One Welfare: Healthy Environments for Human and Nonhuman Animals

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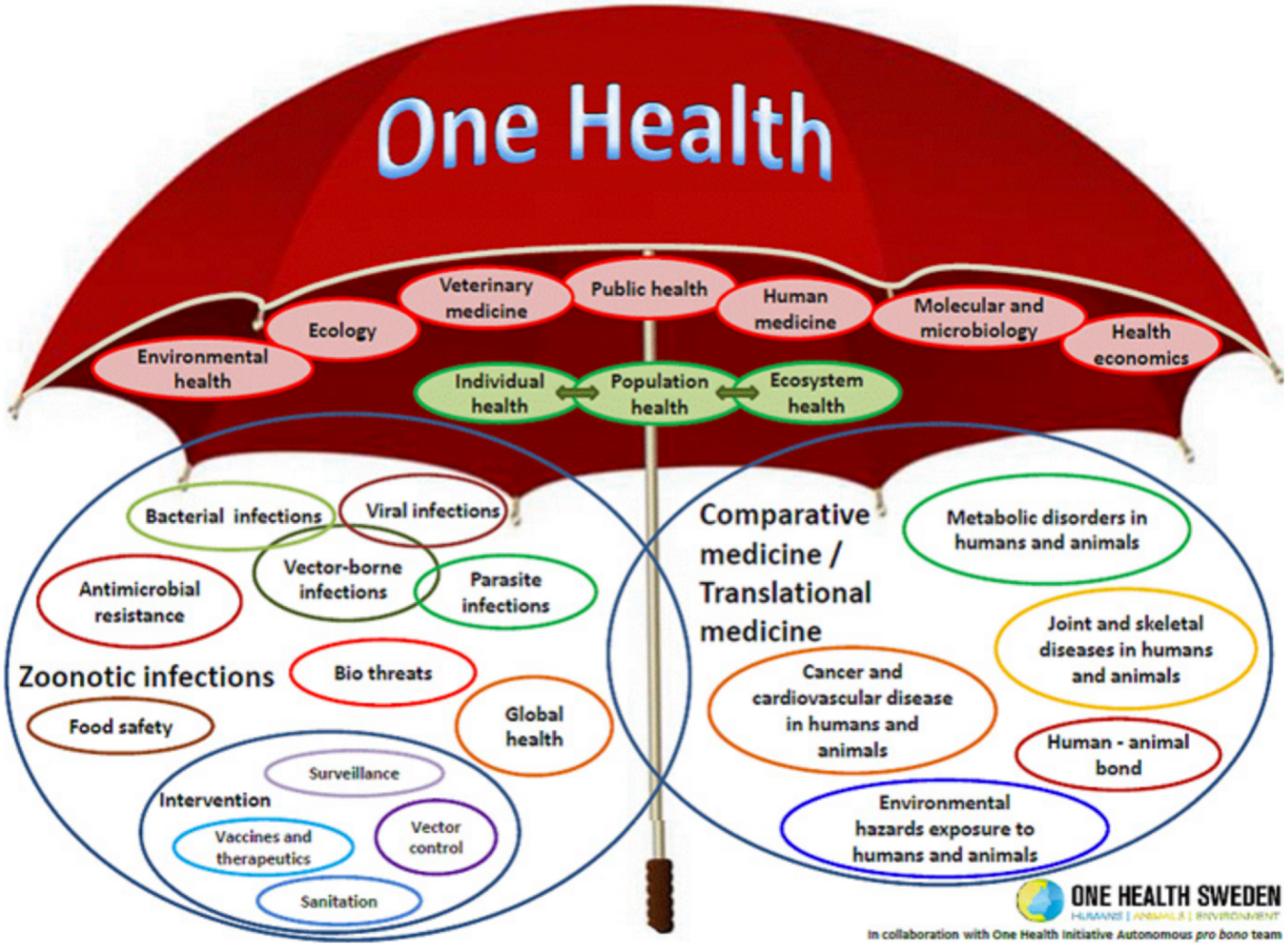


"One Health (formerly called One Medicine) is dedicated to improving the lives of all species—human and animal—through the integration of human medicine, veterinary medicine and environmental science."

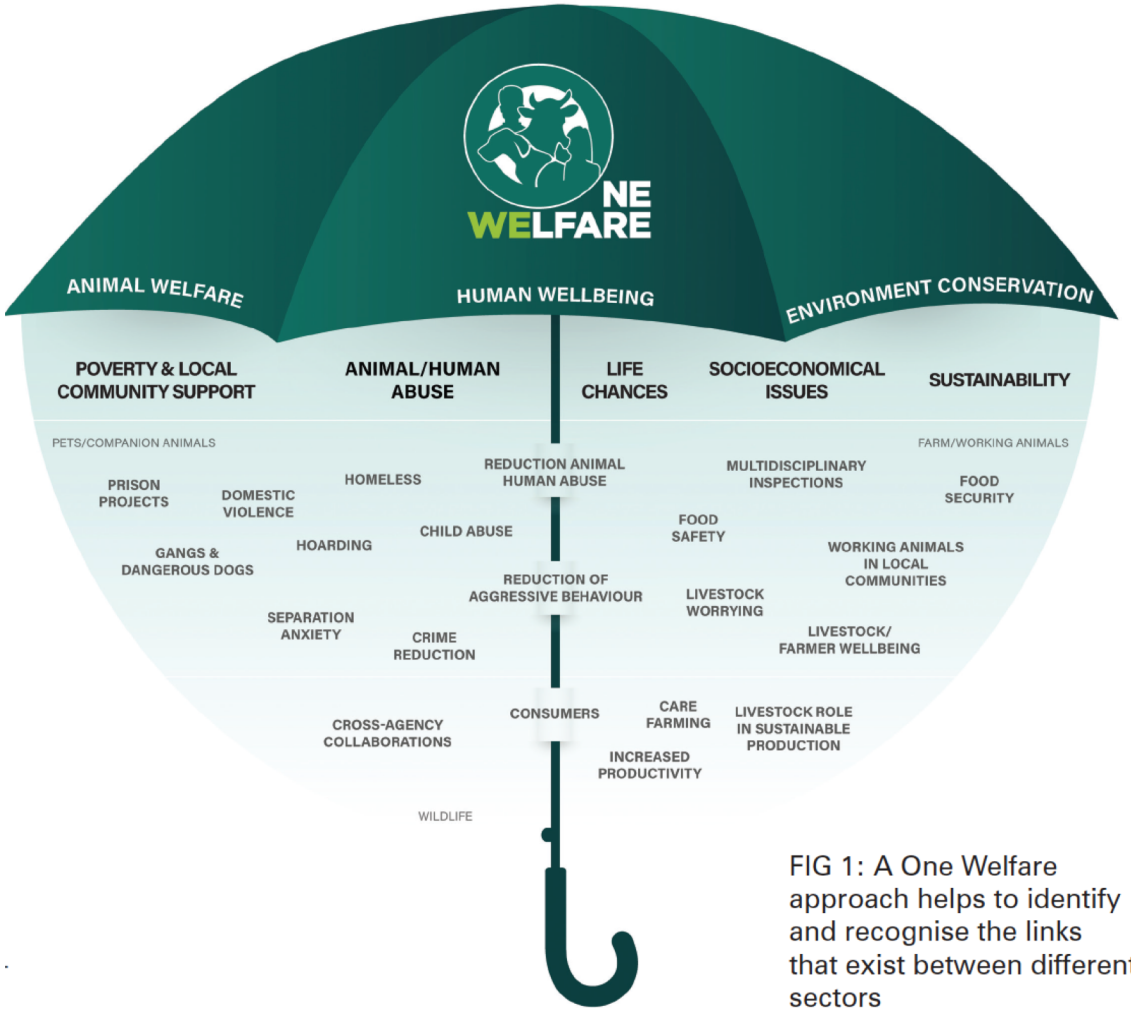


FIG 1: A One Welfare approach helps to identify and recognise the links that exist between different sectors

"One Welfare recognizes the interconnections between animal welfare, human wellbeing and the environment. Integrating this concept in existing projects could foster interdisciplinary collaboration to improve human and animal welfare internationally."

Pinillos, R.G. et al. 2016. *Vet Rec.* doi: 10.1136/vr.i5470

What is “Welfare”?

