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"ALTRUISTIC DEATH", EVOLUTIONARY SOLUTION TO SAVE THE SPECIES

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„Is it true that self-sacrifice is the only thing that gives meaning to death? To this question the warrior is obliged to answer "yes", knowing full well that his suicide mission is pointless".

Lieutenant Nagatsuka, kamikaze pilot

Because of the state of health emergency in which the planet finds itself caught, we are forced to be interested in notions that were previously foreign to us. The world press publishes molecular medicine and epidemiology articles. The cytokine storm is one of the many concepts that have become familiar to us. But its mechanisms still elude even those working in the field.

According to the researchers, in addition to infecting the lung cells, the virus causes damage through direct or indirect infection of the endothelial cells, which are the ones that form the blood vessels that are in the lungs.

José Alcamí, researcher at the Carlos III Health Institute, Spain says that our immune system can be thought of as a kind of army, a force that fights against invading microbes. "In the mechanisms of our body there are soluble substances that cells produce: cytokines. They are like projectiles that locate infected cells and selectively destroy them."

It is a protective mechanism that occurs in any inflammation and is usually able to stop over time, but there are times when it gets out of control and the production of these cytokines becomes excessive, both quantitatively and qualitatively. "It's like sowing the whole body with grenades: infected cells will be destroyed, in this case by the coronavirus, but there will also be destruction of healthy cells"

New increases in the number of those infected and hospitalized with the coronavirus have once again called the cytokine storm concept into question. An uncontrolled reaction of the immune system that has had a fatal outcome for many of the patients with COVID-19.

"What probably happens is that the virus infects cells in the lungs causing pneumonia, but it also damages blood vessel cells. Thus, a cascade of events is caused that will lead to extremely high levels of certain cytokines, which will not only cause damage to the lungs, but to the whole body", states Alcamí.

It is not yet known why there are people who do not develop this serious condition. "It occurs more often in the elderly, in obese patients, with diabetes or hypertension." It can cause significant damage to the lungs, kidneys and heart. "Coronavirus infection ceases to be a local disease of the respiratory system and becomes a systemic disease that affects the whole body".

Russian scientists were tasked with finding a substance that would act as a "death switch," stopping the chain reaction of the cytokine storm. The drug, called Leitragin, was developed by the Biomedical Technological Research Center of the Russian Federal Agency for Medicine and Biology (FMBA) and is currently in clinical trials in Russia. Although its basic substance was previously known and used in medicine for the treatment of ulcers by Soviet doctors, it was the FMBA team that discovered how to apply it to the treatment of severe cases of Covid-19 and potentially other deadly diseases that cause life-threatening lung inflammation.

Trying to stop this uncontrolled immune response while maintaining the body's ability to fight the virus without causing further damage is what scientists and doctors in intensive care units around the world are struggling to achieve. In this regard, Leitragin appears as an essential change, because its new mechanism works in a specific way and is said to be completely safe for the health of patients.

This method is more effective than using monoclonal antibodies which are very expensive and not suitable for clinical treatment. The procedure of completely neutralizing the patient's immune system with anti-inflammatory steroids puts the patient at risk for other infections.

"This drug solves a key problem, providing the most advanced treatment," Moscow University (MSU) researcher Professor Maxim Skulachev told Russia Today magazine.

Professor Skulachev is one of the eminent researchers in the field of mitochondria. He discovered "mitochondrial electricity" and "Skulachev ions" (penetrating ions that are directed electrophoretically to mitochondria) (1969). Proposed a theory of programmed aging as a mechanism that increases evolutionary capacity (1997). Prof. Skulachev also suggested that the gradual programmed aging observed in almost all mammals has an evolutionary advantage over the sudden programmed death observed in some animals, such as salmon, octopus and male marsupial mice, as well as many insects and plants.

