

Essay
Gaia, Suicide and Suicide Prevention

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Abstract: The Gaia Hypothesis, in which the Earth is viewed as a self-regulating system, is explored for its implications for suicidology. Seven questions are raised by applying the Gaia Hypothesis to suicidal behavior: (1) Is suicide ever a rational act? (2) How common is burdensomeness as a motive for suicide? (3) Can suicide be an instinctive behavior? (4) Does suicide benefit the society? (5) Is suicide found in animals other than humans? (6) Why have we failed to have a major impact on the suicide rate despite all of our efforts and will we ever have an impact? (7) Is there a natural suicide rate?

Keywords: Gaia hypothesis; suicide; rationality; burdensomeness; instinct; animal suicide; preventing suicide; natural suicide rate

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The present paper explores whether the Gaia Hypothesis has any implications for suicidology. It may be that some of the implications offend readers, and the present author does not endorse all of the implications or, indeed, agree with all of the theories presented.

Lovelock (1995, 2000) proposed that the Earth was a cybernetic system with homeostatic tendencies as detected by chemical anomalies in the Earth's atmosphere, which he replaced with the term Gaia, suggested by William Golding (Margulis, 1998, p. 118). The Earth may be regarded as a superorganism (which is not the same as a single organism) that controls and maintains its environment – its temperature, acidity/alkinity and gas composition. Gaia is “emergent property of interaction among organisms, the spherical planet on which they reside, and an energy source, the sun” (Margulis, 1998, p. 119).

Margulis gave as an example the symbiosis between bacteria and mammals. Bacteria remove hydrogen from the air (both from the hydrogen gas itself, from hydrogen sulfide expelled by volcanoes,

and from water), and they expel oxygen which mammals need to breathe. In an early computer model, Watson and Lovelock (1983) showed how the sun and plant species could achieve a stable surface temperature. In Daisyworld, the name of their computer model, they postulated two species of daisies, black daisies that grow best when it is cold and white daisies that grow best when it is hot. As the sun falls on a cool earth surface, the black daisies grow faster and, being black, absorb the heat. This warms the surface, resulting in lower rates of growth for the black daisies and a faster rate of growth for the white daisies. As the white daisies increase in proportion, they reflect back the sun's rays, thereby cooling the earth's surface, leading to the black daisies benefiting. The result is an equilibrium, oscillating in a limited temperature range.

It is interesting to note that Ward (2009) proposed a counter-hypothesis, which he called the Medea Hypothesis, after the mythological Greek goddess who killed her own children. Ward claimed that the Earth is a doomsday system experiencing cataclysm after cataclysm and that it can be saved only by human intervention. Ward pointed to earth-generated mass extinctions, such as the period of freezing which has been proposed as occurring roughly 650 million years ago, as evidence of the

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suicidal nature of the Earth's system.¹ It is interesting to note that this hypothesis at the level of the Earth is analogous to the Freudian hypothesis of the life and death instincts in individuals (see below) in which the death instinct is countered by the life instinct so that people continue to live and move forward despite self-destructive and regressive actions motivated by the death instinct. It may be that the Gaia and Medea trends at the level of the Earth stand in the same conflict as Eros and Thanatos at the individual level, so that existence is a compromise between the two trends.

Some scholars would view the Gaia Hypothesis and the Medea Hypothesis as metaphors rather than as genuine scientific hypotheses, more akin to religion than to scientific theory and, therefore, not testable by scientific methods.

Gaia and Suicide Prevention

Doessel and Williams (2010) reported that, at a conference in which they were presenting an argument that governments have a legitimate role to play in suicide prevention, an attendee argued that a laissez-faire approach to suicide is warranted in order to protect the Earth from degradation. Arguing from the perspective of the Gaia hypothesis, it was asserted that people leave carbon and ecological footprints (Wackernagel & Rees, 1996) which damage the Earth's ability to self-regulate and regenerate itself (Lovelock, 2006). The implication is that, the fewer people on the earth, the less damage humans can cause to the ecological system.