(OED definition of ‘welfare’ = *The state of faring or doing well*)

Poor welfare usually defined in terms of:

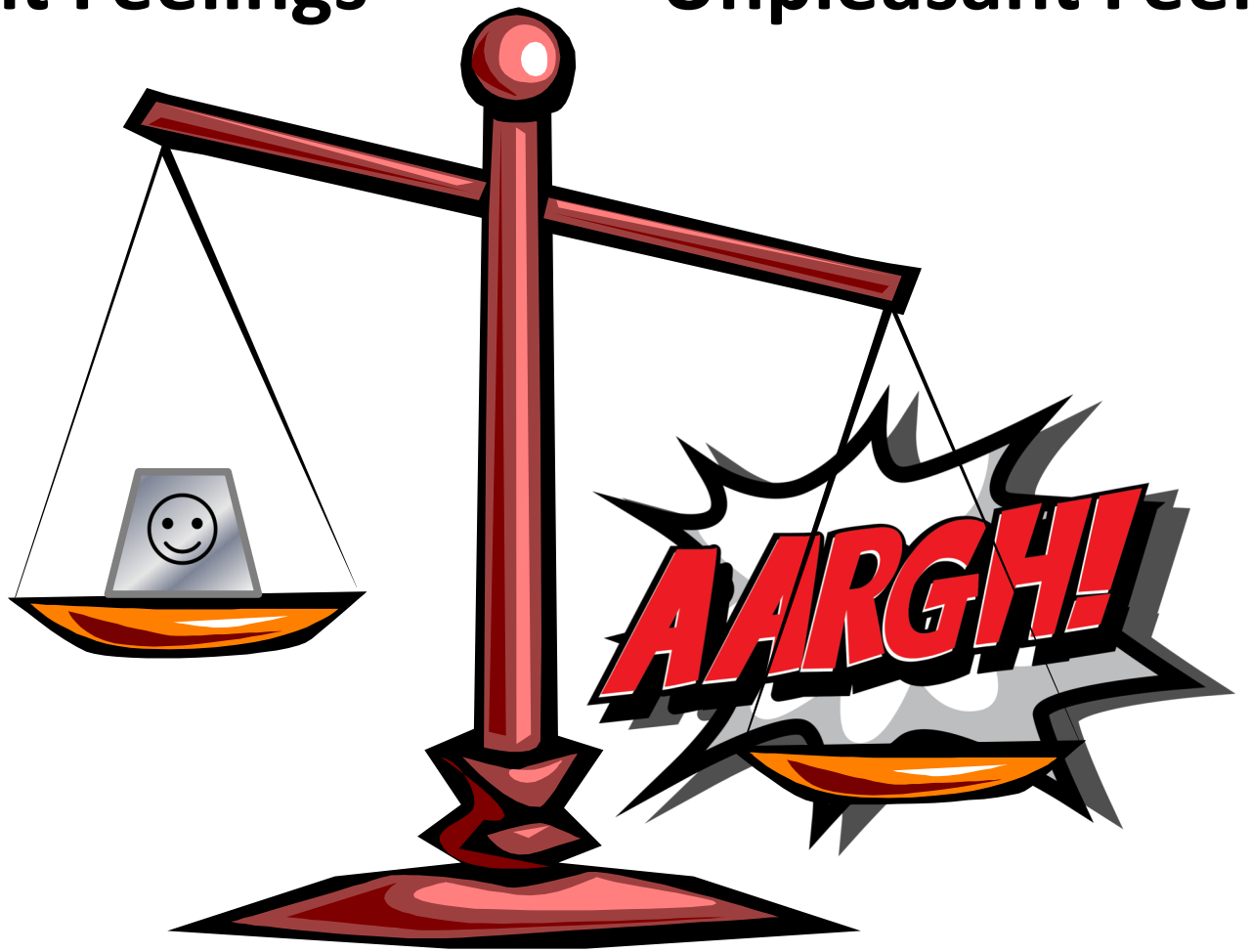
- Presence of unpleasant feelings or emotional states (e.g. pain, nausea, fear, distress, frustration, suffering, and so on).
- Absence of pleasant feelings or emotional states.

The Scales (or Feelings) Model of Welfare

Welfare is represented by the balance of pleasant and unpleasant feelings at any given time.

Poor Welfare

Pleasant Feelings **Unpleasant Feelings**



What is "Welfare"?

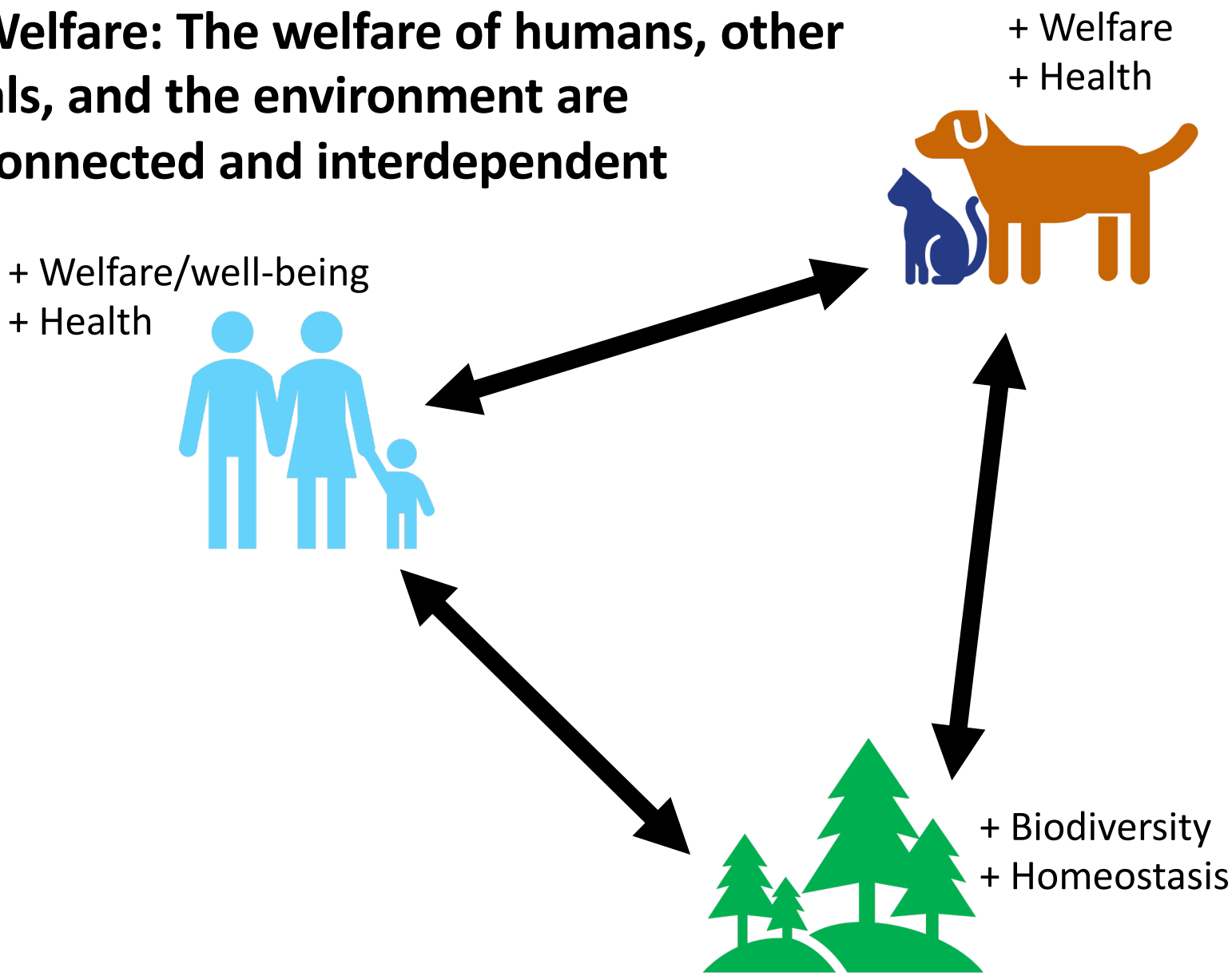
(OED definition of 'welfare' = *The state of faring or doing well*)

Poor welfare usually defined in terms of:

- Presence of unpleasant feelings or emotional states (e.g. pain, nausea, fear, distress, frustration, suffering, and so on).
- Absence of pleasant feelings or emotional states.
- Inability to pursue own interests or express normal/typical behavior.
- Failure to cope with, or adapt to, environmental insults/demands/stressors (stress)—loss of homeostasis.

Welfare is approximately synonymous with well-being and/or quality of life.

One Welfare: The welfare of humans, other animals, and the environment are interconnected and interdependent



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Review

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Sustainable, efficient livestock production with high biodiversity and good welfare for animals

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What is the future for livestock agriculture in the world? Consumers have concerns about sustainability but many widely used livestock production methods do not satisfy consumers' requirements for a sustainable system. However, production can be sustainable, occurring in environments that: supply the needs of the animals resulting in good welfare, allow coexistence with a wide diversity of organisms native to the area, minimize carbon footprint and provide a fair lifestyle for the people working there. Conservation need not just involve tiny islands of natural vegetation in a barren world of agriculture, as there can be great increases in biodiversity in farmed areas. Herbivores, especially ruminants that consume materials inedible by humans, are important for human food in the future. However, their diet should not be just ground-level plants. Silvopastoral systems, pastures with shrubs and trees as well as herbage, are described which are normally more productive than pasture alone. When compared with widely used livestock

Benefits of the "silvopastoral" system compared with traditional pasture grazing:

