has to be recognized that stress mostly manifests itself multifactorially and thus may appropriately be described in behavioural terms.

The provision of a "coccooned" environment, spacious, safe and unvarying, can result in lowered production. The dividing line between necessary stimulus and stress varies widely.

Some degree of stress may be beneficial. In terms of resistance to a common bacterial infection (*E. coli*) in fowls, moderate stressing has been shown to increase resistance.

Above all, in studying the nature of stress factors, there must be continual appreciation of how individuals vary widely in their response to the same stress. This can be of a greater order of magnitude than occurs between strains within a breed, or even between different breeds themselves.

Stress as a "Hypotensive" Condition

By R. N. T-W-Fiennes, Nuffield Institute of Comparative Medicine, The Zoological Society of London

Selye defined "stress" as a general reaction to trauma, physical or psychological, comparable to "inflammation", which is a local reaction. He coined the term for it of "General Adaptation Syndrome". However, neither this nor any other satisfactory term for the condition has found universal acceptance, so that a major physiological/pathological condition is without a proper defining term. Of course, Selye's original studies were made in relation to conditions of disease, whereas "stress" is equally or more important ecologically as a population controlling mechanism in wild-life; in this context the word syndrome, as generally used, is not strictly applicable.

Endocrinologically, the condition is reasonably simple on Selye's pituitary/adrenal axis hypothesis, in that under "stress" the pituitary makes more adrenocorticotropic hormone and fewer hormones directed to the sex glands. There is thus a fall in fertility and fecundity and the adrenal cortex reacts by adapting to the "stress" situation in Selye's three stages: alarm, resistance, exhaustion.

So far, so good. However, this leaves an important gap in that the basic physiology—and physiological anatomy—of the condition is unexplained, except in so far as the acute manifestation of the condition, "shock", is known to be associated with a sudden and marked full of arterial blood pressure, associated with a general stasis of blood in the splanchnic vessels.

It occurred to me some years ago that a study of the low pressure blood system—the venous system—of the body might be rewarding. A series of studies was, therefore, started in collaboration with my colleague, G. H. du Boulay, radiologist to the Nuffield Institute of Comparative Medicine, who made extensive vena-cavagraphs of blood flows in different animals and under variable conditions. In addition, I myself made extensive studies of the anatomy and histology of the vena cava in a great many species.

The vena cava proved, unexpectedly to me at least, to be a somewhat complex organ. The dog may be taken as the type species for Mammalia, man being aberrant and even unlike other Hominoidea, chimpanzee, orang utan and gorilla. As is seen from the slides, there are five segments: (1) posterior; (2) renal; (3) hepatic, where it tunnels the liver; (4) diaphragmatic, where it forms a chamber within the diaphragm, the tendon of which is inserted into the wall; and (5) thoracic.

The posterior segment has as its main coat the adventitia, which is composed mainly of collagenous fibres. Its properties are viscous, that is it takes its shape from the pressures within and arount it.

The renal segment accepts the renal and adrenal veins. The adventitia is transformed into a thick coat of longitudinal smooth muscle fibres. Its properties are visco-elastic; viscous when the muscle is relaxed, elastic when the muscle is in tone.

The hepatic segment is totally enclosed in the caudate lobe of the liver and is much widened. The adventitia has a thick coat of longitudinal smooth muscle fibres. It accepts the posterior hepatic veins and numerous punctate venules from the caudate lobe.

The diaphragmatic segment accepts the two anterior hepatic veins and the diaphragmatic veins. It forms a chamber within the diaphragm. It loses its adventitious coat dorsally where the wall is very thin and formed by endothelium and diaphragm tendon fibres. At inspiration, it is extended through the caval foramen into the thorax. Its properties are viscous. The tendon of the diaphragm is inserted into the caval wall at the caval foramen, so that the vessel moves posteriorly during inspiration and anteriorly during

expiration.

The thoracic segment is markedly narrower and receives a new adventitious coat of elastic fibres. Its properties are fully elastic.

In man, venous return to the heart occurs chiefly because of negative pressure in the thorax. In the animals we have studied, the main returning force appears to be positive pressure in the abdomen applied largely by pressure of the diaphragm and rib cage in inspiration on the liver. However, whereas in man blood returns during inspiration, in other animals it occurs mostly in expiration because the vena cava is shut off when the disphragm contracts due to its oblique passage through the diaphragm. Blood from liver entering the diaphragmatic portion of the cava, only, returns during inspiration because this portion is forced through the caval foramen.