Professor Skulachev leads the SkQ Megaproject to study the effect of cationic derivatives of plastoquinone (SkQ) in inhibiting the effects of ROS on mitochondria, interrupting the aging program and, consequently, providing potential treatment agents for various age-related diseases. The preliminary results are interesting, especially with regard to age-related eye diseases such as dry eye syndrome. For this disease, clinical trials have already been successfully completed.

The professor's extensive experience in this field, different from most epidemiologic investigators, allowed him to draw surprising conclusions. Until now, a cytokine storm was thought to be triggered by an uncontrollable release of dozens of different types of cytokines, which was difficult to understand. However, Professor Skulachev says they were only able to identify one key "offender".

At first, Russian scientists spent months determining that the Covid-19 virus tested on mice did not lead to viable results. The rodents' response to the disease does not match that of humans, even in so-called "humanized" mice. Next, they used a drug-screening strategy and identified a substance that deactivates the "storm." It is supposed to be a specific cytokine that triggers this deadly process.

Appreciating the "enormous amount of work" that went into FMBA, MSU's Professor Skulachev says a team at his institute achieved similar results during their own research on cytokine storms. In addition, he believes the two teams have independently discovered a universal "evolutionary suicide mechanism" that kills an organism to prevent the spread of serious infections.

This "evolutionary suicide mechanism" that attacks a contagious individual to protect the rest of the species invites reflection. We are talking about an involuntary suicide, a biological programming hitherto ignored in humans. Natural selection turns out to be of extraordinary occult sophistication.

The theory of biological evolution by natural selection first presented by Charles Darwin (1859) is probably the most revolutionary idea in the history of human thought. Surprisingly, and despite its crucial importance to our understanding as a species and every other biological species, very few human beings really understand, or even know, the natural mechanism that created us. Never has a seemingly simple concept been so difficult to understand. It is as if natural selection, in creating an intelligent species like ours, has at the same time obscured the basic biological logic behind its operation.

It was believed that the ultimate reason why natural selection is not part of the cultural baggage of all mankind is due to an active resistance to it, because the idea of natural selection as the creative source of the natural world forces us to wake up from millennial dreams. Behind natural selection is a worldview that shakes the depths of culturally inherited beliefs and myths. Natural selection is revolutionary because it tells us that we are not special, because it puts us in our place in the order of things, of nature. No one expressed better than Jacques Monod (1970) the emotional impact of discovering our "total loneliness, radical strangeness, in a Universe deaf to our music, indifferent to our hopes, sufferings and crimes".

Natural selection is the process that intrinsically results in the production of organs, structures, and behaviors that are designed for survival and reproduction. The parasite-host relationship is one of the key factors in the evolution of life. Most cellular life forms possess various modes of defense against pathogens, including innate immunity, adaptive immunity, and programmed cell death (altruistic suicide). The coevolution of these different but interacting defense strategies produces complex evolutionary regimes.

In 1802, theologian W. Paley published Natural Theology, in which he argued that the functional design of organisms points to an omniscient creator. According to him, the human eye, with its delicate design, was the conclusive proof of God's existence. Natural selection is also opportunistic and myopic because it selects for that

variant that is useful at each time, regardless of whether this selection turns out to be counterproductive for the population at a given time. It does not take into account the social value of the individual, but only the biological one: a body dangerous to the group must be eliminated.

Biological evolution is the historical process of the transformation of some species into other descended species and includes the extinction of the vast majority of species that have existed. One of the most romantic ideas contained in the evolution of life is that any two living organisms, however different, have a common ancestor at some point in the past. We share a common ancestor with any of the bacteria that exist today, although the time to this ancestor goes back more than 3 billion years in this case. The idea of evolution is an open concept, it is a mechanical description of change that says nothing about the driving force or creative force that underlies the transformation.