Animal welfare

- Fewer ticks
- Less overheating
- Less starvation
- Reduced fear

Human welfare

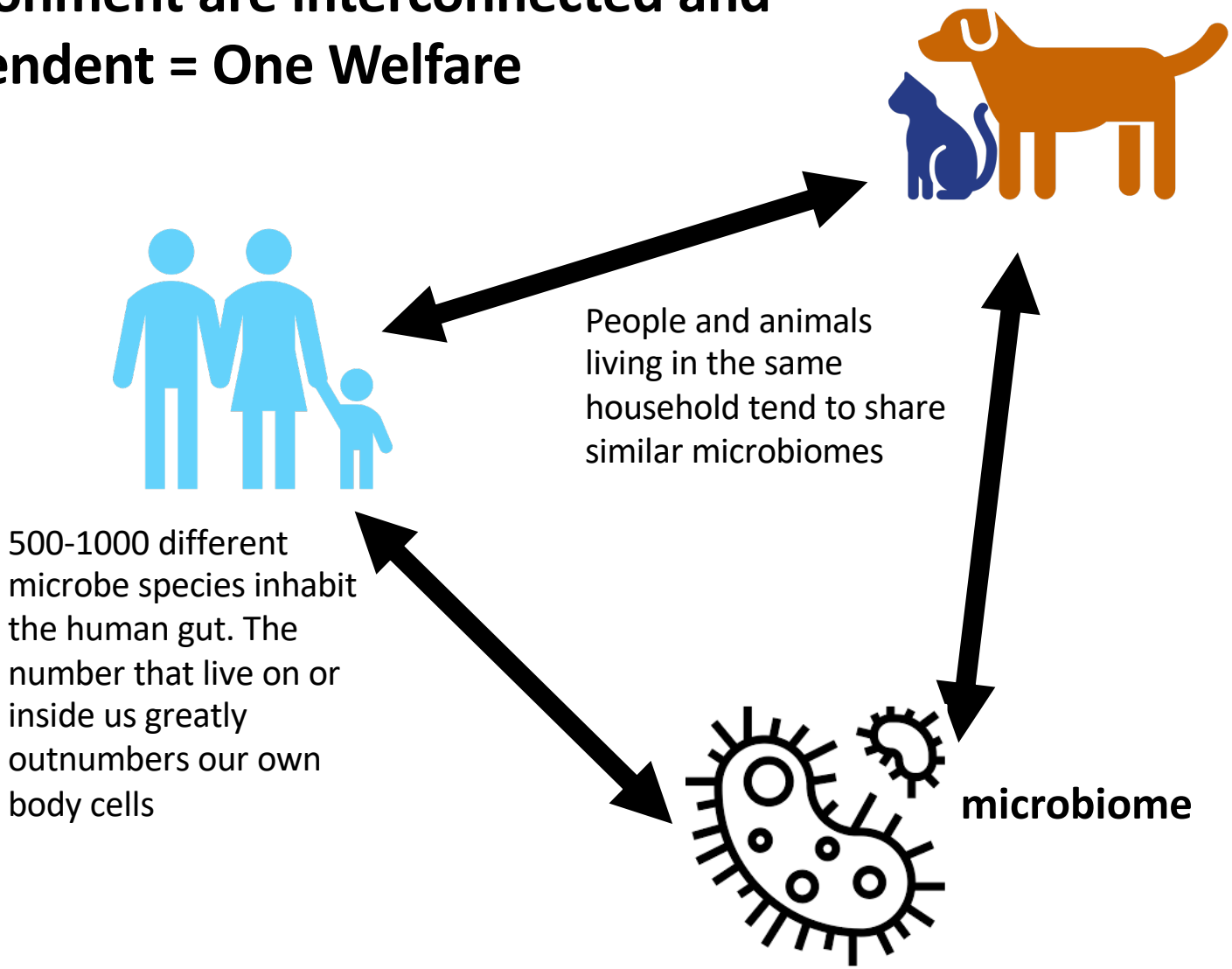
- Reduced costs
- Higher meat production
- Improved job satisfaction

Figure 1. Cattle browsing *Leucaena* in a silvopastoral system, Caribe, Colombia. (Photograph Walter Galindo, CIPAV).

Environmental benefits

- 3 x bird and insect biodiversity
- Half as much methane/tonne of meat produced
- Less land required/tonne of meat.

The welfare of humans, other animals, and the environment are interconnected and interdependent = One Welfare



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RESEARCH ARTICLE

Cohabiting family members share microbiota with one another and with their dogs

Se Jin Song[1], Christian Lauber[2], Elizabeth K Costello[3], Catherine A Lozupone[4†b], Gregory Humphrey[2], Donna Berg-Lyons[2], J Gregory Caporaso[5,6], Dan Knights[7,8], Jose C Clemente[4†a], Sara Nakielny[9], Jeffrey I Gordon[10], Noah Fierer[1,2], Rob Knight[11,12]*

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ARTICLES
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The neuroactive potential of the human gut microbiota in quality of life and depression

Mireia Valles-Colomer[1,2], Gwen Falony[1,2], Youssef Darzi[1,2], Ettje F. Tigchelaar[3], Jun Wang[1,2], Raul Y. Tito[1,2,4], Carmen Schiweck[5], Alexander Kurilshikov[3], Marie Joossens[1,2], Cisca Wijmenga[3,6], Stephan Claes[5,7], Lukas Van Oudenhove[7,8], Alexandra Zhernakova[3], Sara Vieira-Silva[1,2,9] and Jeroen Raes[1,2,9]*

tabolism and mental health is one of the most intriguing and controversial top-
icrobiota–gut–brain communication has mostly been explored in animal models,
-scale metagenomics studies could facilitate the translational process, but their
icated reference databases and tools to study the microbial neuroactive potential.
ohort (Flemish Gut Flora Project, $n=1{,}054$) with validation in independent data
ome features correlate with host quality of life and depression. Butyrate-producing
were consistently associated with higher quality of life indicators. Together with
ed in depression, even after correcting for the confounding effects of antidepres-
amework, we assembled a catalogue of neuroactive potential of sequenced gut
faecal metagenomes identified the microbial synthesis potential of the dopamine
as correlating positively with mental quality of life and indicated a potential role of
depression. Our results provide population-scale evidence for microbiome links to
er importance.

BIOMEDICINE

Gut bacteria linked to mental well-being and depression

Microbial biochemistry may affect nerve cell function

By **Elizabeth Pennisi**

Of all the many ways the teeming ecosystem of microbes in a person's gut and other tissues might affect health, its potential influences on the brain may be the most provocative. Now, a study of two large groups of Europeans has identified several species of gut bacteria that are largely missing in people with depression. The researchers can't say whether the absence is a cause or an effect of the illness, but they showed that many gut bacteria could make or break down substances that affect nerve cell function—and maybe mood.

"It's the first real stab at tracking how" microbial metabolism might affect psychological function, says John Cryan, a neuroscientist at University College Cork in Ireland, a vocal proponent of a microbiome-brain connection. The study "really pushes the field from where it's been" with small studies of depressed people or animal experiments. And it is likely to encourage nascent efforts to treat depression by al-

the same two species were missing in depressed people, and they were also missing in seven subjects suffering from severe clinical depression. The data don't prove causality, Raes says, but they are "an independent observation backed by three groups of people."

Looking for something that could link microbes to mood, Raes and his colleagues compiled a list of 56 substances important for proper nervous system function that gut microbes either produce or break down. They found that *Coprococcus* seems to make a metabolite of dopamine, a brain signal involved in depression, although it's not clear whether the bacteria break down the neurotransmitter or whether the metabolite has its own function. The same microbe makes an anti-inflammatory substance called butyrate; increased inflammation may play a role in depression. (Depressed subjects also had an increase in bacteria implicated in Crohn disease, an inflammatory disorder.)

It's "a massive signal to the clinical community ..."

Linking the bacteria to depression "makes sense physiologically," says Sara Campbell, a physiologist at Rutgers University in New Brunswick, New Jersey. Still, no one has shown that

ication lines tightly
ost central nervous
has been suggested
aying an active role
hysiology, psychol-
ited to modulation
s[2], but also encom-
lood–brain barrier
tion of neuroactive
in communication

alterations. Unfortunately, translation of model-based preclinical findings to the complex human phenotype has been shown to be far from straightforward[13]. With only a limited number of exceptions[8,14], sequencing-based analyses of microbiota alterations in neurological pathologies have focused on taxonomic composition. Functional interpretation of metagenomes in a microbiota–gut–brain context remains challenging and is hampered by the lack of a dedicated reference database of gut microbial neuroactive metabolic potential.

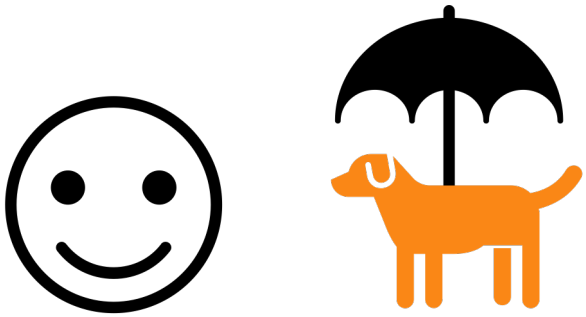
In this study, we first assess gut microbiota compositional

So What Do We Gain by Applying the One Welfare Approach to Animal-assisted Interventions?

The Instrumental Approach to Animal-Assisted Interventions

"Nothing else dogs do compares to the kinds of intrinsically stressful social interactions that take place when they visit clinical, educational, or post-trauma situations..... Most dogs have been bred for generations to distinguish between outsiders and the family, and to act accordingly. There has never been a breed of dog designed to enjoy encroachment from strangers. Dogs who actually enjoy interactions in clinical and educational settings are very rare" (Butler, 2004: 31).

Ethical Approach to Animal-Assisted Interventions



"It would be unethical to initiate an AAI with a goal of improving a patient's welfare through a program that compromises the well-being of the animal or other individuals. In designing effective AAI's, facilities and handlers must ensure that adequate provisions and protocols are in place to continually monitor and safeguard the health and well-being of all patients, staff, handlers, visitors and animals involved" (IAHAIO, 2019).

Is the message getting through?

