Too Much of a Good Thing: Protein and a Dog's Diet

Dana H. Murphy

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terrestrial animals, but exempted the animals of the sea. For the same reasons, in the 1930's when the whaling industry had begun to decline in the West, to be relegated to mythology and seaport museums, the Japanese were just starting to commercialize whaling on a grand scale, using new devices like the harpoon gun. Whaling on a large scale continued until the mid-1960's, when catches suddenly began to drop dramatically. Therefore, by 1978, whale meat comprised only 1.5 percent of total Japanese meat consumption—a luxury item—even though the Japanese delegation to the IWC continued to think in terms of a vast commercial whaling operation and asserted that whale meat is still an important staple in the Japanese diet.

But the New Scientist article contends that the most important factor at work in Japan's dissent may well be based upon her long history of animosity toward western intrusion in what she views as her own internal affairs. Yet once more, the white man seems to be taking up his colonialist burden, and foisting off her own insular values upon the Japanese. Nor can Japan correctly be labeled an anti-conservationist in any broad sense: she has 27 national parks and 50 quasi-national parks scattered throughout the country.

The author concludes by advising that the aggressive techniques used by groups that seek to disrupt whaling operations at sea will only increase the resolution of the Japanese to oppose IWC decisions. Better campaigns might involve efforts at enticing the Japanese to work within IWC to, for example, formulate more accurate mathematical models for estimating whale populations. However, the New Scientist author, in this conclusion, appears to be sadly behind the times: disruptive activities have all but ceased, and population estimation techniques have become highly sophisticated.

Peter Singer, also puzzled by the Japanese mind-set about whaling, visited Japan under a grant from the Australia-Japan Foundation. Before his journey, he felt that the slaughter of dolphins by Japanese fishermen, like the stubborn continuance of whaling, showed a "pattern of apparent Japanese disregard for the lives and suffering of cetaceans."

In the Spring 1982 issue of Outcry, he described his unsettling, and at times contradictory, findings about the Japanese people.

He found virtually no opposition to the killing of whales among the Japanese, but there were many different kinds of reasons and feelings underlying this single attitude. First, the Japanese have a long tradition of not interfering in each other's business, and in particular are loathe to criticize another's actions. Second, Japan has no real animal welfare movement in Japan—the only such organization was founded by British residents, and confines its concerns, in the main, to dogs and cats. Third, the environmental movement is much less prevalent or vocal than in the West. The Japanese, Singer discovered, tend to place a higher priority on business interests and, in addition, are more human-centered than westerners. Fourth, the Buddhist message of reverence to all life forms seems to have been severely diluted over the years; for example, very few Japanese Buddhists are vegetarians.

Finally, the Japanese believe that western opposition to whale-killing represents a classic instance of cultural nearsightedness: Japanese see no difference between taking whales for meat and the slaughter of cows and sheep for the same purpose.

Nonetheless, there are still some fascinating paradoxes that lie behind the Japanese public bluster on whaling. In an article in Australian Outlook (35(3): 283-294, 1981), K.D. Suter first quotes from the radical language used in a brochure handed out by the Japanese Whaling Association at a 1980 IWC meeting:

Japanese people and whalers have the right to maintain their culture and traditions. Dietary habits are aspects of specific cultures and traditions, and these naturally differ by country. Trying to enforce value judgments on others unilaterally is tantamount to imperialism or, at worst, fascism.

Yet in the same paper, Suter reports that all signs indicate that the Japanese whaling industry is actually winding down. He notes that in recent years a drastic reduction in work opportunities has occurred, and few young men have shown much inclination to enter an industry with such a bleak future.

