

## Effects of human contact on animal health and well-being

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The human-animal bond has received much attention because of the beneficial effects of animals on human physical and mental health.<sup>1,3</sup> Various physiologic responses in human beings have been shown to be associated with animal contact. The presence of a family pet is associated with a significantly higher survival rate in patients with angina and myocardial infarction.<sup>4</sup> Observation of aquarium fish is associated with decreases in blood pressure.<sup>1</sup> Blood pressure in children is significantly lower when a dog is present,<sup>5</sup> and people under moderate stress experience a reduction of blood pressure when in the presence of friendly dogs.<sup>4</sup> Mental health benefits have also been reported,<sup>6</sup> including relief from clinical depression,<sup>7</sup> decreased anxiety<sup>8</sup> and enhanced relaxation,<sup>3</sup> moderation of stress in the elderly,<sup>9</sup> and improved emotional well-being.<sup>10</sup> The data indicate that visual, verbal, and tactile contact with animals can be an effective means of reducing stress,<sup>1</sup> and it has been postulated that stress reduction and companionship are the 2 benefits of animal contact most likely to have a positive influence on human health.<sup>11</sup> The precise mechanisms underlying these effects have not been elucidated.

Discussions of the influence of the human-animal bond have focused exclusively on the benefits of the bond to human beings.<sup>1</sup> The effects of human contact on the physiologic processes, health, and emotional well-being of animals are not widely known. However, in 1928, Pavlov described animals as having a "social reflex" after observing that the presence of a human being caused physiologic changes.<sup>12</sup> At about the same time, the American physiologist Walter B. Cannon published *Bodily Changes in Pain, Hunger, Fear and Rage*,<sup>13</sup> which described an array of physiologic responses of various animal organ systems to petting and human handling. These effects, however, were labeled by Cannon as "remarkable perturbations" and simply mentioned in passing.

Recent studies have revealed that human contact affects the physiologic, health, and emotional status of animals during all stages of life. The purpose of this report is to review published work on the effects of human contact on animals. Because human contact is an integral part of animal care in veterinary medicine, knowledge of the effects of such contact is of paramount importance in providing optimal care. An understanding of these effects has great potential to

enrich the profession. For the purposes of this report, contact is defined as "the state of being in association with,"<sup>14</sup> and includes specific types: visual, tactile, auditory, and olfactory.

### Infant and Growing Animals

Young rats petted and handled by human beings gain more weight than those not handled.<sup>15,16</sup> Infant rats handled daily during the first 10 days of life have more pronounced brain development than nonhandled rat pups, as measured by percentage of myelinated axons and glial cell number at 6 months of age.<sup>17</sup> Rats gently handled between 21 and 60 days of age display superior performance on discrimination tasks, compared with nonhandled control rats.<sup>16</sup> Daily handling of infant rats during the first 21 days of life results in an increased immune response to antigenic challenge,<sup>18</sup> and rats handled from birth respond more vigorously to challenge with flagellin at 9 weeks of age and to a booster immunization 4 weeks later, when compared with nonhandled control rats.<sup>19</sup> Infant rats handled by human beings survive longer as a group than their nonhandled littermates when implanted with carcinoma cells (Walker carcinoma 256).<sup>20</sup>

Emotional health and development are highly influenced by handling during infancy. Petting and handling of young rats increases viability under stress.<sup>21-23</sup> Handling of rat pups in infancy is the most powerful variable affecting emotional reactivity throughout life.<sup>24</sup> Handled animals appear to be less emotional than those not handled,<sup>25,26</sup> and reduced anxiety responses endure.<sup>25</sup> The influence of human contact on animals' emotional states appears to extend beyond lessening fear of human beings, and the breadth of effects has been documented by investigators who used various measures of emotional reactivity, including fear responses in the open field,<sup>26,27</sup> activity and defecation during learning trials,<sup>28</sup> degree of timidity when emerging from the home cage,<sup>29</sup> and activity in novel environments.<sup>24</sup> Postnatal handling of rats results in reduced displays of anxiety and fear when rats are placed in situations of novelty or conflict, and these emotional effects persist into adulthood.<sup>30</sup>

Human handling of infant animals can slow changes associated with aging. A study<sup>31</sup> of the effects of neonatal handling on rats revealed that rats handled as infants had less hippocampal cell loss and fewer age-related spatial memory impairments in old age.