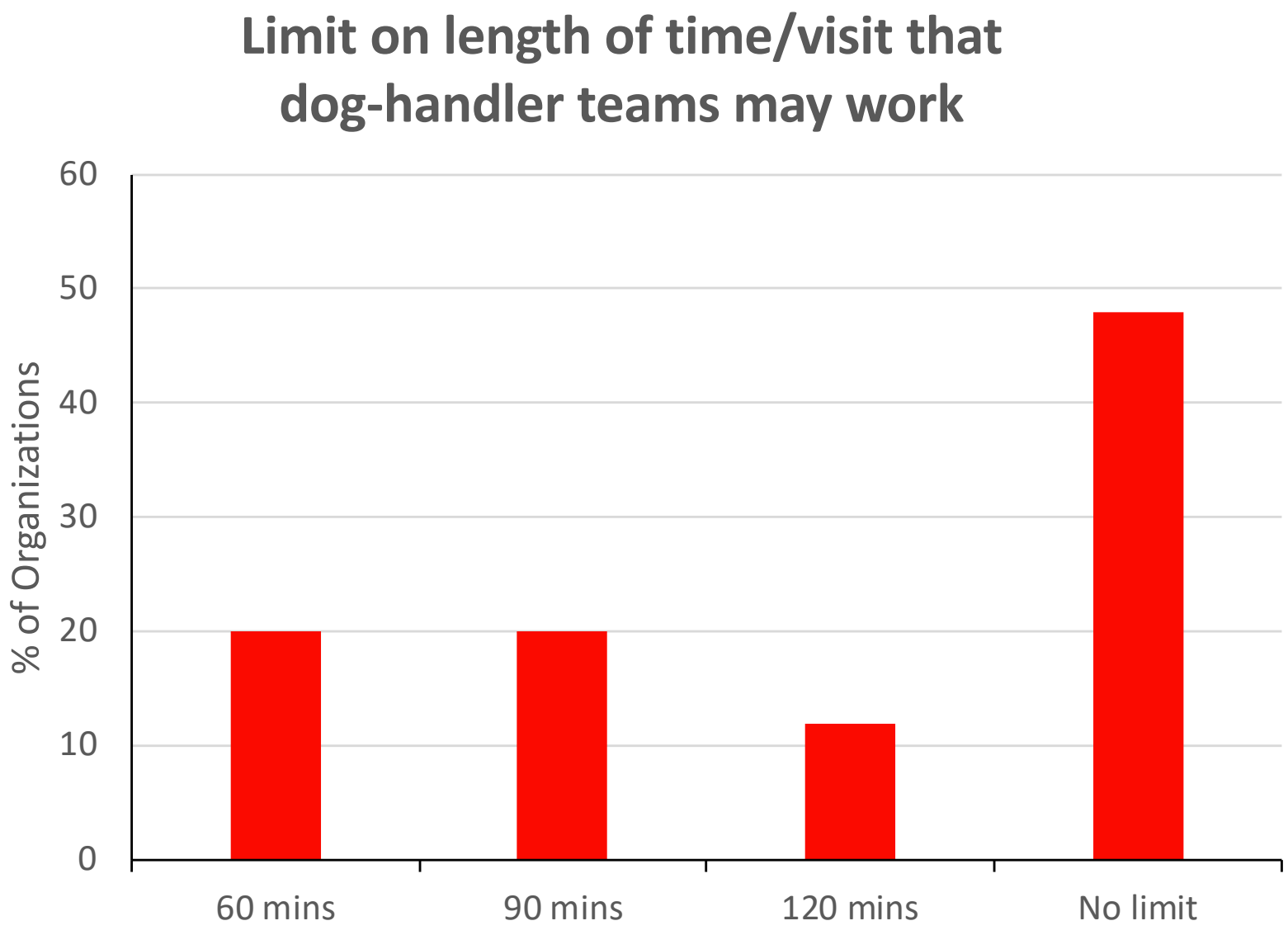
According to a recent survey of US therapy dog organizations

25% of organizations have no formal written policies on acceptable/ unacceptable training methods.

Of those that do, 30% allow handlers to use choke, prong, e-collars, etc.

And only 50% require that handlers use only reward-based/ positive reinforcement training methods.

Serpell & Kruger, *in prep.*



Inconsistent with One Welfare

One Welfare Approach to AAIs

"[Dogs should] *welcome*, not just tolerate, interactions with strangers" (Pet Partners, 2019).

"AAI should only be performed with the assistance of animals that are in good health, both physically and emotionally and that *enjoy this type of activity"* (IAHAIO, 2019)

What evidence do we have that the animal's attitude or behavior makes a difference to its therapeutic impact?

Pet owners who reported high behavioral 'compatibility' between themselves and their pets experienced:

- Better overall mental health ($P < 0.05$)
- Enhanced feelings of well-being ($P < 0.05$)
- Less distress ($P < 0.05$)
- More positive affect ($P = 0.055$)
- Less anxiety ($P < 0.01$)
- Fewer physical symptoms of ill-health ($P < 0.05$)

Independent of other factors, such as human social support

(Source: Budge, R.C. et al. 1998. *Society & Animals*, 6(3), 219-234)

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Dog's gaze at its owner increases owner's urinary oxytocin during social interaction

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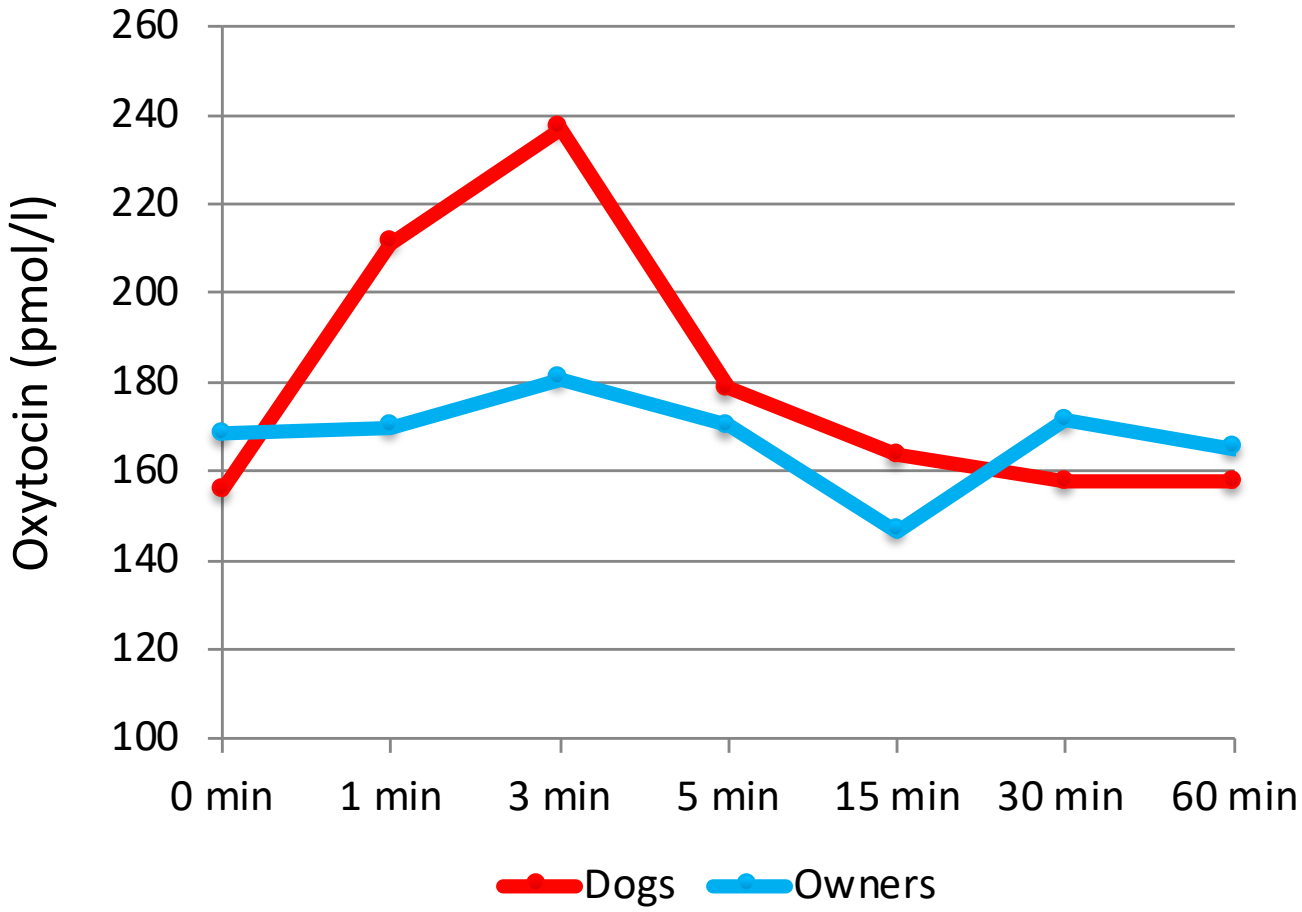
ABSTRACT

Oxytocin (OT) has been shown to play an important role in social bonding in animals. However, it is unclear whether OT is related to inter-species social bonding. In this study, to examine the possibility that urinary OT concentrations of owners were increased by their "dog's gaze", perhaps representing social attachment to their owners, we measured urinary OT concentrations of owners before and after interaction with their dogs. Dog owners interacted with their dogs as usual for 30 min (interaction experiment) or were instructed not to look at their dogs directly (control experiment). We observed the behaviors of owners and their dogs during the experiments, and measured OT concentrations by radioimmunoassay in urine samples from the owners collected just before and 20 min after interaction with their dogs. Using a cluster analysis, owners could be divided into two groups: one received a longer duration of gaze from their dogs and reported a higher degree of relationship with their dogs (LG); the other received a shorter duration of gaze and reported a lower degree of relationship (SG). Urinary OT was higher in LG than SG after usual interaction with their dogs, but not in the control experiment. In the interaction experiment, a high correlation was found in LG between the frequency of behavioral exchanges initiated by the dog's gaze and the increase in urinary OT. We conclude that interactions with dogs, especially those initiated by the dog's gaze, can increase the urinary OT concentrations of their owners as a manifestation of attachment behavior.