Facing frequent challenges with bacteriophages, bacteria have developed numerous mechanisms to resist infection. A commonly used resistance strategy is abortive infection (Abi), in which the infected cell “suicides” before the bacteriophage can complete its replication cycle. Abi prevents the spread of the epidemic to nearby cells, thus protecting the bacterial colony. The Abi strategy is manifested by a multitude of mechanistically diverse defense systems that abound in bacterial genomes. In turn, bacteriophages have developed equally diverse mechanisms to defeat the bacterial Abi system.

Prokaryotic adaptive immune systems comprise genes that are involved in cell suicide, such as nuclease toxins. Coevolution of adaptive immunity and suicide in a structured population depends on immune efficacy.

In real biological communities, the effectiveness of innate and adaptive immune systems is limited by ecological factors such as population size, structure, and diversity. The incessant “arms” race between hosts and pathogens sets a limit on the performance of defense strategies, which is determined by the host's ability to keep up with pathogen mutations. In this regard, studies of host-parasite local adaptation suggest that parasites tend to be ahead of hosts in this co-evolutionary race. Consequently, the evolution of immune systems is modeled on the assumption that they have a constant efficacy that is extrinsically determined by a multitude of factors beyond the host's control.

The evolution of suicide as a defense mechanism is only possible if the host population is structured and the degree of immunity that hosts can achieve by other means is limited. The ubiquitous nature of suicidal systems in prokaryotic genomes calls for a reconsideration of the relative importance of population structure to genome evolution.

In bacteria, this mechanism is known as the abortive infection system (Abi). In multicellular organisms, an infected cell may undergo programmed cell death or apoptosis. The term comes from the Greek: apo = far and ptosis = fall, a term referring to the "falling of leaves" in autumn)

In conclusion, we can talk about an "altruistic death", which can be considered an example of convergent evolution, in which bacteria, eukaryotic and prokaryotic cells independently developed a mechanism to trap a pathogen in the infected cell. As a result, the cell dies, killing the pathogen within and thus benefiting the rest of the cell population.

Without being knowledgeable in the field and without any other evidence of the presence of the mechanism in other higher organisms, just because the simplest organisms, bacteria, as well as the most evolved, humans, are equipped with the same system of defensive self-immolation, I infer that the rest organisms own it.

Outside of avoiding an epidemic, Caenorhabditis elegans worms show a certain predisposition to die to contribute to the good of their colonies. This is indicated by a study carried out by researchers from University College London (UCL), who looked at how some of these worms are genetically predisposed to die before reaching old age, so that the demand for food is reduced, which ends up benefiting the colony.

Finally, finally, the evolutionary mechanism discovered during the research of the Russian scientists who studied the cytokine storm leads to the conclusion that we are programmed, like bacteria, to suffer an altruistic death in case of epidemic infections that endanger the survival of the species.

Altruistic suicide is therefore known in the context of programmed cell death (PCD) in unicellular and multicellular individuals, which is understood as an adaptive process that contributes to the development and functionality of the organism. It is necessary to critically evaluate the current conceptual framework and experimental data used to support the notion of altruistic suicide, in the biological sense, in complex organisms such as humans.

It is a time of rapid change and dramatic progress. It is a period of material comfort unsurpassed in human history. And yet, epidemics seem to test us with the same virulence as when medicine was not so advanced.

People's ability to consciously, rationally accept the reality of death is extremely low. In fact, sociologists have described it as a goal of modern palliative care: to help patients face their death with open awareness and courage, the "ideal" of a heroic death in the supportive care of family, friends and their community. .This acceptance of death is commonly identifiable in the narrative of many patients, especially the very old, as they anticipate what the future holds.

If an organism passes on to its offspring an inherited trait that gives them an advantage, that trait would gradually spread throughout the population. And conversely, any hereditary trait that reduces the reproductive possibilities of the offspring would be eradicated. So if natural selection involves the survival of the fittest, how does one explain the success of an organism that, as a phenotypic trait, can deliberately remove itself from this competition?