Human handling of infant cats significantly accel-

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erates development and maturation of the CNS and hastens physical development.<sup>32</sup> Cats handled during infancy are more resistant to stress, display less fear, open their eyes at an earlier age, and are capable of learning certain tasks faster than cats that are not handled.<sup>32</sup> Acceleration of development, as measured by age at emergence from the nesting box, time of eye-opening, specific EEG patterns, and initial appearance of differences in coloration, has been observed in Siamese cats petted and handled during infancy.<sup>33</sup>

Human contact also relieves signs of adverse emotional states in animals, such as distress exhibited by mammalian species when infant and mother are separated.<sup>34</sup> In fact, the presence of a human being decreases crying in infant kittens separated from their queens as much as does the presence of the queen.<sup>32</sup>

## Mature Animals

Contact with human beings elicits physiologic responses of large magnitude in dogs. Research indicates that human beings, especially through tactile contact, can markedly reduce and even eliminate dogs' behavioral and physiologic responses elicited by conditioned fear and painful stimuli.<sup>35-37</sup> Animal pain, as assessed by clinical signs, is lessened when animals are petted and stroked by human beings. Human contact reduces the vocalization, restlessness, tachypnea, and tachycardia associated with pain.<sup>38</sup> Physiologic responses are most pronounced when a person simply pets a dog during a painful stimulus.<sup>36</sup> A shock to a dog's forelimb will cause the dog's heart rate to increase<sup>36</sup>; a response attributable to pain, fear, or both.<sup>39</sup> Researchers have found that if a shock is administered to a dog simultaneously being petted by a person, the heart rate increase is significantly less than that in dogs experiencing a shock without petting.<sup>40</sup> When the cardiac response is conditioned to the stimulus, simultaneous petting not only eliminates the tachycardia, but induces a bradycardia. This indicates that petting can eliminate prior conditioned fear responses in dogs.<sup>41</sup> Gently stroking, petting, and talking to companion animals can reduce their anxiety and fear, including that associated with pain.<sup>38</sup>

Tactile contact (petting) has broad physiologic effects on the cardiovascular system of dogs<sup>39</sup> and horses.<sup>42</sup> In one study,<sup>37</sup> dogs were placed alone in a room, and a person entered. The person's entry elicited marked increases in the dogs' heart rates (10 to 80 beats/min). When the same person petted these dogs, petting was accompanied by an abrupt decrease (5 to 40 beats/min) in heart rate from the dogs' resting rates 1 or 2 seconds after initial tactile contact. Heart rates that did not decelerate during petting usually increased when petting ceased.<sup>37</sup> After expanding these studies to include the entire canine hemodynamic system, it was discovered that human contact elicited major changes in a dog's blood pressure and in its aortic and coronary blood flow.<sup>36</sup> Human contact caused such profound increases in the latter that even the investigators were surprised, commenting, "in some dogs the person was almost as potent a stimulus to coronary flow as violent exercise on the treadmill, despite the small increase in motor activity caused by the person."<sup>43</sup> Horses petted

by human beings experience such a precipitous decrease in heart rate that dropped beats are often observed.<sup>42</sup>

Gentle handling of dairy cattle and other domestic animals improves productivity.<sup>44</sup> Studies of interactions between dairy cows and herdsmen indicate that the single most important variable in determining milk yield and reproductive success in dairy cows is the personality and attitude of the herdsman toward the cows,<sup>45</sup> and dairy farmers who touch and speak to their cows usually have higher producing cows.<sup>46</sup> Cows that calve in the presence of human beings have improved milking performance, compared with cows whose parturition is not associated with human contact; they are less restless and require less assistance from the stockperson during milking.<sup>47,48</sup> Presence of a human being is also associated with increased reproductive efficiency in sows.<sup>49</sup>