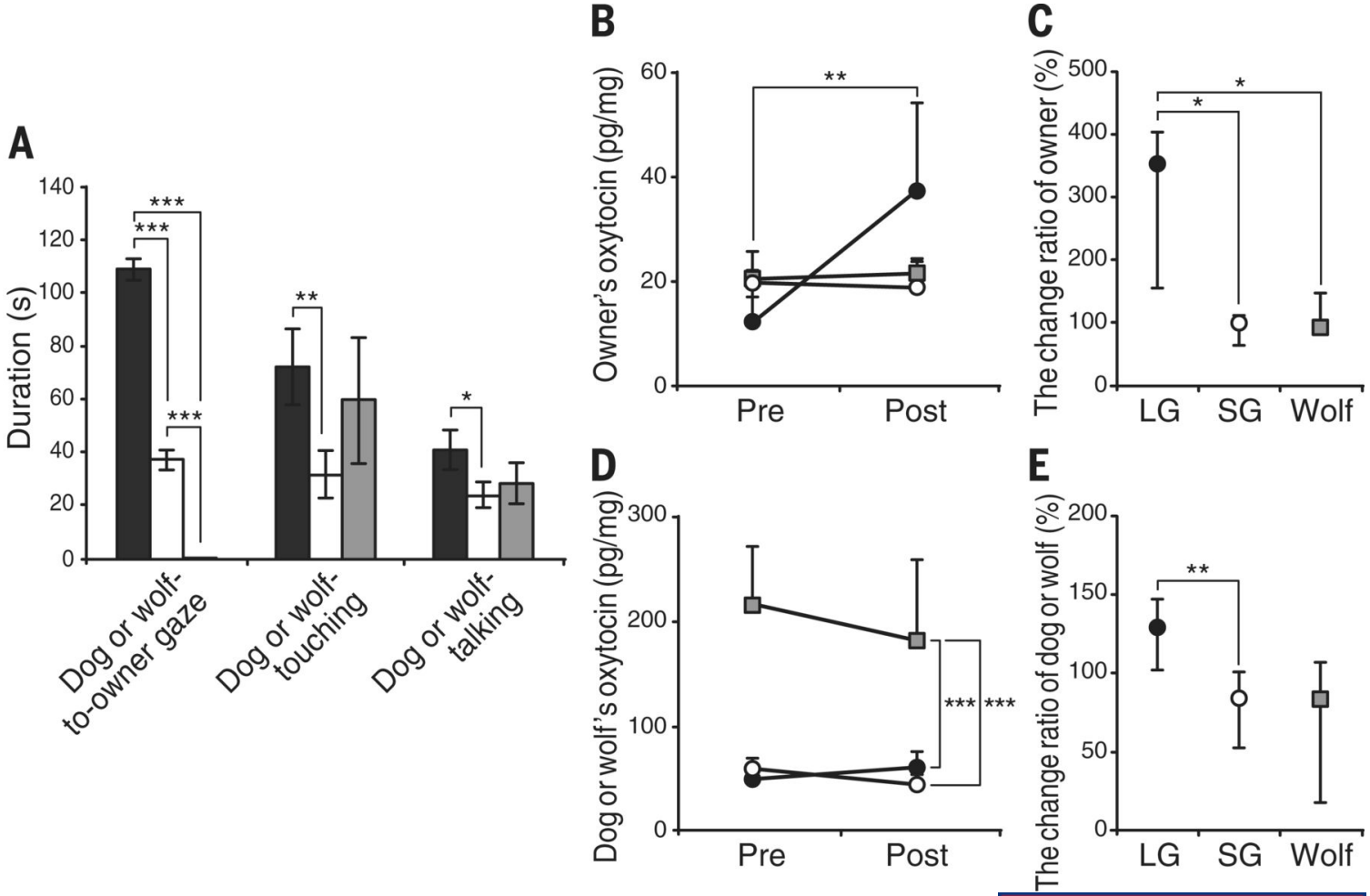
Owner's and dog's oxytocin levels associated with the perceived quality of the relationship (Handlin et al., 2012)

All owners completed the Monash Dog-Owner Relationship Scale (MDORS):



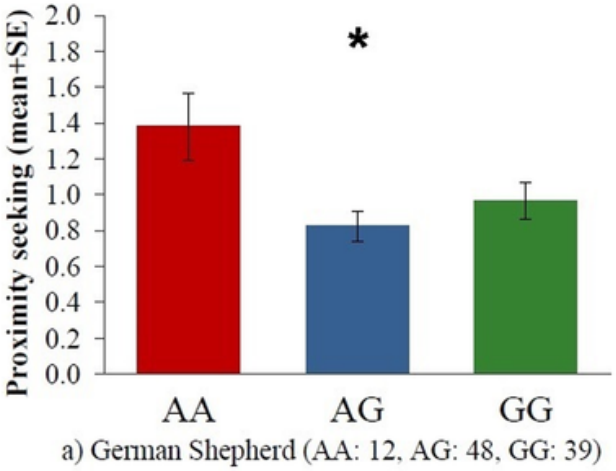
- Both owner's and dog's oxytocin levels positively correlated with how often owners reported kissing their dogs.
- Owners' perceptions of the costs of dog ownership were negatively associated with dog's oxytocin levels.
- Both dog's and owner's oxytocin levels were positively correlated.

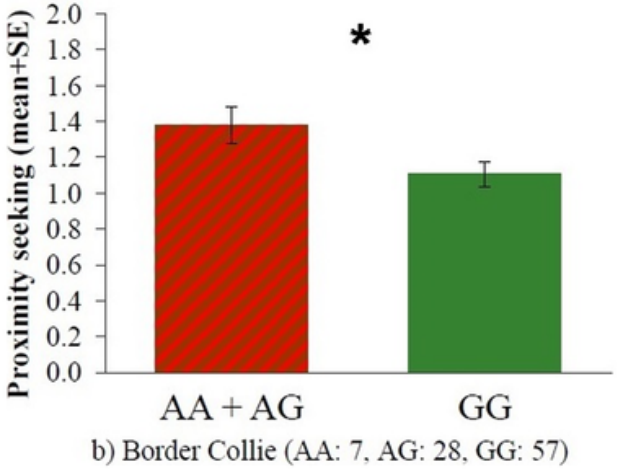
Fig. 1 Comparisons of behavior and urinary oxytocin change among long gaze dogs (LG, n = 21, black bars and circles), short gaze dogs (SG, n = 9, white bars and circles), and pet wolves (wolf, n = 11, gray bars and square).



Nagasawa *et al. Science,* 2015;348:333-336

Figure 2. Proximity seeking scores mean differences between the different −212AG genotypes in German Shepherds (a) and Border Collies (b). Sample sizes for each genotype group are provided in parenthesis.