This seems to involve two alternative propositions. The first is that any action which leads to a reduction in the population is good since it limits the ecological degradation of the Earth by humans. In this case, policies such as those to eliminate (or reduce the incidence of) diseases are bad. The difference between mortality from suicide and from diseases is that suicide is an act chosen by the individual whereas malaria and cancer are not illnesses willingly sought by people. However, this encounters the often-made argument that suicide is an irrational choice made by psychiatrically disturbed individuals. If it is permissible to treat a medical disease, is it not permissible to treat a psychiatric disease (such as an affective disorder) so that individuals can make rational decisions? These considerations lead to the first question:

Question 1: Is suicide ever a rational act?

It could be argued, of course, that, for the Gaia hypothesis, it does not matter whether an act is rational or irrational. Suicide is part of the self-regulating system under the Gaia hypothesis, and explanations proposed by humans to explain this

¹ Ward includes only cataclysms generated from the Earth itself and not caused by external forces such as meteor impacts.

behavior are irrelevant. However, the role of decision-making in suicide, rational or irrational, is sometimes used as argument against preventing suicide (e.g., Szasz, 1971, 1986) whereas this argument is rarely used, if ever, as an argument against preventing and treating medical diseases.

The second alternative proposition is that Gaia will regulate itself even if one component of the Earth's ecosystem (humans) changes it, and even degrades, it. The composition of the Earth's ecosystem may change (as in some novels portraying dystopias and in apocalyptic movies), but eventually conditions will settle down to a new equilibrium. In this case, human behavior is irrelevant to the Gaia Hypothesis.

Can Suicide Benefit Gaia?

*Burdensomeness*²

The commentator at the presentation by Doessel and Williams mentioned above focused on the degradation of the planet by humans. However, there are other, narrower issues involved. One is the question of whether people ever commit suicide with the goal of contributing to Gaia.³ Perhaps not in the most abstract sense, but Joiner (2005; see also van Orden, et al., 2010) has proposed a theory of suicide in which three factors contribute to the desire for suicide: (1) thwarted belongingness and (2) perceived burdensomeness, combined with (3) an acquired capability for harming oneself. DeCatanzaro (1995) also proposed that a sense of burdensomeness toward kin may erode self-preservation desires. Joiner, et al. (2002) compared the notes written by those who attempted suicide with those who had completed suicide and found that statements related to burdensomeness were more characteristic of the suicide notes from the completed suicides than of the notes from the attempted suicides. Lester (2010) presented case studies of female suicide bombers in the Middle East which indicated that a sense of perceived burdensomeness to kin played a role in the decision of some of the women to complete suicide for political purposes. This motive for suicide resembles the motives implied in Durkheim's (1897) description of altruistic suicide, in which people commit suicide in order to help others.

In some societies in the past, the elderly occasionally committed suicide, sometimes passively (by ceasing to eat) in order not to be a

² There are several theories of suicide mentioned in this essay, and each could be the subject of a comprehensive review and critique. The purpose of this essay is not to present such a critique but rather mention the theories for their relevance to the application of the Gaia Hypothesis to suicidology.

³ An interesting question raised by Richard Colby, a colleague of mine, is whether adherents of the Gaia Hypothesis have more accepting attitudes toward suicide and are more prone to suicidality, especially when facing personal crises.

burden to their kin. In *The Ballad of Narayama*, a Japanese film in 1983 made by director Shohei Imamura, based on the book *Men of Tohoku* by Shichiro Fukazawa, set in a small rural village in 19th Century Japan, an elderly matriarch of the family follows the tradition that, once a person reaches the age of 70, he or she must travel to a remote mountain to die of starvation.