It has been said that in humans, suicide can be caused either by a lack of moral integration, which does not create a strong enough bond between the individual and society, or by a lack of moral norms that regulate the individual's desires, goals, and ambitions. A suicide that is related to moral integration could involve two different types of suicide. First, a situation in which the individual does not have a sufficient sense of belonging, to society or to a relevant social community, a life in which the individual has been alienated from the community or collectivity, which does not give meaning to the existential horizon. This type of suicide was called egoistic suicide by Émile Durkheim. Second, the individual was excessively integrated and lacked a sense of his own personality and autonomy, which could therefore turn death into a meaningful action. This concept was called by Durkheim altruistic death and we can think, for example, of the great collective deaths in religious sects.

Some might argue that suicide needs no evolutionary explanation, something to the effect that the emergence of supposed free will and culture places us outside the laws of nature. It can be argued that suicide is due to genes in the same way that, for example, the trait of not having children is passed on.

According to C.A. Soper, evolutionary analysis suggests that selection is unlikely to have tolerated the capacity for intentional self-killing in (non-human) animals. The possibility of escaping pain by suicide would have presented a serious and recurrent adaptive problem for an animal with a reproductive future to protect. If the potential for suicide arose in the evolutionary past, anti-suicide mechanisms could have co-evolved, as we believe they did in adult humans.

It is also important to know some facts about the epidemiology of suicide. No fewer than 1.4% of all deaths are attributed to suicide, about 800,000 per year, meaning more people die by suicide than by war and homicide combined, according to UN data from 2014. However, the actual incidence it is probably higher because many accidents may actually be suicides, and because of the stigma associated with suicide in many cultures, family members may conceal the true cause of death. Deaths by suicide are the tip of the iceberg of suicidal behavior, which is much more common. It is estimated that for every suicide there are 20-25 attempts, and that 2.7% of the world's population has attempted suicide at some point in their lives, 0.4% in a one-year period.

When it comes to explaining the human capacity for suicide from an evolutionary point of view, we basically have three options: it's an adaptation, it's a byproduct, or it's just "noise." There are no other known mechanisms by which a characteristic, whether physiological or behavioral, can be genetically transmitted from generation to generation.

An adaptation is an inherited characteristic that becomes typical of the species through a process of natural selection because of the adaptive advantages it confers on the offspring that receive it. The eye is an adaptation, for example. It is important to realize that adaptations do not have to be present from birth. For example, bipedal locomotion is a human adaptation, but children do not begin to walk until about one year of age. The same goes for breasts and other secondary sex characteristics that don't appear until adolescence.

Another possibility would be that this suicidal ability is a by-product of an adaptation, that is, the trait in question was not directly selected by natural selection, but comes bundled with another trait but was not selected for. In this case, the characteristic is not beneficial in itself, but is associated with something that is beneficial and has therefore been chosen by natural selection.

An example would be the white color of the bones or the sound the heart makes when it beats. Natural selection did not directly select for the white color of the bones, but rather the consistency provided by the calcium of the bones and the white color is secondary. It is assumed that the human sensitivity to back pain does not have

a direct adaptive advantage, but is a side effect of our upright posture. A byproduct explanation of suicide would go along the lines of it being a cost for other behaviors that are advantageous.

The third product of an evolutionary process would be noise or random effects. Noise can be due to random mutations that neither add nor take away from the efficiency of an organism's design, which is called genetic drift. These neutral effects can be passed down from generation to generation if they do not affect the functioning of the adaptations. Noise differs from by-product in that it is not related to adaptive aspects, but is independent of these features.

That the "aptitude" of suicide is due to chance is ruled out for several reasons. First, suicide is not something that occurs in some isolated populations or places but seems to be something universal, suggesting that the human mind has been subjected to the same evolutionary pressures everywhere.

Suicide is not reproductively neutral, but harmful, and that doesn't fit with random drift. Traits that occur by chance in a population are usually transient, but history indicates that suicide is a permanent feature of our species. Dropping the noise, we would be left with adaptation and byproduct as explanatory phenomena of the human capacity for suicide.