However, if the longitudinal muscle of the hepatic and renal portions of the cava is relaxed, blood will pass more slowly or not at all, the muscle when in tone acting as variable elastic tissue. What happens during normal respiration, and when the muscle is paralysed by shock, is seen in the film shown of the rabbit cava.

What happens in "shock", and to a lesser extent in its chronic counterpart "stress" appears to me therefore to be due largely to an interference with the function of the longitudinal smooth muscle of the abdominal vena cava. If this is correct, then shock and stress are "hypotensive" conditions of venous origin, the opposite to what happens in hypertension. If an animal's flight path is open, it goes into hypertension from the fear and flight reaction (catecholamine stimulation). If the flight path is blocked, then the hypotensive reaction takes over. The pharmacology of the caval muscle needs to be studied, so that corrective drugs may be acquired.

The Assessment of Stress in Poultry

By B. R. Howard, A.R.C. Poultry Research Centre, Edinburgh

From the physiological point of view, stress may be considered as the non-specific response to abnormally intense or prolonged stimuli. In mammals it is characterized by increased activity in the hypothalamo-hypophyso-adrenal axis, and may involve short- or long-term adjustments to the activity of the cortex and medulla of the adrenal gland. Because both of these structures are present in the hen it has often been assumed that a similar situation pertains to poultry (e.g., see Freeman, 1971).

The evidence for adrenal-cortical involvement in long-term adjustments to chronic stress is rather disappointing. The role of the adrenal medulla has not been studied, but several points concerning the action of adrenalin are worthy of consideration.

(a) Intravenous infusion of 2 to 10 μg to adult hens does not consistently increase heart-rate; the predominant effect is one of cardio-deceleration.

(*b*) It does not increase the rate of conduction through auricular muscle of the heart—this is evidenced by constancy of the P-R interval during test (*a*).

(*c*) After intravenous administration of about 5 μg to adult hens blood pressure often falls.

Extremely little is known about the physiological aspects of stress in aves. Most reports refer to responses to heating and cooling (e.g. Boone & Hughes, 1971; Parker & Boone, 1971) or to exposure to hypoxic conditions (e.g. Burton, Smith, Carlyle & Sluka, 1969). Under these conditions, only a few physiological correlates have been examined and these are usually overshadowed by homeostatic responses. Short-term stress is usually accompanied by an elevation of blood glucose levels and by a rise in heart rate (Howard, 1972), though Candland (1969) was unable to correlate changes in heart rate with behaviour during open field studies. These signs suggest a general state of sympathicotonia. This appears to be the only similarity with the mammalian syndrome outlined earlier. Changes in respiration rate have been reported in mammals, but are not a reliable index.

Draper & Lake (1967) have shown that stress may disturb circulating levels of gonadotrophins; this argument has been widely adopted in the evaluation of welfare problems —it is assumed that undue stress causes a fall in egg production. Biswas & Craig (1971) were unable to correlate the rate of lay with agonistic behaviour in White Leghorn hens. In fact, there is little firm evidence for any relationship between productivity and stress in domestic livestock, as pointed out in the Brambell Report (1965).

Recently Draper (1972) has demonstrated marked alterations in the electrolyte composition of skeletal musculature following the exposure of young chicks to brief chilling. Catabolic changes accelerate the breakdown of muscle protein (Squibb & Reed, 1970) and extracellular space increases at the expense of cell size and number. Changes in plasma

urea, potassium and sodium levels of up to 600 per cent were still being recorded two months after the initial stimulus. There is an increasing awareness by poultry husbandrymen of the importance of mineral balance in their livestock's rations (Oakley, 1972). Increasingly carcasses from intensive pig and poultry husbandry units are being condemned by meat inspectors (Judge, 1969). Such meat is very wet and does not "firm" well—possibly a consequence of decreased muscle cell size. Changes in energy metabolism have also been reported by Evans & Boda (1970); concomitant changes in endocrinological status, involving thyroxine, growth hormone and insulin would be expected, but this has not been studied.