These considerations lead to the second question:

*Question 2: How common is burdensomeness as a motive for suicide?*⁴

Ethology And Suicide

Ethology is the study of animal behavior, focusing on how and why animal behavior occurs. Ethologists stress accurate observation and description of animal behavior, particularly in the animals' natural habitats, but also in experimental situations where the stimuli with which the animals are confronted can be presented in a systematic fashion. Ethology believes that the mechanisms behind animal behavior are programmed into the animal's neural networks and, thus, are determined largely by the genes and by the ways in which evolution has changed the characteristics of the animal.

The basic concepts of ethology were developed by Karl von Frisch, Konrad Lorenz and Nikolaas Tinbergen who were awarded the Nobel Prize for Medicine in 1973 for their work. Consider the following example, the egg-rolling response of the greylag goose. When a goose which is incubating eggs notices an egg near the nest, its attention is focused on this egg. It slowly rises, extends its neck over the egg and with the bottom of its bill rolls the egg back up into the nest. This behavior is called a fixed action pattern. The response appears to be innate rather than learned, the coordination and patterning of the behavior is stereotyped, and, once initiated, the pattern is completed without any further sensory input. The stimuli which release the fixed action pattern is called the innate releasing mechanism. Because the goose responds to only one aspect of the object, the stimuli are also called the sign stimuli. The fixed action pattern is turned off and on by drives or motivation which limit the behavior to a particular period of time, in this case incubation until hatching. Innate releasing mechanisms are thought to illustrate the innate, programmed nature of much of animal behavior. They focus the animal's attention and enable animals to respond quickly to stimuli without interference from thinking.

⁴ It may be argued that suicidal individuals may think that they are a burden to the earth, but only to significant others. However, the Gaia hypothesis does not necessarily assume that people have to be cognitively aware of Gaia and whether or not they are living (or dying) in accordance with Gaia.

Attempted Suicide As An Innate Releasing Mechanism

The first application of ethology to suicidal behavior was made by Stengel and Cook (1958). Referring to the work of Lorenz and Tinbergen, they suggested that the suicidal attempt acts very much as a 'social releaser' (p. 117). Stengel (1962) later wrote that "the suicidal attempt functions as an alarm system and an appeal for help. It does so almost with the regularity of an 'innate release mechanism'" (p. 726). It is of interest that these concepts are embodied in the title of Farberow and Shneidman's (1961) influential book, "The Cry for Help," where the suicide attempt, the innate releasing mechanism, is the stimulus which elicits a response, the fixed action pattern, in other people. The response elicited in others is evidently care-giving. This notion was also suggested by Henderson (1974) who characterized attempted suicide as care-eliciting behavior and saw it as a developmentally primitive signal for care.⁵

Attempted Suicide As A Fixed Action Pattern⁶

Attempted suicide can also be seen as a fixed action pattern. In Freud's early version of psychoanalytic theory, there was only one source of energy for human behavior, an energy which he called libido. In this version of the theory, the natural response to frustration is to aggress against the frustrating object, that is, to become assaultive. If this outward-directed aggression is forbidden or punished, then the aggression is blocked and turned inward onto the self, resulting in depression and self-destructive behavior (Henry and Short, 1954).

However, in the later version of his theory, Freud proposed two major motivations for humans, the life and death instincts, Eros and Thanatos, fueled respectively by libido and destrudo. In this latter theory, adopted by Menninger (1938) in his theorizing about suicide, self-destructive behavior becomes a basic pattern which, in order to survive, we must control. In this view, suicidal behavior is an innate pattern of behavior, a fixed-action pattern in ethological terms.

If suicidal behavior can be viewed as a fixed action pattern, two questions arise. First, what is the innate releasing mechanism that elicits this behavior? At the most general level, stressors could be seen as the stimuli which elicit the behavior, but research has shown that the stressors which most commonly precipitate suicidal behavior vary with age, gender, and other personal characteristics (Lester, 1992).

⁵ For such appeals to work, they must elicit altruistic or care-giving behavior in the significant others, but the lack of such behavior does not negate the ethological analogy.

⁶ For an extended version of this analogy, see Lester and Goldney (1997).