Gentle handling and petting (gentling) by human beings was shown to dramatically reduce mortality in rats after surgery.<sup>50</sup> In rats undergoing thyroidectomy-parathyroidectomy, mortality rate (from acute parathyroid tetany) was 13% in a group gentled by a human being each day since infancy, compared with 79% in a group not gentled.<sup>50</sup>

The progression and outcome of disease states in animals can be strongly influenced by human contact as well. Researchers allocated rabbits to 2 groups and fed them a 2% cholesterol diet.<sup>51</sup> Rabbits in the control group were given normal laboratory care, and rabbits in the second group were held, petted, talked to, and played with several times daily. On postmortem examination, atherosclerotic lesions in the gentled rabbits were < 50% as severe as lesions in the control rabbits.<sup>5</sup> Subsequent unpublished experiments performed by the same investigators confirmed these results.<sup>4</sup> In another study,<sup>52</sup> chickens were talked to and gently handled or provided with minimal human contact for 7 weeks, after which they were exposed to *Escherichia coli*. When compared with chickens whose contact with human beings was minimal, chickens provided with social human contact had more than a 60% reduction in death and pericarditis, as well as improved feed efficiency and an increased antibody response to canine RBC.<sup>52</sup> In separate studies, chickens talked to and handled gently by human beings were found to be more immunocompetent, with greater resistance to bacterial infections, and had increased blood protein concentrations and increased weight gain.<sup>53-55</sup>

## Factors Influencing the Effects of Human Contact

Human contact is not uniformly beneficial to animal health and well-being. Studies of laboratory animals reveal that human contact has variable—and in some cases conflicting—effects. Chickens subjected to an intentionally unpleasant form of human contact described by the investigators as hassling (being shouted at, their cages banged on, and other loud noises) had a reduced antibody response but increased resistance to *E coli* infection.<sup>52</sup> Human handling of infant rats and mice influences resistance to various potential pathogens, but not in a consistent direction; handling



administered throughout infancy increases resistance to some pathologic processes, decreases resistance to others, or may have no apparent effect.<sup>35,36</sup> For example, mice handled as infants were found to have shorter survival times when lymphoid leukemia was transplanted into them as adults.<sup>37</sup> Another study examined the effect of daily handling (picking up and placing in a novel cage for 15 minutes) and gentling (handling accompanied by 3 minutes of dorsal tactile stimulation) on experimental allergic encephalomyelitis (EAE) in adult rats.<sup>38</sup> Adult rats of both sexes handled in infancy were more susceptible to EAE, as measured by higher incidence and more severe clinical signs of the disease.

Stress mechanisms appear to be an important component of the effects of human contact on animal health. In certain cases, human contact elicits responses consistent with those of stress.<sup>39</sup> In infant animals, similar effects to those induced by handling, such as a reduction in emotionality, tolerance to stress, and resistance to certain disease states, have been seen when animals are subjected to known stressors such as electrical shock.<sup>24,60</sup> This indicates that the effects of human tactile contact in infant animals may be primarily mediated by stress mechanisms involving the pituitary-adrenal axis.<sup>61</sup> Conversely, some effects of human contact on infant animals appear to result from reduced stress (eg, aversive emotional states), as evidenced by diminished signs of separation anxiety in some infant mammals when human contact is provided.<sup>32,36</sup> In another study, handling in infancy reversed behavioral deficits induced in rats by unpredictable prenatal stress.<sup>62</sup> Experiments involving laboratory rodents indicate that conventional experimental handling of adult mice and rats can cause apprehension and stress, with increased plasma corticosterone concentrations and measurable adverse physiologic and immunologic consequences.<sup>62-65</sup> Several studies have looked at the effects of human handling on pigs. This research has consistently revealed that pigs displaying intense fear of human beings have physiologic evidence of a chronic stress response.<sup>66</sup> Studies of the effect of human contact on heart rate in dogs indicate that tactile contact evokes cardiac deceleration only when its emotional content is positive.<sup>67</sup> When dogs were petted by an experimenter who had previously punished them, increased heart rates were observed.<sup>68</sup> In contrast, many studies indicate that gentle human contact in adult animals is more consistent with reduction of stress<sup>36,40,41</sup> and enhances comfort states.<sup>35</sup> In mature animals, experimental data as a whole indicate that the effects of human contact cannot be attributed solely to stress-mediated factors, because the effects of high or low stress are not equivalent to, respectively, the effects of harsh or gentle human contact.<sup>32,35</sup> Reductions in stress, fear, and other aversive emotional states clearly are important, but the data also indicate some direct beneficial effect of human contact.<sup>32</sup>

Although not totally responsible for the outcome, stress mechanisms do mediate animals' responses to human contact. Three contributing factors have been found to play a role: socialization, genetics, and quality and type of contact.