But perhaps the most perplexing bit of information comes from the magazine Agenda (2(1):7, 1983). The Nippon Research Center, the Japanese affiliate of the Gallup Poll, published a study on October 30, 1982 which indicated that more than 75 percent of those Japanese sampled favored acceptance of the whaling ban. So perhaps the phenomenon of apparently entrenched Japanese opposition to the IWC decision may represent less a manifestation of cultural complexities, and more the obstreperous and well-organized voice of the native fishing industries.
relations firm, Manning, Selvage & Lee). The kit also lists some other stressors that may have the same effect: travel, a long stay alone, grooming, noisy children, dog shots, and being hungry. The information in the kit tells us that emotional (and other) stressors can result in severe protein depletion, as the dog's body gradually becomes so worn down that he must catabolize his own tissues, protein, to meet his energy requirements. This assertion is backed up by several research papers that are also included in the kit, by Dr. David Kronfeld of the University of Pennsylvania, on the nutritional needs of racing sled dogs.

But note the equation that is being made here: the claim made by Alpo is that the physiological ramifications of emotional stress are precisely equivalent to those of physical stress and, in particular, the physical stress of a very special kind of situation, the rigors of athletic training.

Granted, the PR brochure, "A Dog's Life: Stress and Your Dog," does fudge a bit on the language, limiting its claim to: "The stress experienced by sled dogs racing at 20 miles an hour parallels [our emphasis] the stress undergone by the family dog beset with everyday problems." Yet the prescription for both conditions remains the same — more protein, which conveniently, is exactly what a can of Alpo can provide.

But within Kronfeld's own papers are data that undermine Alpo's facile argument, even though a considerable portion of what Kronfeld, and Alpo, state is, in fact, correct. As Kronfeld asserts, stress has been generally understood as a "nonspecific response of the body to any demand" (quoted by Kronfeld from the "Father of Stress," Hans Selye, in the latter's book, The Stress of Life, published by McGraw-Hill in 1976). It is also true that nearly all stressors elicit the same sequence of events in the central nervous system and endocrine glands. In stress, the hypothalamus of the brain is stimulated to activate the anterior pituitary, which in turn acts upon the adrenal such that corticoids and pro-

techolamines are secreted. These biochemicals induce a broad range of physical and chemical changes throughout the body. The catecholamine epinephrine increases both heart rate and the force of each heart contraction; smooth muscle in the lung and intestine become relaxed. At the same time, glucocorticoids prepare the body's concentrated stores of energy such as glycogen and lipid molecules for rapid mobilization. All of these dramatic changes serve to prepare the animal for the "flight or fight" that may be necessary in an emergency. Finally, if the stress is extremely severe, or if it lasts for too long a period of time, protein can be converted to glucose. It then becomes available as an additional source of fuel for the body, but it is energetically less efficient than lipid or glycogen because more complex biochemical transformations are required to convert it to oxidizable fuel (glucose).

Where the analysis done by Kronfeld on stress in dogs goes awry is in its implication that this conversion of protein reserves occurs during a mild or transient period of emotional turmoil. At the point of fact, catabolism of proteins only begins after an extended duration of severe stress, as a consequence of an extreme condition like a long sled race or a bad infection. Therefore, a mildly stressed animal probably needs carbohydrates (and perhaps fats) far more than supplemental protein, since the former can be quickly and easily converted into bodily fuel. And in the case of the stress induced by mild illness, it is probably best to let the animal follow his natural instincts, and simply let him fast. The metabolism and consequent nutritional requirements of an animal in training — a racing sled dog — differ both qualitatively and quantitatively from those of an animal subjected to sudden and unexpected stress, whether of the transient, mild or the more severe type. Finally, there may be real danger in feeding a dog more protein (an energy basis) for growth, gestation and lactation, and 9 percent protein as a minimum for maintenance (if dogs will eat such a low protein diet). And later:

For Kronfeld (and Alpo) it is a short hop from these data on the protein needs for physical endurance in sled dogs, to other physical traumas, such as surgery, burns, or infection? He asserts, "The prescription for both conditions remains the same — more protein, which conveniently, is exactly what a can of Alpo can provide." But within Kronfeld's own papers are data that undermine Alpo's facile argument, even though a considerable portion of what Kronfeld, and Alpo, state is, in fact, correct. As Kronfeld asserts, stress has been generally understood as a "nonspecific response of the body to any demand" (quoted by Kronfeld from the "Father of Stress," Hans Selye, in the latter's book, The Stress of Life, published by McGraw-Hill in 1976). It is also true that nearly all stressors elicit the same sequence of events in the central nervous system and endocrine glands. In stress, the hypothalamus of the brain is stimulated to activate the anterior pituitary, which in turn acts upon the adrenal such that corticoids and pro-

gressive kidney disease. And it is virtually certain that a large daily ration of protein will exacerbate any pre-existing kidney conditions, especially in older dogs, since the damaged organ is simply unable to handle the extra work required to excrete the additional levels of toxic by-products of increased protein catabolism.