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Manifestations of Stress

By F. R. Spratling, School of Veterinary Medicine, Cambridge

A clinician, even though he may not have realized it, is an ethologist expert in the behaviour of his patients. An M.R.C.V.S. is on oath to be humane. I am both clinician and M.R.C.V.S. It follows that I am expressing the thoughts of an applied ethologist committed to the promotion of the health and welfare of animals.

My understanding of "stress" in relation to animals other than *Homo sapiens* allows no distinction between mental stress and physical distress. In discussing some of the consequences, I refer to the important work of Selman and his colleagues. Their studies of the behaviour of the cow and her newborn calf and some simple experiments have proved that "mothering" produces measurable protection of the calf against infectious illness. Figures from official surveys of disease lend some support to the idea that the cow may also benefit from this "stress-free" relationship. Other figures from these surveys show that calves suffer harm when transported far from their birthplace to be reared elsewhere.

I mention the effects of transporting animals to markets and abattoirs, and give other examples of the manifestations of stress, ending with a reminder that intensive methods of animal husbandry are not necessarily inhumane and that although extensive methods may appear more "natural" they sometimes result in great distress.

The Behaviour of the Domestic Fowl in Stressful Situations

By Ian J. H. Duncan, A.R.C. Poultry Research Centre, Edinburgh

Stress may be defined as the non-specific physiological response and/or behavioural state, within a living organism, which results from the interaction of the organism with stressors. Stressors are stimuli which are abnormally intense or prolonged or otherwise aversive in the particular circumstances. A brief account of the physiological response in the fowl is given, emphasizing how this may differ from other, non-avian species. The type of behavioural changes that might be expected in stressful situations are discussed; a new behaviour pattern may appear, the proportion of time spent performing existing behaviour patterns may change, the quality of existing patterns may change, or an expected behaviour pattern may be absent. Examples of these changes are given.

The stressful situations likely to be encountered by the domestic fowl are described. These situations involve either (1) social attachments, (2) group interactions, (3) bird-environment interactions, or (4) bird-man interactions.

Situations involving the making or breaking

of social attachments are probably less important in the fowl than in other domestic species principally because under commercial conditions there is no parental contact. On the other hand social isolation will almost certainly be stressful, but this is unlikely to occur in practice.

Group interactions involve the formation, size, and density of groups. The increase in intensive husbandry practices has made it vitally important to understand fully the effects of such factors. However, most studies to date have failed, through their inability to tease out the individual treatment effects. For example, group size and density are almost always confounded.

As well as an increase in intensification, there has been a trend to keep chickens in a more and more artificial environment. A knowledge of bird-environment interactions is essential if an optimum environment is to be designed. A few studies have touched on this subject and these are discussed.

Bird-man interactions occur during handling, surgical procedures such as dubbing and debeaking, transportation, and arrival at the abattoir, and may be among the most stressful situations encountered by the bird. However, relatively little is known of how the bird responds to these experiences.

Stress and Intensive Livestock Production in Canada

By F. M. Loew, University of Saskatchewan, Saskatoon, Canada

The Canadian Council on Animal Care (Executive Director: Dr H. C. Rowsell) whose financial support derives from the National Research Council and Medical Research Council of Canada, has been primarily concerned with standards of care and use of experimental animals in Canada. This concern eventually led to an examination of housing and management of livestock used in agricultural schools and research establishments and then to livestock under contemporary practical systems.

At the present time, three significant areas appear to involve the imposition of stressors on livestock: (*a*) rearing and production (fattening, milking, laying); (*b*) large-scale rail movement of feeder and slaughter cattle (500,000 to 600,000 head per year over distances averaging 1500 to 2000 miles per journey); and (*c*) slaughter and attendant procedures. Of these, no legislation exists in respect of the first, with production being the principal if not sole criterion for assessing a given technique. The second, rail transportation, has been subject to federal legislation in the past and is currently under active review. For the third, a generally satisfactory "Humane Slaughter Act" exists.

In common with the United Kingdom, the main abnormalities resulting from the animal's response to the stressors induced by these systems are the "production diseases" as they were named by Payne, e.g. cannibalism in chickens and swine, metabolic disturbances in ruminents often related to feeding behaviour, oesophago-gastric ulcers and "stress syndrome" in swine, and the like. In addition, the ultimate response to long-distance rail transport of cattle appears mainly in the form of respiratory disease and body fluid volume shifts ("shrink").