**Socialization**—Early socialization determines whether certain experiences later in life (eg, human contact) are stressful, beneficial, or neutral.<sup>36</sup> For some animals, such as those that are feral, untamed, or not socialized with human beings, contact with people may cause intense fear.<sup>69,70</sup> In many nondomesticated species, frequent human contact leads to habituation, resulting in reduced fear responses.<sup>70</sup> Even fully domesticated species often require early socialization. Without this, fear responses to human beings may remain prominent throughout life.<sup>66,71,72</sup> Adequate socialization can be modified by life experiences, so although data indicate the biological importance of human companionship, and that human contact can be a potent source of comfort, it is possible through learning experiences for human contact to become a source of distress.<sup>35</sup> The net effects of human contact on health and well-being depend largely on the animal's previous social experience with human beings.<sup>35</sup>

Familiarity, a specific component of social experience, can also modulate the effects of human contact. Unfamiliar human beings may cause anxiety and fear in animals—domesticated and nondomesticated, socialized and nonsocialized. Contact with an unfamiliar person has the potential to elicit emotional distress, resulting in characteristic stress-related health effects.<sup>64,73</sup> Differential responses of animals to familiar versus unfamiliar human beings were revealed in physiologic studies of cortical activity in rats and rabbits.<sup>74</sup> A rapid and profound effect on the temporal pattern of discharge of cortical neurons occurred on exposure of a new person to these animals, and when these animals were handled by a human being with whom they were not familiar, cortical activity paralleled changes seen in alarm reactions.<sup>74</sup> In studies involving the influence of petting on heart rates in dogs, it was found that a deceleratory response could be elicited by a person who was familiar to the dog, whereas a person less familiar to the dog elicited no change in heart rate, and even elicited a heart rate increase.<sup>36,75</sup> In a rabbit, cardiac responses differed when the animal was petted by a familiar person versus an unfamiliar person.<sup>37</sup> Although familiarity appears to have a substantial effect on cardiovascular responses to petting, its influence is not consistent, because other reports describe profound deceleratory cardiac responses in dogs petted by unfamiliar, as well as familiar, people.<sup>40,76</sup>

**Genetics**—Responses to human contact are also mediated by genetics. In a study examining cardiac responses to petting, members of 1 genetic line of dogs had a consistent decrease in heart rate, whereas members of a second line had no response.<sup>76</sup>

The contributing effects of genetics are also observed in domestication. The process of domestication—a genetic selection for (among other qualities) a diminished fear response toward human beings<sup>77</sup>—reveals that some animals, by virtue of their lineage, are adapted to the proximity of human beings and are, therefore, less distressed by human contact.

**Quality and type of contact**—Quality of human contact is an important modulating factor for that contact's influence on animals. Although studies reveal the



benefits of human contact, it is important to note that such contact is almost invariably gentle. Gentle human contact appears to exert a direct effect that is beneficial to health and not attributable to stress responses. Rough or unpleasant contact is a source of stress and, therefore, is potentially harmful to animal health and well-being. Frequent holding of rats by the back of the neck has been shown to cause hyperplasia of the urinary bladder.<sup>78</sup> The investigators postulated that these changes were caused by stress and indicated that this type of handling was traumatizing to the rats and induced focal ulcerations of the skin of the back of the neck where the animals were held.<sup>79</sup> Some studies specifically compare rough with gentle contact. In rats, rough and gentle handling elicit diametrically opposite effects on brain (mRNA) expression.<sup>79</sup> A study examining the difference between pleasant (patting or stroking) and unpleasant (slapping or briefly shocking with an electric prod) handling of pigs revealed that gently handled pigs had significantly faster weight gain and greater reproductive performance than those handled in a rough and unpleasant manner.<sup>80,82</sup> It was concluded that unpleasant handling resulted in acute and chronic stress responses.<sup>80,81</sup> Another study<sup>84</sup> of chickens included 3 different types of human contact: gentle handling with hand feeding, minimal human contact, and harsh contact consisting of loud banging of a bucket and yelling. Compared with other chickens, chickens experiencing harsh human contact had reduced antibody responses to antigen challenge. This response of hassled birds was consistent with that described for stressed birds.<sup>59</sup>

