

Threads of Ritualistic DNA:  
Epigenetics and the Roman Catholic Church

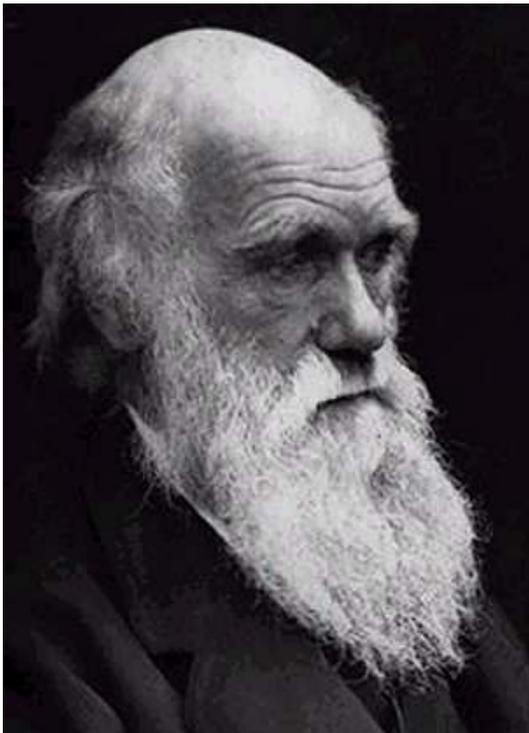
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## **Abstract**

The study of evolution has identified four mechanisms for evolutionary change: mutation, migration, genetic drift and natural selection. Each of these mechanisms allows the introduction of a larger pool of a particular gene into the general population; for instance, in a generation of beetles, two brown beetles produce four brown beetle offspring, and in the same generation, two green beetles die without producing offspring. Thus the subsequent generation has more genes for brown in the population (an example of genetic drift). Evolutionary theory contends that many such genetic mechanisms of change over a great period of time will result in a change in the population as a whole. In the last few decades, a new science has emerged in an attempt to explain population changes that occur over a relatively short period of time: epigenetics. As its name suggests, this science looks beyond genetics and the accepted dogma of evolution. One area studied in epigenetics is the influence of the human environment on genetic expression, and the possibility that the environmental experiences of a parent can influence the behavior of his offspring, and perhaps many generations of offspring down his line. This paper applies the research in environmentally based epigenetics to the field of ritual study, specifically suggesting that the physical, emotional and spiritual impact often generated by repeated religious rituals constitutes a major environmental experience, and thus can have an effect on genetic expression on a multi-generational basis. The paper explores this within the context of the instillation of fear and the rites of punishment in the Catholic Church, and the possibility that early leaders of the Church recognized the presence and power of epigenetics as a means of control over the faithful.

## Evolution: A Brief History

In 1859, Charles Darwin published a book that would prove to change the fundamental means by which scientists study all species that populate the planet Earth: *On the Origin of Species by Means of Natural Selection, or, The Preservation of Favoured Races in the Struggle for Life*. At the time, Darwin's theory of evolution via natural selection flew in the face of most naturalists who "continually refer to external conditions, such as climate, food, etc., as the only possible cause of variation" within a species. (Darwin, pg. 17) To Darwin, logic prevented such a simplistic approach to explaining the vast number of variations, in fact he found it "preposterous to attribute to mere external conditions, the structure, for instance, of the woodpecker, with its feet, tail, beak, and tongue, so admirably adapted to catch insects under the bark of trees." (Darwin, pg. 17) The key term in Darwin's statement is *adapted*, a term upon which his theory of natural selection is based. Natural selection consists of six principles:



*Charles Darwin*

- More organisms are produced than can survive because of limited resources.
- Organisms struggle for the necessities of life, and there is competition for resources.
- Individuals within a population vary in their traits. Some of these traits are heritable – passed on to offspring.
- Some variants are better adapted to survive and reproduce under local conditions than others
- Better adapted individuals (the "fit enough") are more likely to survive and reproduce, thereby passing copies of their genes to the next generation.
- Species whose individuals are best adapted survive; others become extinct. (Summary, pg. 1)

Darwin's theory holds firm that changes in the human genome can only take place over thousands of generations, and millions of years. "...Natural selection acts only by taking advantage of slight successive variations; she can never take a great and sudden leap, but must advance by short and sure, though slow steps." (Darwin, pg. 162) Thus the slight variations that allow an individual to survive are handed down to offspring, who then hand them to their offspring, until over the course of a thousand generations the variations have become dominant in the population, altering the genetic code. Darwin's theories and his research upon which they were based became the accepted scientific explanation for variations within a species, and to this day are taught in basic biology classes. Though unexpected by Darwin, the idea of "survival of the fittest" (a phrase Darwin did not coin, in fact initially rejected) quickly spread from the science of biology to that of sociology, creating fervor among philosophers and some sociologists who applied the theory of natural selection to human existence in what they termed Social Darwinism, which seemed to explain major disparities between rich and poor, the intellectual elite and the common man. American capitalists and upper-class Britons embraced the social theory, as it allowed them to easily "believe that they deserved their relatively comfortable fates. The dismal lot of less fortunate people, such as Irish famine victims, could be regarded as just in that it served to remove the less fit; regrettable, perhaps, but correct, and above all *natural*". (Mills, pg. 134) As was to be expected, these "less fortunate people," and those that purported to represent them, did not agree. "Christians hated the premise of natural selection based on competition, which gave the theory an emphasis seemingly based on struggle and strife. While religion spoke to

charity and predicted the meek would inherit the earth, evolution seemed to suggest the weak should just die.” (Mills, pg. 141)

### **Explaining the Unexplainable: Epigenetics**

Scientists since Darwin’s time have elaborated on his theory of evolution, however it was the invention of the electron microscope in 1931 by Germans Max Knoll and Ernst Ruska which opened the door to the world of microbiology, allowing a glimpse into the tiniest structures that together constitute life. “Electron microscopes generate images of microstructures with much higher magnification and resolution than light microscopes. Such high resolution makes electron microscopes extremely useful for revealing ultrafine details of material microstructure.” (Leng, pg. 79) So revolutionary was the power of the electron microscope in changing how we understand biology, Ernst Ruska was awarded the Nobel Prize for Physics in 1986.