A simple, reasonably informative monitoring system for the response of cattle to the stressors inherent in high-carbohydrate, low-roughage feedlots will be described. Minimization of forage in the ruminant diet is considered a strong stressor on the animal.

Clinical Signs of Stress in Farm Animals—Changes in Behaviour

By R. Ewbank, Faculty of Veterinary Science, University of Liverpool

One of the suggestions put forward in the Bramwell Committee Report (1965) was that perhaps the first and possibly even the only sign of stress shown by animals kept under intensive husbandry might be alteration of behaviour. This concept, together with the opposing (but not unreconcilable) view that a biochemical-physiological change would be a more objective means of assessing stress, has been strongly debated since. Whatever the final outcome of this discussion, the field worker still has to try and evaluate the significance of the various changes in behaviour which seem to occur under certain husbandry systems. These behavioural changes may be roughly divided into three types.

Type I. Self-evident abnormal behaviour patterns with associated pathological changes and obvious economic loss, e.g. tail-biting in fattening pigs.

Type II. Abnormal behaviour patterns with little or no co-existing pathological changes and no evidence of economic loss, e.g. bar-gnawing in stall-confined sows.

Type III. Quantitative and/or qualitative changes in normal behaviour patterns detectable only by systematic observation, e.g. the increase in normal (that apparently needed to maintain the social order) aggression seen in some highly stocked fattening pigs.

Without additional evidence (physiological-biochemical?) the significance of Types II and III behavioural changes is difficult to assess.

The whole concept of stress—the sum effect of the body reactions resulting from the application of an environmental stressor—is obscured by paradox and confusion. It has been put forward that some degree of stress may be beneficial to an organism and that perhaps one should think of stress (the animal adapting quickly and successfully) and overstress (animal showing residual deleterious effects). Extreme extensive systems (e.g. mountain sheep in winter) may be equally if not more stressing than the most intensive forms of animal husbandry. Perhaps there is an optimal degree of intensification to be aimed for, outside of which, in either direction, the animals show increasing signs (behavioural and/or physiological-biochemical) of stress.

"Ethostasis": A Concept of Restricted Behaviour as a Stressor in Animal Husbandry

By A. F. Fraser, Royal (Dick) School of Veterinary Studies, Edinburgh

The subject of clinical veterinary ethology was first given its identity at a meeting of the Society for Veterinary Ethology on these premises by A. Littlejohn in 1968. The nature of the subject was defined and the inadequate scientific status of the subject at that time was pointed out. Littlejohn's principal point was that since normal behaviour can be shown by ethology to relate to relevant and complex circumstances, abnormal behaviour must also be capable of being shown to relate to their own specific circumstances. The preliminary stages in the development of diagnosis in animal disease investigations often are based on this truism.

Littlejohn emphasized the need to recognize, in a systematic fashion, this relationship between abnormal behaviour (so amply reported by Fox in 1968) and the principal physical factors which operate causatively. He made almost exclusive reference to bodily factors such as specific lesions and to dysfunctions of systems. Excusably neglected was reference to ambient factors in a causative role in abnormal behaviour.

Many ambient factors can be seen to affect behaviour by producing adaptive responses. Some ambient factors can affect behavioural properties making them manifestly abnormal in character. In these latter cases successful adaptive behaviour has not apparently occurred in response to the ambient factor.

When Littlejohn referred us, in our study of clinical behaviour, to the particular lesion or the particular impaired system, he reminded us of the diagnostician's need to single out, usually from complex circumstances, the key causative factor. Ambient factors causing abnormal behaviour must also be singularly identified if they are to be appreciated and controlled.

By permitting pathogenic ambient factors to be protected in union under the term of "stress" we are not only technically incorrect but we compound the problem. This false concept of stress has provided us with an excuse for not attacking this problem afflicting domesticated animals. It has made the problem seem too complex and forbidding to be challenged.

Although Hans Selye gave stress its medical meaning he did not deprive the word of its broad meaning to the layman. This broad meaning has caused confusion among us. Those of us who would study stress in animals have been hampered by an inadequate vocabulary.