More interestingly for an ethological perspective is the possibility that interpersonal stimuli are critical in eliciting suicidal behavior, a possibility most clearly illustrated in Richman's (1986) focus on the role of the family in both eliciting and reducing the occurrence of suicidal behavior. If this is the case, then we have sequencing, in which the behavior of one person releases the suicidal behavior pattern in another, which in turn releases care-giving behavior in the first person. Much more abstract analysis has been conducted on the dynamic interchange between the murderer and the victim (e.g., Luckenbill, 1977) than has been conducted on the interchange between the suicidal individual and his/her significant others, and this lacuna needs to be remedied in future research on suicidal behavior.

The second question is, if suicidal behavior is a fixed action pattern, what will happen when no innate releasing mechanism appears? According to ethology, fixed action patterns must be expressed from time to time. As time passes without the occurrence of the fixed action pattern, the stimuli required to release the pattern become weaker and weaker, until the pattern can occur without any releasing stimulus, resulting vacuum behavior.

In writing about outward-directed aggression, Lorenz (1966) addressed this problem by suggesting that socially acceptable outlets must be provided for the outward expression of aggression, outlets such as contact sports and paramilitary organizations. The same may, therefore, be true for suicidal behavior. The society must provide socially acceptable ways for self-destructive impulses to be safely discharged, for example, in death-risking activities such as mountain climbing or in chronic and focal suicidal activities, to use Menninger's (1938) terminology, such as drug use and self-mutilation. Just as the dog shakes a slipper rather than breaking the neck of its captured prey, perhaps people can abuse alcohol and other drugs rather than commit suicide with overdoses. From this perspective, therefore, drug abuse may be a means of preventing suicide!

These considerations lead to the third question:

Question 3: Can suicide be an instinctive behavior?

Evolution And Suicide

It has long been noticed that animal populations adjust to the size and abundance of nutrients in the environment. When resources are abundant, the population grows; when resources are scarce the population shrinks. Does the human animal fit this pattern? Many human practices can be viewed as serving to achieve population regulation. Infanticide, geronticide, and murder in general can be seen as reducing the population in times of scarce resources. Social regulations on marriage, taboos on

child spacing, abortion and homosexuality can also be seen as ways of controlling population size.

Addressing the problem of drug addiction, Jonas and Jonas (1980) noted that, although addiction to drugs initially seems gratifying to the individual, the addict eventually suffers from declining health and a disrupted social adjustment. The fertility of the addict is impaired, and his genes are typically removed from the gene pool. (Natural selection involves the survival of the genes of individuals who are fit while those of less fit individuals are weeded out over time.)

Jonas and Jonas speculated that the genes of the addict (and perhaps of those with psychiatric illnesses) predispose them to be sensitive to external stimuli and group pressures. These tendencies may have been adaptive when societies were smaller and when people had to be acutely sensitive to danger from the environment in order to survive. But in modern society, this sensitivity leads to discomfort which can sometimes be alleviated, for example, by people blunting their perception by means of drugs.

Jonas and Jonas saw addicts today as forming an available pool of individuals readily amenable to a reduction in the population. (The large increase in stress diseases can also be seen as ways of reducing the population.) Jonas and Jonas noted that self-eliminatory behaviors have adaptive significance for the species. Addiction and similar behaviors are pathways along which some people move toward removing their genes from the gene pool. As the sociobiologists have noted (see below), suicidal behavior fits well into this process. Suicide clearly removes the genes of those individuals from the gene pool and reduces the size of the population.

Furthermore, when we look at the kinds of individuals who complete suicide, we find that, typically, suicide rates are highest in those who are older and past child-bearing age, except in the poorest nations of the world where suicide rates are higher among the young and fertile female members of the society (15 to 24 year-olds) than among the older women (Lester, 1982). Thus, it seems that when resources are scarce, as in the poorest nations, it is the fertile who kill themselves at the highest rate, thereby reducing the potential for growth in the population. The fact that suicide rates are much higher in those who are psychiatrically disturbed (Lester, 1992) can also be seen as genetically useful, for the suicide of these people removes their (possibly defective) genes from the gene pool in the society.

