Biology of Animal Stress: Implications for Animal Well-Being

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Historically, research on animal stress has covered a wide range of scientific topics, from brain biochemistry to wildlife population dynamics. Stress research has also encompassed some of the best and worst examples of scientific investigation, ranging from Cannon's imaginative recognition of the "fight-or-flight" response (Cannon, 1929) to the 1960s' callous and simplistic research showing that inescapable electric shock makes caged animals aggressive.

The conference "Biology of Animal Stress: Implications for Animal Well-Being," held August 16-19, 1998, in Davis, California, fully conformed to this tradition of diversity. The conference included four major sessions of invited presentations. One session covered basic bodily reactions to stress, including changes in endocrine responses, metabolism, immune function, and behavior. Most of the presentations dealt with laboratory and farm animals and emphasized the hypothalamus-pituitary-adrenocortical (HPA) response to stress made famous by Selye (1956). A second session examined the effects of long-term stress, especially confinement and social disharmony. A third covered a range of cognitive and developmental aspects. A fourth session dealt with the alleviation of animal stress through genetic selection, environmental enrichment, and improved animal welfare.
handling. In addition, poster presentations covered such disparate topics as hypothermia in pigs and the effects of fishnets on dolphins.

The conference brought together roughly three groups of participants: (a) scientists doing basic work on the endocrinology, physiology, and biochemistry of stress; (b) scientists studying animal welfare and behavior; and (c) a variety of nonresearchers, including humane movement workers, representatives of farm organizations, and even a scientifically oriented sled-dog racer. The organizers clearly intended to create some much-needed interchange among the different constituencies. In formal workshops and informal social events, the superbly planned conference provided excellent opportunities for mingling and discussion.

Nevertheless, interdisciplinary dialog remained patchy. When participants and others reflect on the proceedings, to be published by CAB International in 1999, new ideas linking stress biology and animal welfare may well arise. Such ideas, however, were rarely apparent in the presentations. The stress biologists presented their findings with relatively little reference to the practical and animal welfare interests represented in the audience. Some animal welfare scientists used conventional snippets of stress physiology in their work. For example, David Mellor showed how his group had used blood cortisol levels to assess different analgesic treatments for animals undergoing surgical procedures. Yet, new ideas for integrating stress biology and animal welfare science rarely materialized. Moberg’s concept of the “pre-pathological state” (Moberg, 1985) continued to be proposed as a link between stress and well-being. There was little evidence, however, that the concept has been developed significantly during the decade after it was first proposed. In fact, some of the most innovative contributions from the animal welfare and behavior scientists were those that relied least on biological stress theory. Frederick Toates, for example, gave a masterful presentation of the hypothesis (Toates, 1998) that animals, when they learn certain tasks, learn both cognitive and stimulus-response components, and that distress can arise when these become uncoupled during later experience.

A few of the speakers came close to sparking dialog between the stress biologists and animal welfare scientists. In his keynote address, George Chrousos presented exciting evidence linking human emotional states and depressive disorders to both overactivity and underactivity in the HPA stress response. This material, however, made up only a small part of his presentation, most of which summarized new developments in basic stress biology (Chrousos, 1998) and fell short of igniting a coming together of the welfare and stress workers.

Chrousos, Catherine Rivier, and other speakers did demonstrate how recent decades have greatly clarified Selye’s conception of stress. In particular, the brain pathways and the links between the central nervous system, the endocrine system, and the immune system are now understood in far greater detail. This progress appeared solid but not visionary. Had Selye been listening, he might have been
pleased that his canon remained so intact—or would he have been looking impatiently for a brave new synthesis and a new sense of direction for stress research?

Research on animal stress has always had a dubious side, both scientifically and ethically. Selye himself described how he conceptualized a general response to stress after purposely injecting rats with formalin (Selye, 1956); and stress biologists have continued ever since to study animals’ reactions to extreme and highly unnatural circumstances. In the conference, Don Lay reviewed some of this work. He described, for example, the huge body of literature purporting to show how early stress or stimulation affects later development. The treatments used in these studies, however, often consisted of biologically meaningless interventions—handling of rat pups by a human for a few minutes each day—with no apparent thought given to how such arbitrary procedures might relate to the evolved adaptations of the species.

The use of seemingly bizarre or arbitrary causes of stress was especially incongruous at a conference focused on animal well-being. When William Mason described his earlier studies of primate infants raised artificially in social isolation, the animal-welfare-oriented participants politely bit their tongues. When a speaker showed the changes in cortisol secretion of lambs that had been tied and blindfolded for 6 hr, many of the audience were more disgusted and mystified by the choice of methods than impressed by the results. If stress biology and animal welfare science are to complement each other, they must find mutually acceptable methods and devote more effort to broad, integrative thinking.

REFERENCES