The Alpo-Kronfeld Dossier

One of the items in the packet from Manning, Selvage & Lee is a letter by Dr. Kronfeld, entitled "Protein for Hard Working Dogs" (Pure-Bred Dogs American Kennel Gazette, November 1980). This paper is intended to provide the principal scientific underpinning for the brochure's claims that stressed dogs need more protein. The article first discusses the different roles played by protein within the body, and then explains how protein needs change when dogs are placed in conditions of physical stress. Protein, Kronfeld tells us, can be used in three ways: to supply any acids for oxidation, to provide materials for construction and repair of bodily tissues, and, of special importance for racing dogs, "to promote the generation of red blood cells ... in canine athletes." RBC's increase in both number and volume during training, in order to supply more oxygen to working muscles. However, during periods of maximal stress in the racing season, the number of RBC's decreases if the dog's diet contains only 31 percent protein. On two other diets, with 40 and 53 percent protein, RBC numbers were sustained during stress.

Kronfeld concludes:

The protein requirements for stress and hard work is [sic] more than 38 percent but not 40 percent on a dry matter basis. In terms of available energy, at least 28 percent should be provided in the form of protein which has a quality (efficiency of utilization) of about 70 percent. Comparable figures are about 25 percent protein for growth, gestation and lactation, and 9 percent protein as a minimum for maintenance (if dogs will eat such a low protein diet).
The kit also lists some other stressors that may have the same effect: travel, a long stay alone, grooming, noisy children, dog shots, and burns. The information in the kit tells us that emotional (and other) stressors can result in severe protein depletion, as the dog's body gradually becomes so worn down that it must catabolize its own tissues to meet its energy requirements. This assertion is backed up by several research papers that are also included in the kit, by Dr. David Kronfeld of the University of Pennsylvania, on the nutritional needs of racing sled dogs. But note the equation that is being made here: the claim made by Alpo is that the physiological ramifications of emotional stress are precisely equivalent to those of physical stress and, in particular, the physical stress of a very special kind of situation, the rigors of athletic training.

Granted, the PR brochure, "A Dog's Life: Stress and Your Dog," does fudge a bit on the language, limiting its claim to: "continuous stress experienced by sled dogs racing at 20 miles an hour parallels (our emphasis) the stress undergone by the family dog beset with everyday problems." Yet the prescription for both conditions remains the same—more protein, which conveniently, is exactly what a can of Alpo can provide.

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Kronfeld concludes: The protein requirements for stress and hard work is [sic] more than 30 percent but not 40 percent on a dry matter basis. In terms of available energy, at least 28 percent should be provided in the form of protein which has a quality (efficiency of utilization) of about 70 percent. Comparable figures are about 25 percent, protein of low energy basis for growth, gestation and lactation, and 9 percent protein as a minimum for maintenance (if dogs will eat such a low protein diet).

For Kronfeld (and Alpo) it is a short hop from these data on the protein needs for physical endurance in sled dogs, to other physical stressors, such as stress from traumatic injury, and thence to emotional stressors. As Kronfeld stated in a letter to us (September 15, 1982): "The same controls evoke the same biochemical responses to emotional or physical stimuli. The kinds of responses are the same in all stress situations; they differ only in degree." With his letter, Kronfeld also sent along an article, "Nutritional Demands Imposed by Stress" (National Dairy Council, Dairy Council Digest 51(6):31-35, 1980). This piece was supposed to resolve our qualms about the precise relationship between physical and emotional stress. Interestingly, although both psychological and physiological stressors are discussed at the beginning of the article, only data from physiological stress, such as exposure to cold in rats, are cited further on. Based on these kinds of findings, the article states that "if the stress is short-lived, the changes in stress hormone levels will be transient and unlikely to induce a cataleptic response." And later: For usual stresses encountered in daily living (i.e., stresses which result in transient increases in urinary nitrogen excretion, the Food and Nutrition Board, NAS-NRC, advises that nutrient intakes in excess of those indicated in the Recommended Dietary Allowances (RDAs) are unnecessary.