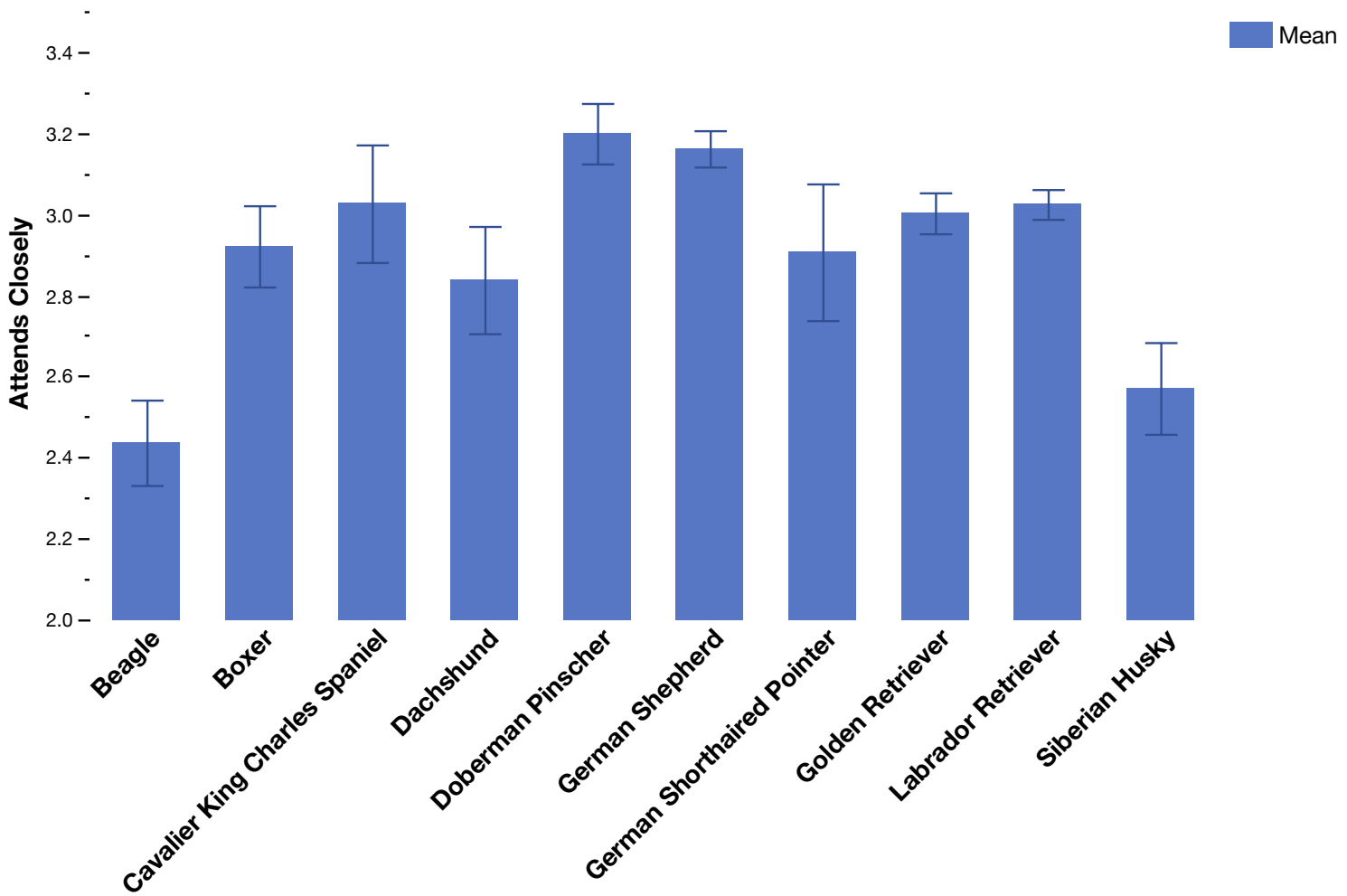


Kis A, Bence M, Lakatos G, Pergel E, Turcsán B, et al. (2014) Oxytocin Receptor Gene Polymorphisms Are Associated with Human Directed Social Behavior in Dogs (Canis familiaris). PLOS ONE 9(1): e83993. https://doi.org/10.1371/journal.pone.0083993
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0083993

Not All Therapy Animals Are Equal

Breed Differences in Key Behaviors

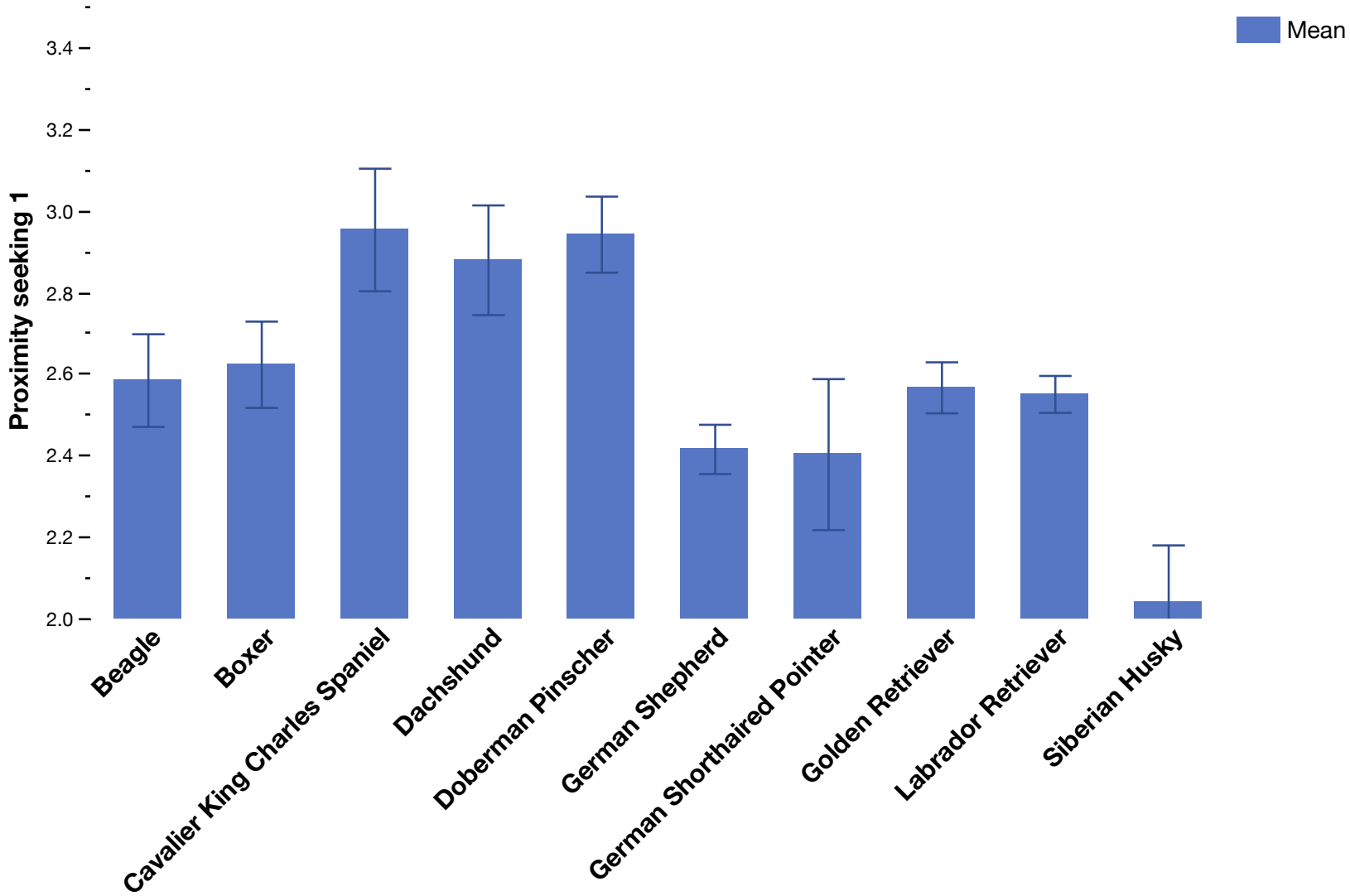
"Attends/listens closely to everything you say or do"
(data from the C-BARQ database)



Breed Differences in Key Behaviors

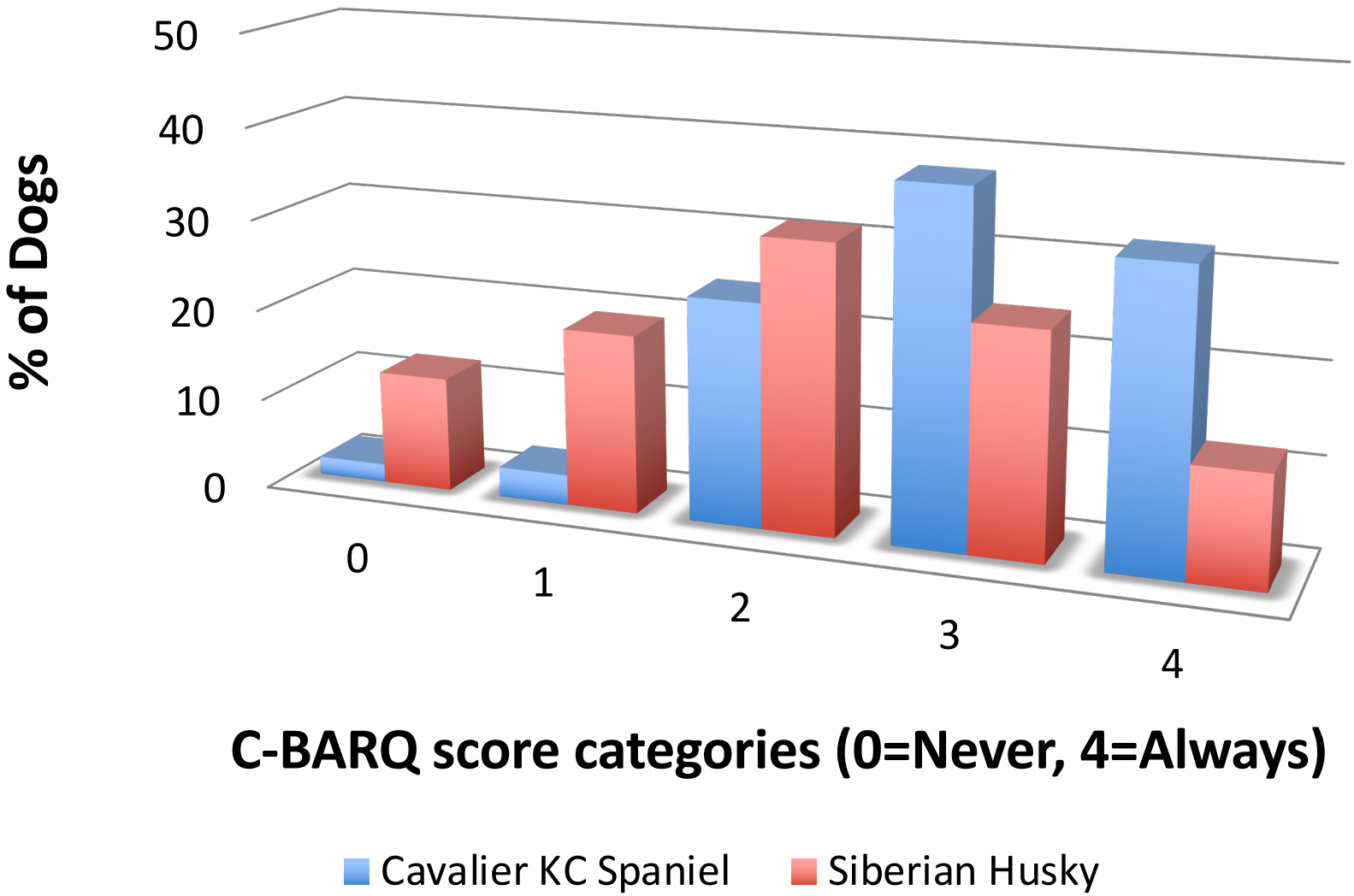
"Tends to sit close to, or in contact with, you...."