Evolutionary psychologists have not studied suicide very thoroughly. Only two authors have devoted themselves deeply to this issue, and they are the ones we will see in this article. One of them, Denys deCatanzaro, conceives the capacity for suicide as an adaptation, while the other, Clifford Alan Soper, considers it a by-product. Denys deCatanzaro has several published articles on this topic and also a book, "Suicide and Self-Damaging Behavior." A sociological perspective". For his part, Clifford Soper dedicated his PhD thesis to this problem, "Towards Solving the Evolutionary Puzzle of Suicide", and in 2018 he published a book about it.

Denys deCatanzaro draws on M. Hamilton's theory of inclusive fitness to formulate his suicide thesis. In biology, fitness is understood as the ability of an individual to reproduce, to pass on its genes to the next generation. But Hamilton discovered that reproduction itself is not the only way an individual can promote the transmission of their genes to the next generation.

Since relatives carry their genes in a certain proportion (for example a brother or a son in 50%), an individual can favor the transmission of their genes to the next generation, helping relatives to survive and reproduce. This concept is called fitness in English and can be translated as inclusive fitness, inclusive effectiveness or complete effectiveness.

DeCatanzaro explains suicide as a synergy between genetic factors on the one hand and cultural factors on the other. In terms of genes, what deCatanzaro suggests is that suicide occurs in subjects who have a reduced biological capacity – compared to other individuals in society – and therefore have a reduced capacity to promote the existence of their genes to the next generation .

The reasoning is similar to George Williams' explanation for aging or disease occurring in the elderly. When we think about why the genes for Huntington's disease or Alzheimer's are inherited, the evolutionary explanation is that these diseases appear after reproductive age, that is, by the time Huntington's symptoms appear, the subject has already reproduced.

Colloquially speaking, natural selection doesn't really care what happens to us as we age. Therefore, any genetic condition that is expressed once reproductive capacity is lost could be maintained in the population because it would be, say, invisible to natural selection. Suicide should be rare in fit subjects with a good ability to pass their genes on to the next generation, as they do. These theories do not explain the genetic diseases that manifest themselves during the reproductive stage.

A second, very important factor that deCatanzaro introduces is altruism. When an individual's ability to reproduce disappears, the way it can help represent its genes in the next generation is to help reproduce relatives who share its genes. Self-elimination of the individual would be favored if it entailed a benefit to his relatives (to his genes). In this regard, it is a reality that many suicidal patients complain that they are a burden to their relatives and that their families would be better off if they were not there. This type of thinking is considered a risk factor and can even be explained by fitness.

Once this reasoning is exposed, deCatanzaro argues that most risk factors for suicide can be understood as an accumulation of threats or reductions in vital capacities. Whether it's financial problems, a relationship breakdown, the death of a family member, etc., the most stressful events or suicide triggers involve declining fitness.

The subject is unable to cope with the circumstances at present and believes that this will continue to be the case in the future. It is true that suicide is more common in cases of serious illness, economic ruin, which is more common in the single, divorced and widowed, in the elderly, in socially isolated people without social support, etc. All of these circumstances can effectively be read as fitness declines.

This approach could also explain the higher frequency of suicide in men. Reproductive success in men depends more on status, their ability to obtain financial resources, education, etc., which is not so marked in women. Therefore, adverse events involving a failure in this intrasexual competition would have more severe consequences for males.

But even accepting the genetic argument, the reality is that only a minority of people who have a decline in fitness end up killing themselves, so other factors involved in suicide must be found. And deCatanzaro accepts the role of culture and learning. Self-destructiveness can be learned and suicide methods are found to be different in some cultures and in others.

The relationship that deCatanzaro raises between technology and suicide is interesting. The most used method of suicide in the world is probably hanging, and this method requires some technology, although this technology has been available for thousands of years, at least since we have been able to use clothes or ropes.