The existence of fatalistic suicide (Durkheim, 1897), in which people kill themselves in conformity to societal pressures, may also be seen as fitting the type of suicide necessary for this evolutionary view better than the suicides of the isolates and the alienated of the society (egoistic and anomic suicides). The ritualistic suicides, for example, sati in Indian widows and seppuku in

Japan, are suicides committed in response to social pressures. Mass suicide too can be seen as satisfying this evolutionary need.

Sociobiology And Suicide

Sociobiology is an "amalgamation of behavioral biology, modern population ecology, and evolutionary theory...Its central concern is to understand how and why animal social behavior has evolved" (Wittenberger, 1981, p. 6). Animal behavior orients the species toward maintaining and advancing its biological fitness, maintaining its existence and promoting its reproduction (DeCatanzaro, 1981).

DeCatanzaro (1980, 1981) noted that suicide appears to act contrary to this trend by removing the individual's genes from the population gene pool. However, DeCatanzaro noted that suicide occurs primarily in those who are under stress which reduces their biological fitness and who have a reduced capacity to promote their genes in future generations. Suicide has been more common in those who are older, who have no children, who are divorced, widowed and single, and in those who are psychiatrically disturbed, factors that reduce the capacity and ability to have children and pass on genes to future generations. There were many criticisms of DeCatanzaro's thesis, including that it is tautological (Carr, 1908) and not amenable to a priori hypothesis testing (Anisman, 1980).

Since suicide is related to decreased reproductive status, it does not necessarily remove genes from the population gene pool. Furthermore, the suicidal individual may, by committing suicide, support related individuals in their quest for survival and reproduction, individuals who share some of their genes because they are members of the same family by descent. For example, the suicide of the elderly in primitive societies removes a burden on the remaining members of the society who no longer have to feed the aged and infirm and whose migration is no longer hindered by the weak elderly.

Perhaps this made sense in 1981 when DeCatanzaro wrote his book. However, the rising youth suicide rate in the 1980s and 1990s in most nations of the world seems to argue against this point of view. The youths who are committing suicide would in all probability have children later had they not killed themselves. Furthermore, DeCatanzaro is very selective in his presentation of suicide statistics. For example, he notes that the high suicide rates in the widowed and divorced fits with his theory (since these individuals are presumably less likely to reproduce than married people), but he ignores phenomena such as the reduced suicide rate in women after they pass their period of child-bearing. Furthermore, the sociobiological perspective on suicidal behavior ignores nonfatal suicidal behavior. The sociobiological hypothesis

about suicidal behavior thus seems to explain only some aspects of fatal suicidal behavior at some points in time and in some nations of the world. These considerations lead to the fourth question:

*Question 4: Does suicide benefit the society?*⁷

Can Animals Commit Suicide?

If the Gaia Hypothesis views suicide as a useful mechanism for achieving the equilibrium of the Earth, it is relevant to ask whether suicide appears in animals other than humans. Biologists often use the word "suicide" to describe the behavior of animals which leads to their self-destruction, animals such as the pink bollworm moth (Bariola, 1978), butterflies (Trail, 1980), pea aphids (McAllister and Roitberg, 1987), birds (O'Connor, 1978) and bacteria such as motil aeromonads (Namdari and Cabelli, 1989). Muller and Schmid-Hempel (1992) described a behavior that resembles suicide as a result of not wanting to be a burden! Bumblebee workers who become infected with parasites remain outside of the hive, thereby dying sooner and avoiding infecting others in the hive.