So much for transient physical stress. But what happens in a true emergency as, for instance, severe physical injury such as surgery, burns, or infection? It is this sort of drastic situation that initiates the complete sequence of the CNS-hor monal cascade described above. The hormones that pour out into the blood as a response to injury induce the body to meet its augmented energy requirements from available glycogen stores (principally, the glycogen contained in liver and muscle tissue). Then, if stress is protracted, that is, lasts for more than 24 hours, Kronfeld tells us that protein begins to be used as a fuel supply. But
even then, its caloric contribution is supplemented by energy supplied by the dog's metabolic processes. And, of course, if the dog is fed during this period, he can go even longer before protein or lipid will begin to be depleted.

It would seem, then, that the case for a daily intake of large amounts of protein (and Alpo contains only about 45 percent protein, on a dry-weight basis) is based on a dubious linking of a number of scientific data, each of which, however, is true enough if considered in isolation. Racing sled dogs do indeed need more protein, probably because of the increase in RBC count and individual blood cell volume. Physical stress does induce metabolic and hormonal alterations, resulting in increased expenditures of body fuel. And, after 24 hours, protein may begin to be converted to glucose and oxidized, along with newly mobilized fatty acids derived from concentrated lipids. Finally, as noted in the Dairy Council report, emotions like fear and anxiety do increase expenditure. However, it is clear that these separate facts simply do not add up to the conclusion postulated by Alpo in its PR campaign on dogs and stress, namely, that stressors as a class of phenomena will be likely to result in protein depletion, and that a high-protein diet is therefore necessary to maintain sound physical condition. For it is highly unlikely that the kinds of problems mentioned in the press kit brochure, "A Dog's Life: Stress and Your Dog," such as a 3-hour drive, a single trip to a dog show, or staying outdoors during the day, will trigger sufficiently strong CNS stimuli to result in much more than a depletion of some carbohydrate (glycogen). Therefore, the protein catabolism rate will be unlikely to increase by much.

So the dog in the picture may be sad; he may need some supplemental carbohydrate; but he certainly does not require high level feeding of protein.

How Much Protein Does a Dog Really Need? The search for an absolute minimum is like the search of the philosopher for the absolute truth. There is not one but many protein minima, [each] a resultant of many factors. E.P. Cathcart, quoted in Nutrient Requirements of Dogs, National Academy of Sciences, Washington, D.C. 1974).

Part of the complexity involved in determining an exact figure for the protein requirement of dogs stems from the multiple roles that proteins play within the body. The amino acids that make up proteins, on one hand, comprise the chief building blocks of the body's architecture. They are the principal storage elements in muscle, tendon and connective tissues; with lipids, they form the semi-permeable membranes that surround all cells; and they constitute the special-function molecules like some hormones, antibodies, and enzymes, which catalyze the energy-producing and energy-using chemical reactions in the body. On the other hand, protein can be oxidized to provide energy for cellular work. What's important about these two possible pathways for ingested protein is that both depend, although to differing degrees, on the amount and type of protein provided in the diet.

Early work by W.C. Rose and E.C. Rice (Science 90:166, 1939) showed that nine amino acids were required by dogs as constituents of the proteins they ingest (the so-called "essential" amino acids), since the animals' bodies are unable to synthesize these in sufficient quantities for optimum health. These amino acid requirements, therefore, establish one minimum baseline for daily intake of protein.