(data from the C-BARQ database)

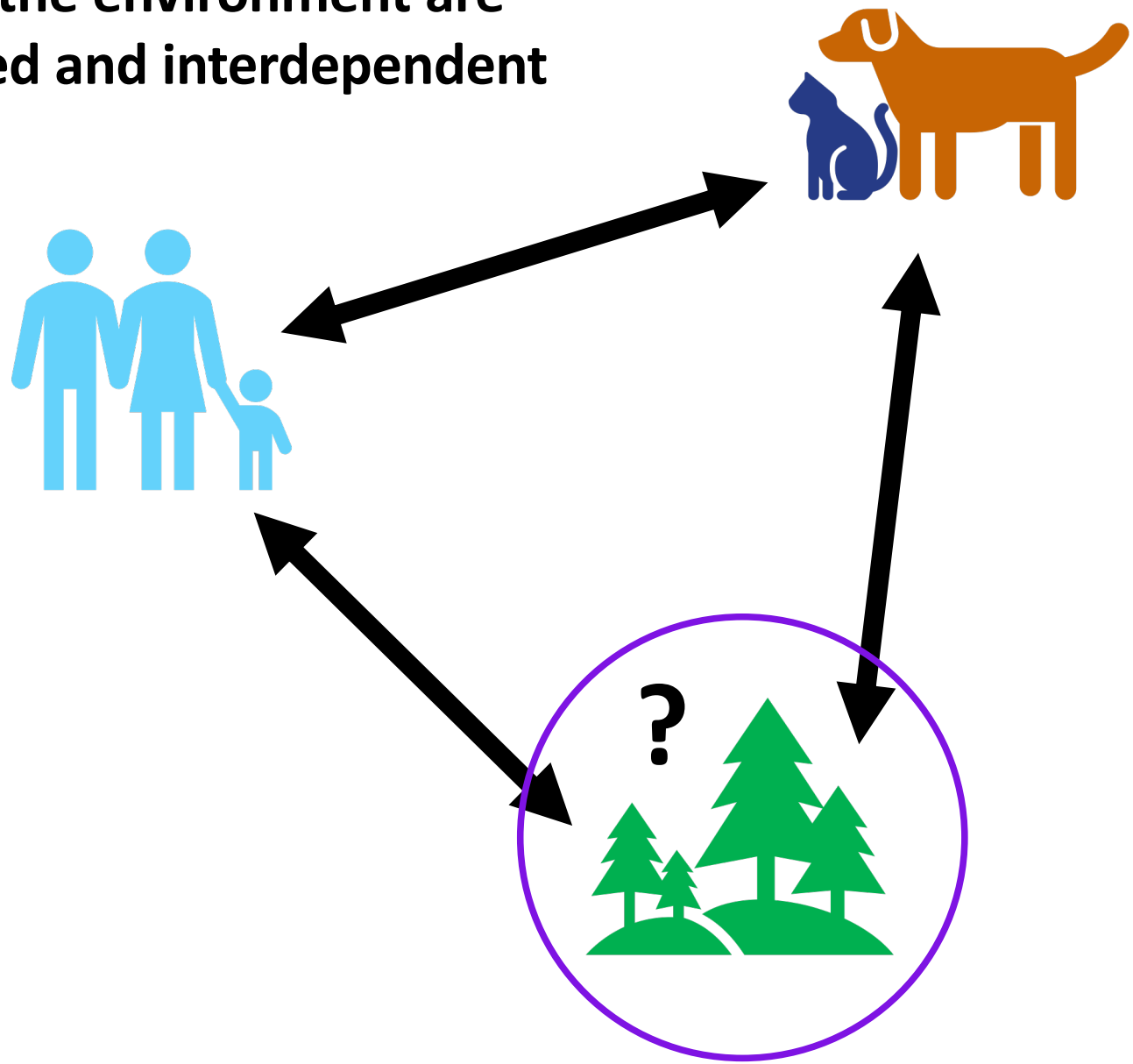


Individual Differences in Key Behaviors

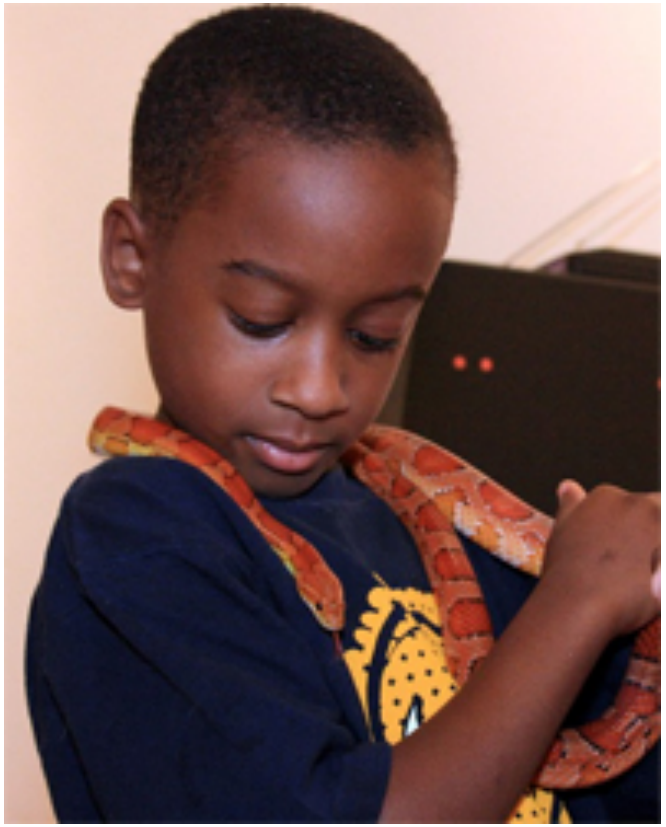
"Tends to sit close to, or in contact with, you...."



One Welfare: The welfare of humans, other animals, and the environment are interconnected and interdependent



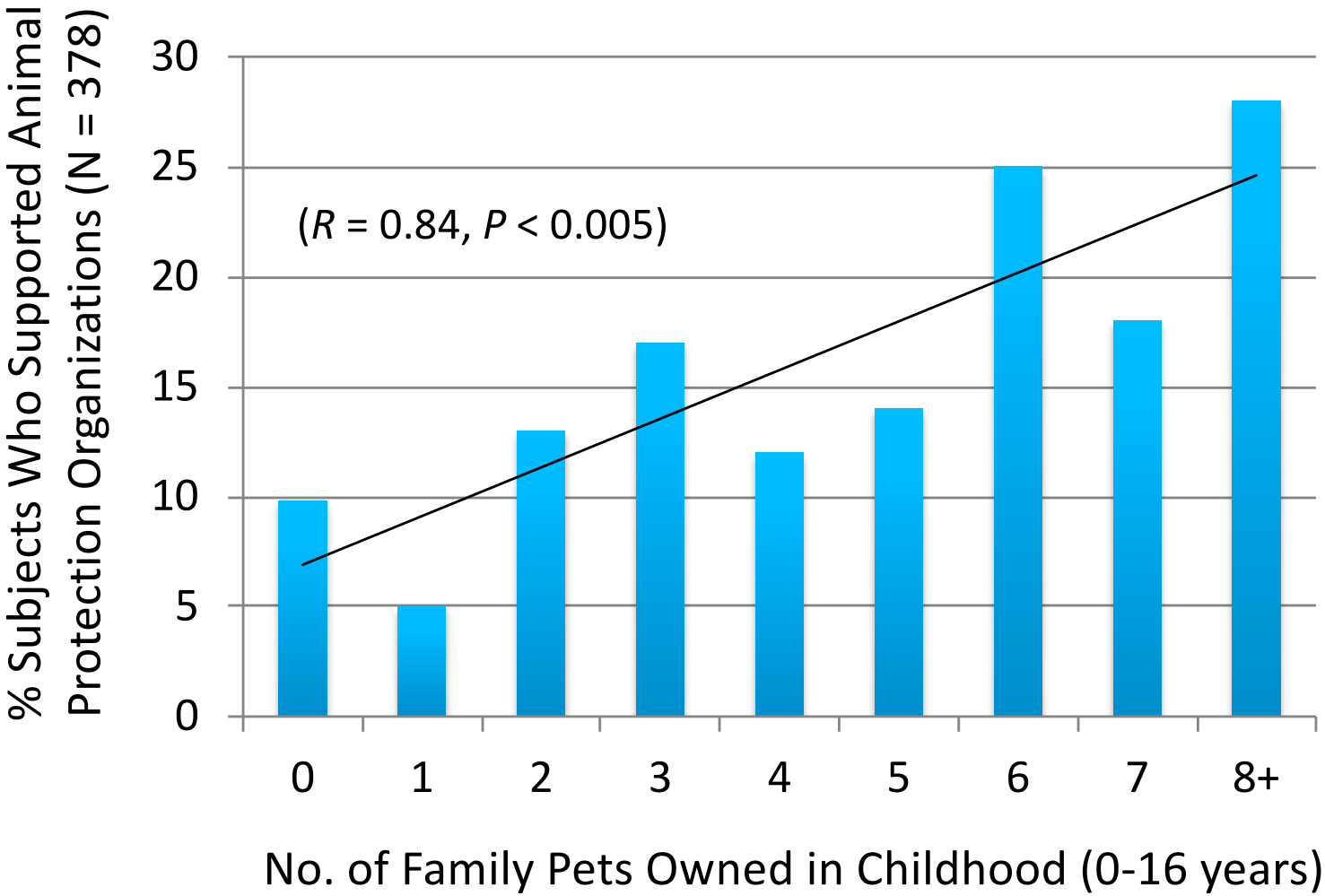
Childhood Attachment to Pets Inspires Empathy for Animals in General



- The individuals with whom we develop social relationships and attachments, particularly in childhood, define both who we identify with and *who we care about*.
- Social exposure to animals expands the circle of 'care' to include animals.[1]
- Ultimately, caring for animals means also caring about the things that matter to animals; hence caring for the animal's habitat, environment, and so on.