The phenomenon of apoptosis involves programmed cell death in multicellular organisms that is sometimes described as suicide (Martin, 1993). Scholars such as Menninger (1938) use the term "suicide" in a broad sense which permits non-conscious intent and mildly self-destructive behavior to be included in the category. The behavior of higher animals has often in the past been viewed as suicidal, and Ramsden and Wilson (2010) reviewed historical views on whether this was possible or not and presented historical descriptions of supposedly suicidal behavior in animals such as dogs and cats. Today, animal behavior is occasionally viewed as suicidal, especially in animals such as dolphins (Amory, 1970; Nobel, 2010).

Preti (2005, 2007, 2011) has reviewed the evidence that animals can commit suicide. In his first article on the topic, Preti (2005) examined clues from folklore and noted that they involved anthropomorphizing, but he was able to locate reports of suicide in animals from as far back as the 2nd Century AD. Preti (2007) then reviewed modern commentaries and found that there was some resemblance between self-endangering and self-destructive behavior in animals and suicidal behavior in humans, particularly among animals held in captivity (who sometimes self-mutilate and refuse to eat) and those under population pressures

⁷ Yang and Lester (2007) argued that suicide provides an economic benefit for the society. Yang and Lester estimated that the savings from the roughly 31,000 suicides in the United States each year from the reduced costs of health care, pensions, medical and psychiatric treatment, and nursing home care for these suicidal individuals outweighs the lost productivity by about \$5 billion dollars each year, but there may be other possible non-economic benefits.

brought on by environmental factors such as droughts and diminished food supply.

However, is it possible to prove that an animal can commit suicide? There has been one approach to this problem that has potential for theory and research. Schaefer (1967) first identified the basic issues involved in deciding whether an animal can commit suicide. (1) Can the animal discriminate between life and death or, to be more specific, between a live animal and a dead animal? (2) Can an animal discriminate between a lethal and a nonlethal environment? (3) Under what circumstances will an animal choose to enter a lethal environment?

Schaefer demonstrated how these questions might be answered. To demonstrate that an animal can discriminate a dead animal from a live one, Schaefer used an operant conditioning technique in which one lever in a Skinner box produced food when a live mouse was the stimulus and a second level produced food when a dead mouse was the stimulus. Schaefer's mice learned this discrimination.

To demonstrate that mice can discriminate between a lethal chamber and a nonlethal chamber, Schaefer allowed mice to choose to enter one of two chambers. In one chamber they were electrocuted, while in the other they were allowed to live. The behavior of these mice was the stimulus for other mice. As long as the observed mouse was alive, one lever produced food. When the observed mouse was dead, a second lever produced food. The observing mice learned this discrimination. After learning the discrimination, the observing mice were allowed to enter the chambers. On test trials, the mice entered only the nonlethal chamber. If these demonstrations can be replicated (no-one has pursued Schaefer's ideas in recent years), it would be possible to investigate under what circumstances an animal might choose to enter the lethal chamber.

In his demonstrations, however, Schaefer failed to include controls for several factors. For example, are the mice learning to discriminate between a dead and a live stimulus mouse or merely a non-moving and a moving mouse? Would the observer mouse respond differently if instead of observing mice killed, he observed mice waking from sleep. Perhaps it is the change in the state of the mice that led the observer mouse to avoid the lethal chamber rather than mice being killed? Many other methodological problems can be raised about these demonstrations. However, all of these problems could be overcome, and Schaefer's formulation of the problem enables us to plan a set of studies to explore whether an animal could commit suicide.

These considerations lead to the fifth question:

Question 5: Is suicide found in animals other than humans?

Conclusion

Although the Gaia Hypothesis is probably a metaphor rather than a scientific theory (and perhaps it is better construed as a religious or philosophical system), consideration of the hypothesis can be seen to be provocative, raising questions that, although they have been raised before in suicidology, perhaps merit further thought and study.