However, once the need for the amino acids that are used for bodily proteins like enzymes has been met, an animal will use as fuel any excess that is ingested, as the need for energy requires. At the same time, the several fuels used by the body are virtually interchangeable: If too little carbohydrate and lipid are provided, even those amino acids that are necessary for bodily growth and repair will be "spent" as fuel. The principal end product of amino acid metabolism is the nitrogenous compound urea, which is eliminated from the body through the kidney.

The second complicating factor is the confusing number of ways that protein content of dog food is discussed, precisely because protein plays so many roles within the body. Individual protein sources, like meat and soybeans, can be rated according to many parameters: the percentage that is digested, the amino acid composition, and the calorie values of the other ingredients in the diet. Then, too, dogs in different conditions and of different ages have different protein requirements. Also, there are three basic types of dog food to consider—"dry" (which is actually 10 percent moisture), "semi-moist" (25 percent water), and "canned" (75 percent water). So all protein requirements must be calculated on a dry-matter basis.

Finally, there's an additional hitch introduced by the way dogs actually eat: they eat to satisfy their energy needs. Therefore, diets high in fat (and so also high in metabolizable energy) will be consumed in smaller amounts. High-fat diets should thus contain higher relative percentages of protein, minerals, and vitamins. From recent research (K.A. Houpt and S.L. Smith, Can Vet J 22:77, 1981), we have also found that dogs seem to have other kinds of taste preferences: cooked meat, for example, is more palatable than raw meat. So even after a dog has had an ample portion of cooked-meat food, he will still seem hungry to his owner, who is then sorely tempted to give him more. But it's that extra portion that will make the dog, in time, obese.

Obesity is a widespread problem among dogs in the U.S., according to Dr. Michael Fox of the ISAP, which can aggravate arthritis, pain and intervertebral disk herniation, and impair cardiac function. It also increases surgical risk, and raises the probability of hernia and lipoma tumor development; obesity reduces disease resistance, too, as well as the incentive to be active. In sum, life-span is shortened.

But setting all these caveats aside for a moment, there are some rough guide lines about protein content (expressed as percentages of dry matter) that can be established for healthy adult dogs. The data cited most frequently are those of the National Academy of Sciences publication, Nutrient Requirements of Dogs. For the various types of dog foods, the Academy's requirements for protein are:

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<th>Protein Percentage</th>
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<tr>
<td>Dry type</td>
<td>10 percent</td>
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<tr>
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<td>25 percent</td>
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Since dog food labels only give percentages of total protein, and do not disclose the exact amino acid composition, we asked Dr. Mark Morris, Jr., of Mark Morris Associates in Topeka, KS, whether the consumer need be concerned about meeting his/her dog's minimum requirements for essential amino acids. He replied that there was little need for anxiety, because all of the commercially available dog foods contain so much extra protein that is actually required, that it would take an intrepid and lengthy search to find a food that didn't have sufficient quantities of the important nutrients. Alpo, for example, is about 45 percent protein—more than 7 times the amount that's necessary.

Protein and the Kidney In an article in Gun Dog (11):26-27, 1982), Dr. Morris stated: "High-protein dog food is not good for your dog, and if he has kidney problems, an all-meat dog food can kill him."

What is the scientific basis for this statement? The main reason why lots of protein is not good for your dog is that, if a high-protein diet, protein is burned by the body as fuel, producing high concentrations of the toxic nitrogen-containing end product, urea. If the kidneys are compelled to process too much urea, existing urinary conditions may be aggravated, especially in older dogs. In fact, recent data have demonstrated that continuous ingestion of high protein levels may even cause kid-
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Protein and the Kidney

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ney degeneration.

Dr. Kronfeld for his comments about the potential danger of high-protein diets in older dogs. He responded (letter, September 15, 1982):

The point in the course of moderate or severe failure when the disadvantage of accumulating nitrogenous toxins (principally urea) outweighs the disadvantage of low protein diets on kidney blood flow, filtration, and tubular reabsorption has not been well-established clinically.

In rebuttal to this statement, Dr. Morris said that, while it is true that high protein volumes do enhance one of the measures of kidney function, the glomerular filtration rate (or kidney throughput), the high levels of urea produced in the process impose too heavy a workload on the kidney. What one is doing, in a sense, is “using protein to stimulate an organ that’s already degenerated.”