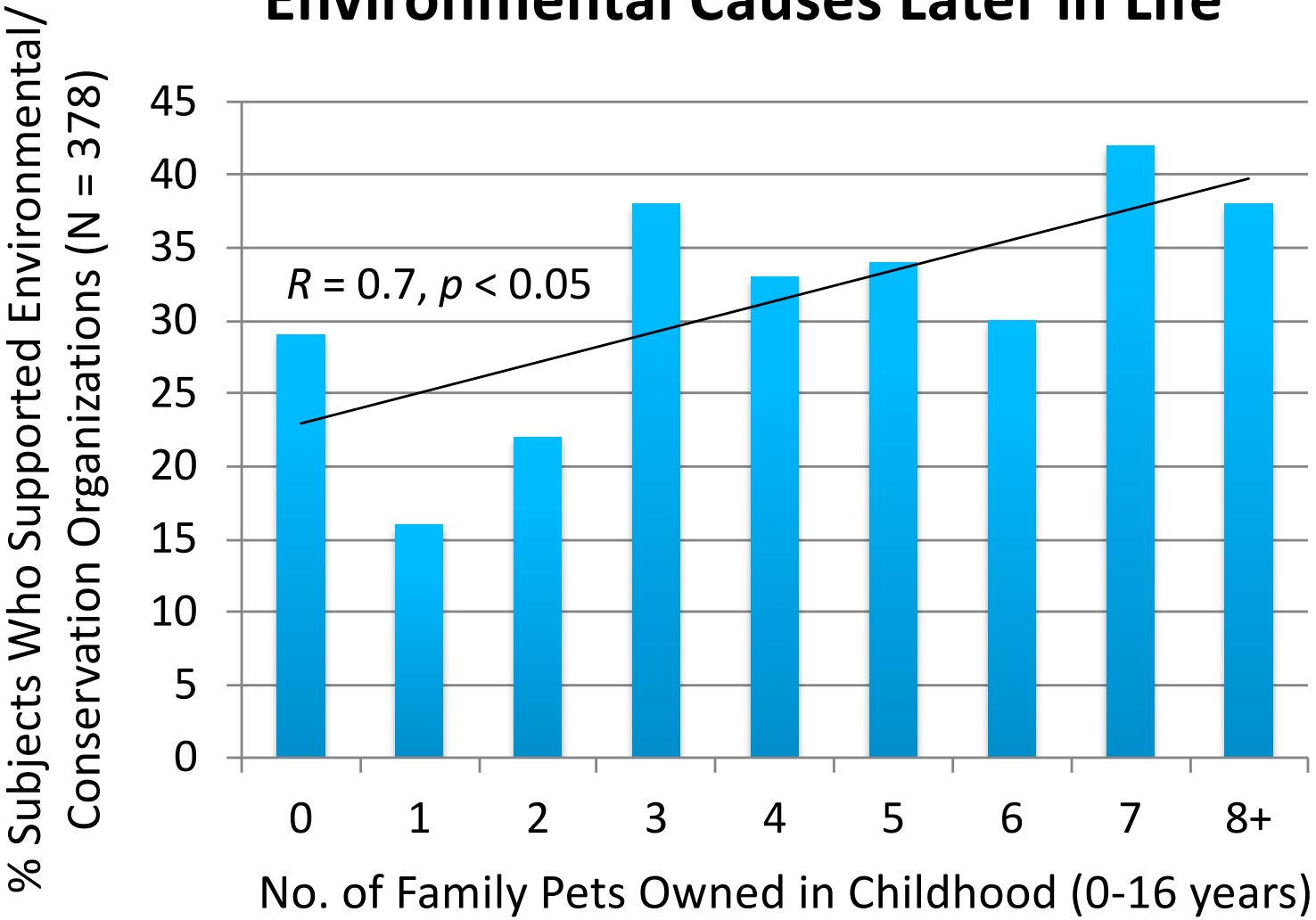
[1] Myers, O.E. 1998. *Children and Animals*. Westview

Childhood Pet Keeping Predicts Support for Animal Protection Later in Life

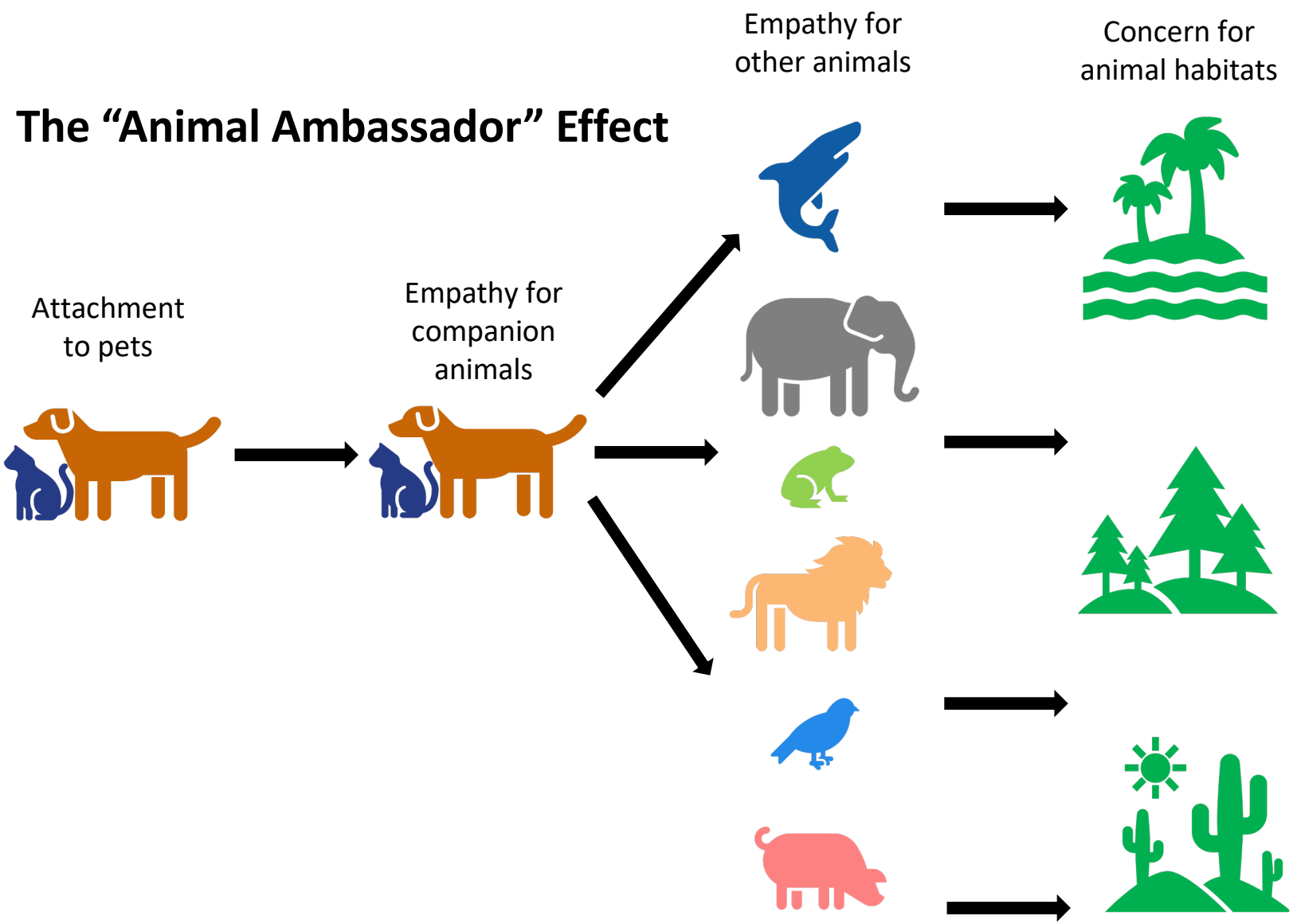


From: Paul, E.S. & Serpell, J.A. 1993. *Animal Welfare*, 2(4).

Childhood Pet Keeping Predicts Support for Environmental Causes Later in Life



The “Animal Ambassador” Effect



Conclusions

- The concept of “One Welfare” provides a useful framework for addressing human problems in ways that simultaneously minimize the harms, and maximize the benefits, to other animals and the environment.
- In the context of AAIs, this means not only protecting the welfare of therapy animals, but also selecting the ones that derive pleasure (i.e. positive welfare) from this type of activity. This, in turn, should maximize their therapeutic impact on AAI recipients.
- While direct benefits to the environment from AAIs cannot be expected, indirect benefits may result from encouraging heightened empathy for animals and nature.
- In light of current existential threats to the natural world, all AAI organizations and groups should consider incorporating this as part of their mission.
- One Welfare requires an interdisciplinary approach to AAIs involving experts from multiple fields.