One final point (and two questions). One reviewer, whom I would like to thank for his or her challenging comments and who did not like the questions that I proposed as raised by the Gaia hypothesis, raised one that he or she thought relevant. The reviewer noted that we seemed to have failed to have a major impact on the suicide rate. To be sure, in some countries, the suicide rate has fallen (hopefully not merely as the result of misclassifying suicidal deaths [Lester, 2002]), but in other countries it has risen or stayed stable (as in the United States over the last few decades). The reviewer suggested that suicide may be one of many self-regulating systems to reduce the negative impact of humans on the Earth, and our theories or perspectives for interpreting or understanding these suicides are irrelevant.

These considerations lead to a sixth question.

Question 6: Why have we failed to have a major impact on the suicide rate despite all of our efforts and will we ever have an impact?

Related to this is the concept raised by Yang and Lester (2009). Yang, an economist, and Lester, a psychologist, noted that, in economic theory, the unemployment rate can never be zero. People are always leaving jobs and getting fired, and they take time to locate new jobs. The resulting level of unemployment is called the natural unemployment rate. Yang and Lester wondered whether there was a natural suicide rate. To illustrate this, they used time-series and ecological regression analyses of the suicide rates in several nations to predict these suicide rates based on social risk factors such as divorce and unemployment. When they set these risk factors to zero, the predicted suicide rates were always positive – never zero or negative. Yang and Lester argued that there was indeed a natural suicide rate.

These considerations lead to the final question.

Question 7: Is there a natural suicide rate?

Acknowledgements:

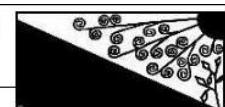
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References

- Amory, C. (1970). After living with a man, a dolphin may commit suicide. *Holiday*, May, 16-18.
- Anisman, H. (1980). Depression and suicide. *The Behavioral & Brain Sciences*, 3, 272-273.
- Bariola, L. A. (1978). Suicidal emergence and reproduction by overwintered pink bollworm moths. *Environmental Entomology*, 7, 189-192.
- Carr, E. G. (1980). Suicide. *The Behavioral & Brain Sciences*, 3, 273-274.
- DeCatanzaro, D. (1980). Human suicide. *The Behavioral & Brain Sciences*, 3, 265-272.
- DeCatanzaro, D. (1981). Suicide and self-damaging behavior. New York: Academic.
- DeCatanzaro, D. (1995). Reproductive status, family interactions, and suicide ideation. *Ethology & Sociobiology*, 16, 385-394.
- Doessel, D. P., & Williams, R. F. G. (2010). The economic argument for a policy of suicide prevention. *Suicidology Online*, 1, 66-75.
- Durkheim, E. (1897). *Le suicide*. Paris: Felix Alcan.
- Farberow, N. L., & Shneidman, E. S. (Eds.) (1961). *The cry for help*. New York: McGraw-Hill.
- Henderson, S. (1974). Care-eliciting behavior in man. *Journal of Nervous & Mental Disease*, 159, 172-181.
- Henry, A. F., & Short, J. F. (1954). *Suicide and homicide*. New York: Free Press.
- Joiner, T. E., Pettit, J. W., Walker, R. L., Voelz, Z. R., Cruz, J., Rudd, M. D., & Lester, D. (2002). Perceived burdensomeness and suicidality. *Journal of Social & Clinical Psychology*, 21, 531-545.
- Joiner, T. E. (2005). *Why people die by suicide*. Cambridge, MA: Harvard University Press.
- Jonas, D., & Jonas, A. (1980). A bioanthropological overview of addiction. In D. Lettieri, M. Sayers, & H. Pearson (Eds.) *Theories on drug abuse*, pp. 269-277. Rockville: NIDA.
- Lester, D. (1982). The distribution of sex and age among completed suicides: a cross-national study. *International Journal of Social Psychiatry*, 28, 256-260.
- Lester, D. (1992). *Why people kill themselves*. Springfield, IL: Charles Thomas.
- Lester, D. (2002). The scientific study of suicide requires accurate data. *Crisis*, 23, 133-134.
- Lester, D. (2010). Female suicide bombers and burdensomeness. *Psychological Reports*, 106, 160-162.
- Lester, D., & Goldney, R. D. (1997). An ethological perspective on suicidal behavior. *New Ideas in Psychology*, 15, 97-103.
- Lorenz, K. (1966). *On aggression*. New York: Harcourt, Brace & World.
- Lovelock, J. (1995). *The ages of Gaia*. New York: Norton.
- Lovelock, J. (2000). *Gaia: A new look at life on Earth*. Oxford, UK: Oxford University Press.
- Lovelock, J. (2006). *The revenge of Gaia*. London, UK: Allen Lane.
- Luckenbill, D. (1977). Criminal homicide as a situated transaction. *Social Problems*, 25, 176-186.
- Margulis, L. (1998). *Symbiotic planet*. New York: Basic Books.
- Martin, S. J. (1993). Apoptosis: suicide, execution or murder? *Trends in Cell Biology*, 3(5), 141-144.
- McAllister, M. K., & Roitberg, B. D. (1987). Adaptive suicidal behavior in pea aphids. *Nature*, 328, 797-799.
- Menninger, K. (1938). *Man against himself*. New York: Harcourt, Brace & World.
- Muller, C. B., & Schmid-Hempel, R. (1992). To die for host or parasite? *Animal Behavior*, 44, 177-179.
- Namdari, H., & Cabelli, V. J. (1989). The suicide phenomenon in motile aeromonads. *Applied & Environmental Microbiology*, 55, 543-547.
- Nobel, J. (2010, March 19). Do animals commit suicide? www.time.com/time/printout/0,8816,1973486,00.html. Accessed March 19, 2010.
- O'Connor, R. J. (1978). Brood reduction in birds. *Animal Behavior*, 26, 79-96.
- Preti, A. (2005). Suicide among animals. *Psychological Reports*, 97, 547-558.
- Preti, A. (2007). Suicide among animals. *Psychological Reports*, 101, 831-848.
- Preti, A. (2011). Do animals commit suicide? *Crisis*, 32, 1-4.
- Ramsden, E., & Wilson, D. (2010). The nature of suicide. *Eneavour*, 34(1), 21-24.
- Richman, J. (1986). *Family therapy for suicidal people*. New York: Springer.
- Schaefer, H. H. (1967). Can a mouse commit suicide? In E. S. Shneidman (Ed.) *Essays in*