Kronfeld’s stance seems to be chiefly based on one series of studies by K.C. Bovee et al. (Invest Urol, 1979). Bovee and colleagues surgically removed 25 to 50 percent of the kidney mass in dogs, and then found that kidney function remained quite satisfactory. Questioned as to whether there was something faulty in an experimental model that yielded such unexpected results, Dr. Morris noted that, after surgical removal of a portion of the kidney, the intact sections tend to hypertrophy to compensate for the loss. So, said Dr. Morris, what Bovee et al. were probably measuring was the functioning of a kidney of near normal capacity.

But perhaps the most fascinating, and gratifyingly unifying, hypothesis on the role of protein in kidney function appeared in the September 9, 1982 issue of the New England Journal of Medicine, in an article by B.M. Brenner et al. They noted that the short-term increases in glomerular filtration rate that appear after a protein-rich meal are, “by cumulative effect, responsible for the sustained hyperfiltration and accompanying renal hypertrophy seen in animals maintained on high-protein diets.” Brenner and colleagues theorize that these changes, in turn, affect the selective permeability of the glomerular membranes such that larger protein molecules like albumin begin to travel across the capillary wall. As a result, these proteins may become deposited on the cell walls of kidney tissue, eventually leading to glomerular sclerosis.

Brenner et al. speculate that the problems caused in the kidney by a steady diet of high protein may be the consequence of an odd glitch in evolution. Long before any of the canids had ready access to food in cans, all carnivores ate according to a particular pattern: they consumed large meals, at infrequent intervals. As a result, two different populations of nephrons (the structural unit of the kidney) developed. The first population of deeper nephrons served to carry on excretory business-as-usual between big meals, whereas the second, superficial population were used as reserve capacity, to handle the extra work required after ingestion and catabolism of protein.

But with the advent of daily, ad libitum protein intake, both deep and superficial populations had to be kept at work all the time. Brenner and co-workers think that this change in protein-eating patterns, with its attendant burden on the kidney, may contribute to the age-associated glomerular sclerosis repeatedly observed in laboratory animals (including dogs) and in human beings. As proof, the note that the simple limiting of food intake, or giving food every other day, has been shown to retard the development of kidney lesions in rats and mice.

Food Fads and Fetishes (vs. Nutrition)

We have all been conditioned, by now, to believe that we live perpetually in a climate that is rife with trauma and stress, and that this kind of environment is of relatively recent origin. Unfortunately, we have no real way of knowing whether the pressures of deadlines, urban sprawl, etc., are really more damaging than the prospect of a dry cow or a barren field was to our ancestors. In any event, most of us feel that plenty of protein is one way to construct the tough-hewn “lean machine” that will insulate us against those terrible external stressors. Various fad diets, as they come and go, have also endowed the word “protein” with a kind of magic. And so, in a prime example of anthropomorphism, we project our own fears and beliefs onto our companion animals, and are easily cajoled into believing that the family dog, too, needs heavy protein doses to survive the day. While some researchers allege that an all-vegetable diet may be difficult for larger dogs to digest, there is certainly a plethora of choices of dog foods that provide a happy medium—enough protein, but not too much, thank you.

Dana H. Murphy
ney degeneration. 

But we must consider the potentially dangerous effects of high-protein diets in older dogs. Dr. Kronfeld for his comments about the potential danger of high-protein diets in older dogs. He responded (letter, September 15, 1982):

The point in the course of moderate or severe failure when the disadvantage of accumulating nitrogenous toxins (principally urea) outweighs the disadvantage of low protein diets on kidney blood flow, filtration, and tubular reabsorption has not been well-established clinically.

In rebuttal to this statement, Dr. Morris said that, while it is true that high protein volumes do enhance one of the measures of kidney function, the glomerular filtration rate (or kidney throughput), the high levels of urea produced in the process impose too heavy a workload on the kidney. What one is doing, in a sense, is “using protein to stimulate an organ that’s already degenerated.”

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