In a study of heat stress in pigs carried out in the tropics and reported by me in 1970, the task was relatively straightforward. The ambient factor was identifiable and measurable. The stress which it produced in the animal had an immediate and obvious form. As the study progressed it became apparent that this stress was like many other diseases in that it had graded levels of manifestation from the acute to the subclinical. This provided variety in symptoms giving that spectrum of symptoms which so many conventionally recognized diseases show. Even with an apparently constant ambient factor, variety in clinical manifestations occurred.

With this form of stress exposed so familiarly it was tempting to look for other disease-like stress conditions, so clearly related to their ambient cause. One's attention was drawn for example to a nutritional stress in newborn piglets in the clinical guise of hypoglycaemia. Management practices evidently create many stresses, often by preventing or restricting the behavioural patterns which we had come to learn about in the work by Hafez, Ewbank and many members of this Society in constructing ethograms.

At this stage the need was felt to identify singular ambient factors in management which seemed instrumental in the production of stress—both physical and behavioural. Terms such as "factory farming" were unhelpful. What is the ambient factor implied by this term—the roof, the floor, the walls,

the balanced rations, the artificial illumination, the impersonal husbandry or the population density? The term implies all of these but many are patently beneficial.

It seemed that an ethological term was needed to describe restrictions of husbandry which resulted in the impediment of activities which featured prominently in naturally or normally occurring behaviour. For this reason the term "ethostasis" was coined.

This term, which would specify a singular potentially pathogenic ambient factor, was then applied in principle in a context which was not novel and not unfamiliar to colleagues. The nursing behaviour of cattle and in particular the cycle of mutually stimulating behaviour between dam and neonate has been widely studied. The practice of arresting this behaviour by removing the calf from the cow immediately at birth seemed to be a suitable test case in appraising the usefulness of the term "ethostasis". Does recognizable stress result from this husbandry practice? It seemed that it does and its most obvious manifestation is incomplete third stage labour —retention of foetal membranes (RFM). Recently gathered figures in Midlothian substantiate this opinion. In a dairy cow population there of approximately 2000 in which zero suckling is practised the incidences of RFM in 1971 and 1972 respectively were 3 per cent and 2 per cent. In a nurse-cow population of approximately 20,000 in the same county the incidence of RFM in the same period of time was approximately 0·025 per cent. The difference is not only statistically significant but clinically significant.

Is "ethostatic" stress not recognizable in other conditions? Are not a whole range of displacement activities and vices in abnormal behaviour testimony to the effect of this pathogenic ambient factor?

I do not plead a case for this term alone; it may not find acceptance. I plead a case for a factorial study of farm animal ambience to seek out critically the roots of stress in both traditional and contemporary farm animal husbandry.

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Welfare Problems Associated with Transportation

By T. N. Allsup, M.A.F.F. Chessington

The transportation of livestock, especially for export, has for some time attracted public interest. The somewhat divergent views of welfare societies and commercial interests, involving subjective and objective opinions, coupled with a wide variety of conditions, livestock and reasons for transportation, have created particular problems.

Ministry of Agriculture veterinary staff are responsible for implementing current legislation on transportation, and where practicable, relevant and possible, accompany livestock on journeys within and out of this country in order to observe the effects of such journeys on the livestock. Nevertheless, there appear to be many uninvestigated areas concerning stress and transportation of animals which could be of interest to those involved in the scientific study of transpotration.

Factors which effect animals in transit which may lead to stressful situations include:

(1) The different types of transport employed, including the effects of the immediate environment.
(2) The purpose for which the animal is transported.
(3) The animal's response.

The assessment of effects of transportation are limited by the tools at one's disposal, often reduced to clinical observation in transit. Observations should involve all stages of the journey from the farm of origin to slaughterhouse or destination farm. For slaughtered stock, lairage and abattoir surveys may be relevant, and observation of the animal's behaviour and clinical condition for several days after transportation could be worth while.

In experimental work, it is not always easy to reproduce the actual conditions under which livestock travel. Projects of this kind may be assisted by observations in depth of actual journeys.

Swedish Studies of the Impact of the Environment on Farm Animals

By Professor I. Ekesbo, Skara, Sweden

The demands of rationalization in agriculture during the post war decades in Sweden have also implied the use of new methods and new techniques. These have changed the animal environment and thereby the animals have been affected. Results of environment health studies in the Dept. of Animal Hygiene at the Swedish Royal Veterinary College have recently been reported.