- self-destruction, pp. 494-509. New York: Science House.
- Stengel, E. (1962). Recent research into suicide and attempted suicide. *American Journal of Psychiatry*, 118, 725-727.
- Stengel, E., & Cook, N. G. (1958). Attempted suicide: Its social significance and effects, Maudsley Monograph Number 4. London, UK: Oxford University Press.
- Szasz, T. (1971). The ethics of suicide. *Intellectual Digest*, 2, 53-55.
- Szasz, T. (1986). The case against suicide prevention. *American Psychologist*, 41, 806-812.
- Trail, D. R. (1980). Behavioral interactions between parasites and hosts. *American Naturalist*, 116(1), 77-91.
- Van Orden, K. A., Witte, T. K., Cukrowitz, K. C., Braithwaite, S. R., Selby, E. A., & Joiner, T. E. (2010). The interpersonal theory of suicide. *Psychological Review*, 117, 575-600.
- Wackernagel, M., & Rees, W. (1996). Our ecological footprint. Philadelphia: New Society Publishers.
- Ward, P. D. (2009). *The Medea Hypothesis*. Princeton, NJ: Princeton University Press.
- Watson, A. J., & Lovelock, J. E. (1983). Biological homeostasis of the global environment: the parable of Daisyworld. *Tellus B (Chemical & Physical Meteorology)*, 35, 286-289.
- Wittenberger, J. F. (1981). *Animal social behavior*. Boston: Duxbury.
- Yang, B., & Lester, D. (2007). Recalculating the economic cost of suicide. *Death Studies*, 31, 351-361.
- Yang, B., & Lester, D. (2009). Is there a natural suicide rate? *Applied Economics Letters*, 16, 137-140.

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