Also, the use of tools that cut or poison involves a technological development. Other means of suicide, such as drowning or jumping from a height, were always available. All this suggests that the availability of means, although not a cause of suicide, can be a facilitating element in its achievement.

In this sense, part of the explanation of suicide could also be sought in a mismatch between the ancestral environment in which our psychological mechanisms developed and the current environment of technologically developed societies. We now have all kinds of tools to cause death, such as drugs, cars or firearms that did not exist in our ancestral environment.

For example, an argument or crisis that in the ancestral environment would have been over in 15 minutes may today lead to the use of a firearm or a poisonous drug. This would happen because the human mind has not had time to adapt to these new technologies and these methods short-circuit natural inhibitory mechanisms. The most conservative conclusion is that technology is changing the methods of suicide, but it is not clear that it has changed the frequency throughout history.

Addressing the mismatch between our current environments and our primitive environments, deCatanzaro also emphasizes the role of stress. The human species is a species that now lives in an environment very different from the one in which its genes were selected. According to deCatanzaro, modern human culture places us in stressful situations for which we are not genetically prepared.

This point of view coincides in a way with that of Émile Durkheim when he spoke about the anomic conditions of modern society in which there was a weakening of family, social and religious ties, the role of authority, etc. There is definite evidence that this lower integration of the individual with his group, compared to that which exists in primitive societies, may be correlated with a higher risk of suicide.

Regarding a criticism of deCatanzaro's theory, it must be said that a first problem is that of differentiating objective from subjective reality. It is true that, objectively, reproductive capacity is diminished in serious mental disorders such as schizophrenia, in serious physical illness or in the elderly.

But in many cases, mental disorders - for example, depression - can be temporary, and a person who under current circumstances does not see a future in his life and may commit suicide will not see it that way when his depression improves. It is not clear that the damage to his ability is permanent. Also, the view that the family would be better off without him may be a distorted view.

Nor does deCatanzaro's theory explain impulsive suicides, which account for about half of all suicides: getting bad grades, a fight with a partner, or an enemy do not imply a permanent decline in fitness. We could also argue that although the elderly can no longer reproduce, they can still help their children and grandchildren to reproduce.

This argument is perhaps weaker because elderly people who commit suicide are often isolated and have lost the ability to act on family, although not always. Part of the answer to these criticisms may come from the theory of the mismatch between the ancestral environment and the modern cultural environment.

C. A. Soper proposes the idea that suicide is the result of two human capacities or adaptations: 1) the capacity to experience psychological, emotional or social pain and 2) our intellectual capacity, our consciousness, which makes us able to conceive that our own death can end that pain. Soper calls them "pain" and "brain" for short.

In other words, suicide is a byproduct of our ability to feel pain and our brains allowing us to see death as an escape. But since pain and the brain are universal, we are faced with the problem of explaining the low rate of suicide, the fact that only a minority take their own lives. Soper's answer is that there are psychological mechanisms in the human mind that function as defenses against suicide.

These defensive mechanisms would have appeared precisely as adaptations against the new capacity acquired by the human being to commit suicide. The ability to kill oneself became an evolutionary pressure that favored the emergence of these defenses. Defenses that exist against suicide are of two types: a) last-line defenses, which would be common mental disorders, and b) first-line defenses, which include psychological biases, cultural taboos, and others.

There is strong evidence that pain, both physical and mental, is functionally adaptive and that the experience of pain has therefore been favored by natural selection. People without physical pain are known to suffer accidents, mutilations and increased mortality. Pain mobilizes us to get rid of noxious stimuli that can cause tissue damage.

Regarding the function of mental pain, there are two overlapping schools of thought. One of them proposes the idea that our survival depends on identifying patterns in the environment. When the environment behaves in an unexpected way that contradicts the person's expectations, for example in a traumatic event, psychological pain would act as a sign of this inconsistency and demand the subject's attention to resolve it. Pain would be a way of responding to discrepancies of meaning.