It has been shown in Sweden that increased herd size and decrease in management time per animal can increase disease incidences. For example, agalactia toxaemica, external

traumatic sow injuries and pig litter morbidity are some examples of diseases which increase when the herd size increases. The morbidity of fattening calves and the incidence of stillborn calves also increase with increasing herd size.

Stable climate, noise and light are shown to influence animal health and behaviour. Thus the incidence of trampled teats in stall-tied cows where a liquid manure system is used is shown to be higher than in conventionally housed cows.

Increasing noise level in animal premises is about to become an important animal health and welfare problem in modern animal production.

The effect of some factors in the animals' immediate environment, is exemplified by bedding and floor area per animal. It has been shown in Swedish studies that cows forced to lie on bare concrete have a higher incidence of mastitis than cows given straw as bedding. Cows given more space per stall show fewer trampled teats.

"Sterile" environments with minimal environmental variety are also shown to cause abnormal behaviour in animals. Symptoms are various and include restlessness and excessive licking.

The large-scale Swedish studies show that it is possible to design environments in which modern technology and animal health are compatible and economical. The figures of total disease incidences from herds in different environments show that it is profitable for the farmer to design the environment according to the demands of the animals' behavioural needs.

The Acute Stress Syndome in the Pietrain Pig and the Probably Possible Relationship to Transport Deaths and Inferior Quality Meat

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The Pietrain pig was imported because of its characteristically high lean meat content. Associated with this desirable trait there were certain limitations, a tendency to die when subjected to severe or unaccustomed physical exercise, or during transport to slaughter, and after slaughter a tendency to produce meat of inferior quality (pale soft, exudative muscle, PSE). The acute stress death also occurs following exposure to normal concentrations of the anaesthetic halothane and certain other pharmacological agents. It is manifest as a severe metabolic acidosis, rapid rise in body temperatures and the onset of a severe muscular rigidity which is invariably irreversible. There is an overall shift from aerobic to anaerobic energy production. Similarly excessively fast anaerobic glycolysis results in the PSE muscle observed after slaughter.

In Britain the Pietrain is now used during "hybrid" production, but the same problems already exist in certain of our native stock. The number of deaths during transportation of porkers and heavy hogs during the years 1961–1972 have been studied. During 1969–1972 the average incidence of deaths of pork weight pigs was 0·07 per cent; in heavy hogs it was higher than 0·10 per cent. These losses were highly correlated with the external environmental temperature, the death rate during the summer months being two-and-a-half times greater than during the winter months. The total distance travelled and space allocated per pig appears to have little effect on the rate of transport losses. There has been no significant increase in the death rate of heavy hogs between 1961 and 1972. The British data is considerably different from the European situation. In the Netherlands during a similar period, the incidence of transport deaths rose from 0·1 to 0·8 per cent of all pigs transported. During the same time the number of pigs classified as grade IA or AA carcases rose from approximately 42 to 57 per cent.

The present evidence therefore indicates that whereas temperatures above 9°C increase the rate of deaths, below 9°C a minimum death incidence between 0·04 and 0·05 per cent persists throughout the winter months. The temperature dependant portion of losses seems particularly likely to be influenced and increased by genetic selection for desirable carcass characteristics. These characteristics in many cases appear to be associated with a failure to adapt physiologically to a changed environment. The stress producing transport deaths in Pietrain and similar pigs is of a degree which would probably be harmless to normal genetic stock.

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Summary: The Synthesis of the Stress Entity

By P. L. Brown, R.S.P.C.A., Horsham

Stress in a lay sense would seem to be a "bad thing" and the situations that give rise to it, "the stressors", should be avoided if possible.

Unfortunately this is too simple an explanation. There is an old English saying that a certain number of fleas is good for a dog because it stops a dog from worrying about being a dog. So it seems with stress—a limited amount of stress is positively beneficial. It will increase resistance to disease, as was shown with "socially stressed" mice and their susceptibility to trypanosomiasis. It will prevent boredom, make life worth living, and is necessary, as it were, to lubricate the physiological machinery, to tune the endocrine engine. This optimum level of environmental stimulation will doubtless produce physiological responses which will be mirrored in changes in blood chemistry which are measurable with today's sophisticated techniques. These measurements may however have limitations. It is well known that the blood chemistry of a thoroughbred horse, for example, gives quite different results at the beginning and end of stabling and even at the beginning and end of sampling in a series of tests conducted over a period of just a few minutes with the sampling needle continuously in the vein.