The effect of human contact on animals also depends on the type of contact involved—tactile, visual, or other.<sup>37</sup> Physiologic responses to petting (tactile contact) are distinctly different from those elicited by the mere presence of a person (visual contact).<sup>36</sup>

## Conclusions

Human contact impacts the well-being of various animal species of all age groups and generates an array of physiologic, emotional, and health effects. As with the effects of animal contact on human health, the exact mechanism of the process is unknown.<sup>36</sup> It is unlikely to be a single effect or mechanism; instead, it is far more plausible that a multitude of effects are involved. At a minimum, it is reasonable to assume that mechanisms operating in infants differ from those in mature animals. One plausible explanation for the physiologic changes detected in infant and growing animals is that human handling and contact act as stimuli. It has been established that maturing animals placed in stimulus-rich environments have more rapid and extensive brain development.<sup>83</sup> Studies specifically comparing animals in stimulating environments with and without human social contact are lacking; therefore, it is not possible to determine how much human contact exerts its influence simply by stimulation of the developing brain. In infant animals, the pituitary-adrenal axis<sup>31,61</sup> and physiologic stress<sup>24,60,84</sup> appear to play an important role. This idea is supported by studies indicating that known stressors can elicit some of the same effects as human handling. Conversely, in

mature animals, lessening of stress, fear, and other aversive emotional states may be responsible for some benefits of human contact. Neither stress nor stress reduction, however, elicit the same total effect as that achieved by human contact.<sup>52,55</sup>

Overall, it would be inaccurate to view human contact as either exclusively good or exclusively bad. Individual circumstances vary so that human contact can have adverse as well as beneficial effects on animal health and well-being. For some animals, human contact is rewarding, associated with pleasant emotional content, and promotes well-being.<sup>67</sup> For other animals, human contact is a source of stress, associated with unpleasant emotional content, and is harmful to well-being.<sup>66</sup> Although many basic questions remain unanswered, data support the following conclusions: 1) human contact can affect the physiologic, emotional, and health status of animals; 2) in general, for socialized animals, the effects are beneficial for gentle contact and adverse for unpleasant contact; 3) stress plays a prominent and complex, but not exclusive, role in mediating the effects of human contact; and 4) the effects of human contact are modulated by at least 3 factors: socialization, genetics, and quality and type of contact.

## Implications for Veterinary Practice

The implications of these findings are diverse and profound for veterinarians, animal owners, and those concerned about animal well-being. Until recently, animal care was guided by moral considerations that prohibited unkind treatment, because it was wrong. Results of research exploring the effects of gentle human contact on animal health and well-being provide a scientific basis for recommending a compassionate approach to the care and management of animals.

Because human contact appears to play a meaningful role in the course and outcome of health processes; it may offer great promise as an adjunct treatment in health care. In general, it would appear appropriate to use gentle human contact before, during, and after illness, injury, and surgery for animals that appear to respond favorably to human contact, that is, those who display no signs of fear toward human beings (eg, withdrawal from human approach, increased heart rate, increased muscle tension). Human contact can be of benefit during all stages of the disease process and should become a routine part of treatment plans in veterinary hospitals. Gentle contact can be offered by hospital personnel, but research suggests the best approach is contact with familiar people. This makes a scientific argument for encouraging in-hospital visitation when animals are hospitalized. This knowledge could be incorporated into the design of animal hospitals; for example, special rooms for visitation where animals and owners could interact without being disturbed could be included in the architect's plans. Familiarity also can and should be promoted in nursing care protocols. Goals should include nurse-patient bonding and continuity of care so that the same nurse would care for the patient throughout its hospital stay.