The other school holds that psychological pain functions as a sign of potential deterioration in an individual's social relationships, a social alarm system to maintain those relationships that are critical to the individual's survival and reproduction. The same role that physical pain plays, especially when it comes to protecting our bodies, would be played by psychological pain in the social world, where it would protect our social relationships.

As G. MacDonald and M. Leary say, psychological pain should be understood primarily as social pain: an emotional reaction to the perception that one is excluded from a desired relationship or is devalued by desired peers or groups. Rejection literally hurts.

M. Leary and R. F. Baumeister are the authors of the sociometric theory of self-esteem, which proposes that it is precisely an indicator, a kind of internal psychological thermometer that measures our degree of social connection and acceptance. Feeling low self-esteem would motivate us to improve our relationships because our reproductive success depends heavily on our ability to predict, navigate, and read the social world.

Pain motivates us to act, and there is a new action that becomes a priority: to escape, to end the pain. Severe pain blocks access to our long-term memories and our ability to think reflectively. Our mind is focused on one task: stopping the pain. Pain affects us cognitively and reduces the range of perceptions and thoughts.

The downside to this problem is that the pain can lead to suicide as a way to end the excruciating pain if there is no other way to treat the source of it. When we talk about mental pain, we mean an umbrella that includes shame, guilt, humiliation, loneliness, despair, and every other variety of psychological torment. It makes sense for the body to group all these emotions under the same aversive emotion.

As we can see, the ability to feel psychological pain is a necessary condition for suicide because it provides a motivation for it, but it is insufficient because most people who suffer from psychological pain do not commit suicide. Other animals also have emotions and suffer psychological pain, but as we have seen, there does not seem to be an equivalent to suicide in the animal world. Specifically, the experience of separation is part of the mammalian condition, as demonstrated by Harry Harlow's experiments. So, besides pain, we need another factor to explain suicide.

"Pain" and "brain" become a new evolutionary pressure, a change in the environment in which the existence of the Homo sapiens species takes place, which is a threat to their survival. And, as with other evolutionary pressures, natural selection responds with adaptations, with defensive mechanisms, to deal with this new threat. For example, if the temperature drops, natural selection will promote mutations that result in thicker skin or more adipose tissue for thermal insulation.

Similarly, animals react to seasonal migrations to cope with climate risks. A more appropriate example might be the so-called "obstetric dilemma", the difficulty of the fetus's skull passing through the mother's pelvis. This problem led to various adaptations such as the birth of more immature babies, a rotation that does not exist in other primates, widening of the pelvis, etc.

Adaptations to the obstetric dilemma have not been perfect either, given that there is greater birth mortality and difficulty than in other primate births, but the price to pay is acceptable compared to the advantages of greater human encephalization.

So we can assume that the threat posed by the pain/brain combination had to give rise to new adaptations, new psychological mechanisms in this case, such as defense against the risk of suicide. These psychological mechanisms would have emerged gradually over many generations, and while we cannot expect them to work perfectly, they would be efficient enough so that the cost paid for the benefits of "pain" and "brain" would be acceptable. Soper's next step is to look for these psychological defenses or anti-suicide mechanisms.

C.A.Soper analyzes the characteristics that these psychological mechanisms should have, which he calls last-line defenses (keepers). It details twenty features that I won't list, but will mention a few to understand its reasoning. Defenses against suicide should be involuntary, controlled instinctively by the autonomic system and not something learned. That is, those defenses should operate compulsively and not let us forget them more than temporarily. We could compare them to breathing, which we can stop for a moment, but have to resume immediately. Triggering these defenses would be suicidal ideation triggered by psychological pain and would not be triggered before adolescence when there is no risk due to lack of cognitive development.

Conscious suicide as an evolutionary mechanism can now be seen in a different light, thanks to the discovery by the team of Russian researchers of the cellular suicide called "altruistic death", which threatens the survival of the species.

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