No sooner had the link between neurohormonal responses and the General Adaptation Syndrome, as Selye had termed it, been established, than ethologists and psychologists began to use the concept of stress to explain and describe environments in which the animal or person was under adverse psychological pressure, and from this it was a short step for the use of the word stress to explain any disease or behavioural malfunction which could not be readily explained in any other way. . . . All sorts of drugs were introduced to minimize, prevent or ameliorate the dire consequences of "stress".

It was because of this looseness of thinking, and in particular, I think, because we had very foggy ideas as to how stress could be defined behaviourally, that this Symposium was held.

It has been suggested in the past that stress was a syndrome like any disease syndrome and that if we really tried we would probably find that we could describe it as an entity. The trouble is that most diseases that I know have chronic, acute and hyperacute forms, and whatever form they take they are undesirable. With the stress entity we have a situation where the absence of stressors and the development of a non-stress condition in the animal may be just as undesirable as the development of too much stress in the animal. I would suggest that in some of our current animal husbandry practices in this country and elsewhere we have situations where we have too little stress as well as situations where we have far too much.

Calves fattened for veal are reared in a deficient environment. They have little freedom of movement; they grow fat and grow fast. Their feed conversion ratio is excellent but in the subdued lighting and the cramped conditions in which they live they do develop behavioural abnormalities, the most noticeable of which are excessive self-grooming and hyperaesthesia. Are these signs of stress or of a lack of stress? I would suggest that the threshold of responsiveness to external stimuli is lowered in these calves. We have noticed the same thing in battery piglets.

It is because of this dilemma that we have sought either to rely on the production of pathological changes as the criteria for assessing suffering, or to use productivity as a yardstick. In this respect the contribution of Professor Ekesbo was so important because here was an attempt to link disease status with the environment and with abnormal behaviour. We have been terrified of the labels sentimentality and anthropomorphism. We have striven to be coldly objective. But as Professor Napier said yesterday, we may need a pinch of anthropomorphism to leaven the dumpling of scientific objectivity.

Mr Ryder, addressing the B.S.A.V.A. Conference recently, put it eloquently when he said: "If anthropomorphism means that I have noted some similarities between the human animal and the other animals then I see nothing wrong in that. The trouble with science so far is that it has not been anthropomorphic *enough*. Scientists have been frightful snobs as regards other animals, and have perpetuated the arrogant fantasy that mankind is entirely different from the other species. To regard ourselves as absolutely superior to other animals is sheer prejudice. The time is long overdue when we should properly accept the implications of Darwin and Wallace, that other animals function rather like us, and behave, feel and suffer rather like us also."

When it comes to stressful situations the similiarities with which both animals and man behave are surely striking. It is surely significant that in both man and his domestic animals crowding and aggression go closely together. It is a basic feature of all bonds that there is a limit to their extendability and those holding a community together, which are extensions of the family ones, cannot be extended indefinitely to hold together more than a certain number of people or animals.

Group size is important in animals if aggression is to be avoided and production is to be maximized. Work in both Scandinavia

and America has, for example, established that the optimum herd size for cattle is about 70 head. Up to this number a satisfactory hierarchy can be worked out, but beyond this number the organization of the hierarchy tends to break down and a degree of social chaos develops.

Much more work needs to be done to establish optimal group size. Too often the remedy when faced with problems of aggression is to resort to isolation.

What then have we learned at this Symposium? We have heard about "frustrated" sows, about "switched off" hens, we have had a plea for more commonsense. We have had an important contribution showing how the impact of the environment and husbandry systems affect the disease status of the animals; information which is almost totally lacking in this country. We have to acknowledge that the only way we shall persuade farmers to enrich or improve the environment for their stock is to show that it pays them to do so.

Finally, I would like to say that for me at least one message has come over loud and clear at the end of this Symposium, and that is that animal behaviour may well prove to be the best indicator that we have of the animal's wellbeing and welfare and that we need to study all behaviour more widely and in greater detail.