The ability of human contact to optimize an ani-



mal's comfort and well-being creates a strong rationale for pet owners being present for many medical procedures. In human pediatric medicine, parents are encouraged to maintain physical contact with their infants during medical procedures to provide comfort and mitigate adverse effects of the procedures.<sup>85</sup> Research indicating that gentle human contact can attenuate the adverse effects of unpleasant stimuli, eliminate fear responses, and alleviate signs of pain in animals supports the value of such an approach in veterinary medicine. The presence and caring touch of the pet owner can be an important benefit to patient well-being during many procedures that involve pain, fear, or other emotional distress. An especially important application of the benefits of human contact is in the special case of euthanasia. No medical act carries more importance—emotional and moral, if not scientific—than euthanasia of companion animals. This unique time requires application of every known tool to optimize animal well-being and comfort, including full use of the effects of human contact. The owner's presence (for those owners who want to be present) and offering petting and soothing words will be of great benefit to the animal's overall experience of life's end.

In the research setting, human contact has a strong impact on the psychophysiologic functions of animals and can lead to unpredictable and erratic results.<sup>67,74,86,87</sup> This potent influence, termed handling effects, is observed for all forms of human contact with researchers and laboratory personnel. As is the case for individual nonexperimental animals, responses to human contact in lab animals vary among individuals and are based on the animal's past experience and genetic makeup. Recognition of the effects of human contact on laboratory animals has led to a reevaluation of how research is conducted and various solutions have been proposed to correct this problem. One way to minimize the variable effects of human contact is to develop a socialization process that all animals would undergo when young, thereby attenuating fear of human beings and promoting positive (or at least neutral) human-animal interactions.<sup>66</sup> The opposite approach is to minimize or eliminate all human contact with experimental animals, which involves automation of data collection.<sup>86,88</sup> However, minimizing human contact risks depriving animals of social needs, thereby creating emotional distress, especially in animals such as dogs that have been bred to a degree of social dependency on human beings.<sup>67,70</sup> Kostarczyk,<sup>67</sup> writing of dogs, states that "experimental situations are not neutral for animals. Their need for social contact depends on their genetic heritage and life experience. If we neglect to interact socially with a socialized animal, our scientific discoveries will be made with deprived, homeostatically disturbed animals." Therefore, by correcting 1 problem—minimizing social contact between human beings and dogs to lessen variable handling effects—we create a degree of social deprivation that yields an abnormal baseline for research. In other social and socialized species, placing an animal in a socially impoverished testing environment can lead to unreliable experimental data.<sup>89</sup>

In the myriad situations of animal care in which

animals and human beings interact, the ideal would be to fully exploit the effects of human contact in a way that optimizes the beneficial effects of such contact. Because the effects of contact depend to a large degree on past experience, optimizing these effects involves special care starting at the earliest ages of development. Experimental findings indicate the following as being effective in optimizing the beneficial effects of human contact<sup>66</sup>: 1) early socialization toward human beings (increasing human contact so that animals may habituate themselves to the presence of human beings); 2) minimizing or eliminating human behaviors averse to animals (ie, those behaviors that increase withdrawal from human beings) and promoting positive human behavior (ie, those behaviors that encourage acceptance of human beings); 3) avoiding situations in which animals may associate aversive events with human beings; and 4) providing situations in which animals may associate rewarding events with human beings. These techniques reduce negative emotional reactions associated with human beings (eg, fear, anxiety, stress), and promote positive emotional reactions.

Evidence supports the broad and substantial effects of human contact on animal physiologic mechanisms—those mechanisms that directly regulate health and well-being. Animal health and emotional well-being can, for various animals in diverse situations, be improved by gentle contact with human beings. Much of this information has immediate clinical application for veterinary medical practitioners and others involved in caring for animals. However, the most effective application of this knowledge must await elucidation of the mechanism(s) involved. Researchers must identify the precise physiologic mechanisms involved, and methods must be developed to exploit these mechanisms for therapeutic use. Understanding the underlying mechanisms will permit their manipulation so that detrimental effects of human contact can be minimized, while beneficial effects are maximized.

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