Roots of self-preservation failure in animal behavior
Commentary on **Peña-Guzmán** on *Animal Suicide*

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Abstract: Affective variation from euphoria to dysphoria, best understood in humans, is also found in the behavior and neurochemistry of many other mammals. Suicide in humans typically occurs in highly dysphoric and despondent individuals. Self-injurious behavior has been observed in dysphoric and despondent nonhuman primates. In humans, suicide is facilitated by a highly-evolved neocortex giving rise to behavioral flexibility and culture. As Peña-Guzmán indicates, some other mammals also have elaborate neocortices and the capacity for cognitive insight, particularly apes, delphinids, and whales. Suicide is most likely to occur in species where individuals live in stable groups of highly interdependent kin.

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I commend Peña-Guzmán (2017) for a thoughtful, well-researched, and stimulating target article. As he indicates, the artificial dichotomy between human sentience and the absence of such a capacity in nonhuman animals is a vestige of prescientific philosophy. The capacities for self-reflection, deliberation, and voluntary behavior are better viewed as continua, with much variation across taxa in relation to neurological and behavioral complexity. As outlined in my own work (deCatanzaro 1980, 1981), greater capacity for learning and initiation of behavior by the neocortex can facilitate departures from self-preservation. However, the emotional concomitants that so often accompany suicide, that is, extreme dysphoria and despondency, clearly have deep roots in animal behavior and are not uniquely human (deCatanzaro 1999).

Human suicide is much more conspicuous than instances of self-destructive behavior in nonhumans would be, because it happens in our families and communities and is often accompanied by verbal statements of intent to die. When despondent nonhumans cease to eat, drink, or shelter themselves from adverse conditions, we are much less likely to observe the event, and even if we did, our preconceptions might keep us from calling it suicide. In many group-living polygynous mammals, the ratio of males to females is roughly equal for juveniles, but among adults there are many more females than males, as dominant males exclude others from

the group. What happens to the other adult males? Some no doubt survive, and deaths may be attributable to various causes, but self-preservation failures could be among these causes.

Deep in archival work on captive primates, there are observations (Frieh 1942; Yerkes 1925) and experimental demonstrations (e.g., Gluck and Sackett 1974; Harlow and Griffin 1965; Mason and Sponholz 1963) of extreme self-injurious behavior in stressful circumstances, including persistent head-banging, self-scratching, and self-biting. The experimental work shows that rearing in complete or partial social isolation can bring on such behavior. Similar behavior has been observed in human children who were given up by their families and placed in institutions due to conditions such as mental retardation (deCatanzaro 1981). Also, raising dogs in social isolation after weaning can cause poor avoidance of electric shock and fire (Melzack and Scott 1957). There is at least one direct observation of self-starvation in a juvenile chimpanzee following the death of its mother (Goodall 1979). Harlow (1974) described conditions similar to human depression and despondency in social primates following major losses. This involves a progression from initial protest, to motor retardation and apathy, to despair, very similar to the progression known as "anaclitic depression" in human infants who have lost their mothers (Bowlby 1973; Spitz 1946).

It may be no coincidence that social isolation and a sense of rejection, burdensomeness, and shame are among the most common antecedents of human suicide (deCatanzaro 1981, 1995). Taking a broad look at the social ecology of suicide, one finds correlations with less successful heterosexual relations, fewer dependent children, greater isolation from family and community, greater age, more infirmity, and a perception that future prospects will not improve (deCatanzaro 1981, 1984, 1991, 1995). It is clear that self-preservation is deeply engrained in many reflexes and innate motivational processes such as hunger, thirst, pain, fear, temperature regulation, and shelter seeking (deCatanzaro 1999). However, in theory, the evolution of self-preservation is not necessarily unconditional; departures from self-preservation can be adaptive if triggered by conditions where individuals encounter a conjunction of poor reproductive prospects and burdensomeness towards kin (deCatanzaro 1991). That conjunction is seen loosely in many suicides, but certainly not all; exceptions are inevitable as a result of psychopathology, modern technologies such as guns and drugs that allow impulsive lethal actions, and some people's capacity to respond to imagined incentives (e.g., rejoining loved ones or other rewards in an afterlife).

On a biochemical level, a wealth of evidence shows that the natural dynamics of monoamine neurotransmitters (i.e., dopamine, norepinephrine, and serotonin) are highly conserved among mammals and play critical roles in affective variation. Various drugs that manipulate these systems can induce artificial elation or depression; there are other natural neurohormones (e.g., anandamides, endorphins, and enkephalins) that modulate affect. Generally, euphoria is associated with behavioral activation, and dysphoria with behavioral suppression (deCatanzaro 1999). Ancient chemical triggers of severe negative affect are accordingly innate and heritable, but they are expressed naturally only during certain forms of severe stress. Extreme dysphoria and despondency, arguably the most common antecedents of self-preservation failure, can occur in many mammals, and depression-induced motor retardation might hasten death simply by inhibiting adaptive behavior.

On a cognitive level, overt acts of suicide can be facilitated by a complex neocortex that permits voluntary behavior, which can override simple reflexes and hypothalamic-limbic

processes that promote self-preservation. For example, many people can force themselves to overcome fear and jump from great heights, due to cognitive reassurance by a parachute or bungee cord. Social learning and the capacity to learn through incentives rather than contingent rewards and punishment can also facilitate suicide. These capacities for neocortical control and incentive learning are certainly better developed in humans than in most other mammals, but Peña-Guzmán has effectively made the case that they are shared by many other species in varying degrees.

Peña-Guzmán is right to suggest that laboratory rodents are unlikely to provide a good animal model of suicide. Species such as mice behave in rigid, fixed action patterns; they have relatively little neocortex, simple social structure, and short life spans. Male mice can be experimentally induced to persist in aggressive encounters to the point of death when in competition for females (deCatanzaro et al. 2000), but that involves competition for tangible reproductive rewards while constrained in artificial laboratory enclosures. For behavior that would meet the definitions applied to human suicide more closely, it would be much better to look at social primates, delphinids, and whales that live in durable groups of interdependent and genetically related individuals. In such cases, an individual's productivity or burdensomeness toward the group will affect the survival and reproduction of kin. Moreover, many of these species have complex neocortices which may allow insight into self and others, anticipation of consequences of complex actions, future planning, and flexible voluntary behavior. Of course, questions about the frequency and forms of suicide among nonhuman animals are empirical, and can only be properly addressed through research that by its nature will be extremely challenging.

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