One of the microstructures revealed by the electron microscope, discovered in 1953 by James Watson and Francis Crick, would forever alter the understanding of life: DNA, the building blocks of all life on the planet. “The discovery of the structure of DNA catalyzed the development of molecular biology and led to spectacular advances in the knowledge of genetics and cell biology.” (Schwartz, pg. 282) As scientists began to study the now visible double helix structure of DNA, they also identified its importance in the study of evolution. “Evolution—the study of changes in populations, leading via natural selection to the adaptation of species to their environment—experienced a strong impact from this molecularization as populational changes became interpreted in terms of shifts in genotypes on the basis of genetic drift or mutations in DNA sequences.” (Speybroeck, pg. vii)

The discovery of DNA led scientists to unravel, and eventually map, the entirety of the human genome. In doing so, much of Darwin's theory was found to hold true, as "the two-layered structure...illustrated both how the [DNA] molecule could be self-replicating and how variations in particular genes could be inherited." (Schwartz, pg. 282) However, further study of DNA and the human genome made it apparent that, while long term genetic changes fit well into the theory of evolution, short term changes in genetic expression were more frequently being identified, and could not be explained by the accepted mechanisms of evolution. The need to explain these short term changes gave rise to a new branch of genetic science called epigenetics.

The term epigenetics was first used by Conrad H. Waddington in the 1940s. "He hypothesized that a change in genetic action is causally linked to a change in one or more developmental pathways. To denote these dynamic actions leading from the genotype to the phenotype, Waddington coined the term *epigenetics* as a synthesis of *epigenesis*...and *genetics*." (Speybroeck, pg. vii) More recently, epigenetics has come to be defined by these characteristics:

- a) Epigenetics is the study of traits that are heritable but do not involve classical mutations at the DNA level.
- b) There is a second inheritance system — an epigenetic system in addition to the system based upon the precise DNA sequences.
- c) An epigenetic change is a change in the properties of an organism that is inherited but that does not represent a disruption in the total genetic potential of the organism.
- d) Enduring phenotypic modifications (i.e. heritable changes in the appearance or other characteristics of an organism) reflect changes

caused not only by DNA mutations but also by nongenetic or “epigenetic” mechanisms.

e) There is a solid body of evidence demonstrating that enduring modifications can be induced in the properties of cells via the presence of environmental stimuli; these modifications continue to be expressed for many cell divisions after withdrawal of the inducing stimulus. (Menger, pg. 263)

Since epigenetics rules out long term evolutionary change of the genome itself as a cause for changes in gene expression, it must look elsewhere. Thus, “multiple contexts, such as the nuclear and intracellular contexts that directly impinge on the genome, but also the intercellular, organismic, and environmental contexts in which a functional genome is embedded, can no longer be neglected.” (Vijver, pg. 2)

Darwin found it “preposterous” that genetic expression could be caused by mere external conditions, “but recent advances in epigenetics show that some environmentally induced alterations in the phenotype are in fact heritable.” (Ruden, pg. 242) In a study headed by Dr. Lars Olov Bygren of the Karolinska Institute in Stockholm, researchers “amassed historical evidence suggesting that powerful environmental conditions (near death from starvation, for instance) can somehow leave an imprint on the genetic material in eggs and sperm. These genetic imprints can short-circuit evolution and pass along new traits in a single generation.” (Cloud, pg. 1) Specifically, Bygren chose as his research population the residents of his home county of Norrbotten, Sweden, which is a remote area with a small but constant population. “Norrbotten is so isolated that in the 19th century, if the harvest was bad, people starved. The starving years were all the crueler for their unpredictability. For instance, 1800, 1812, 1821, 1836 and 1856 were years of total

crop failure and extreme suffering. But in 1801, 1822, 1828, 1844 and 1863, the land spilled forth such abundance that the same people who had gone hungry in previous winters were able to gorge themselves for months.” (Cloud, pg 1)

Bygren and his colleagues began collecting data on the male lineage of families that had lived in the Norrbotten area for many generations, and his conclusions after studying the data were surprising: the sons and grandsons of those who experienced the winters of great abundance and gluttony lived on average six years shorter than the offspring of those who did not. Even more surprising, “once Bygren and his team controlled for certain socioeconomic variations, the difference in longevity jumped to an astonishing 32 years.” (Cloud, pg. 1) The implications of the research are clear: environmental stressors can leave a genetic imprint that is handed down from generation to generation. In the case of the Norrbotten residents, starvation followed closely by gluttony during the early- to mid-1800s left an epigenetic marker passed on to offspring, making it more likely the offspring’s gene for gluttony would be triggered, which in many cases caused the offspring to over eat, and thus they lived shorter lives.



*Three Generations: Dr. Lars Olov Bygren, with son Magnus and grandson Ludvig*

Epigenetics “has implications for the way in which we should view heredity and evolution. In particular, recognizing that there are epigenetic inheritance systems through which non-DNA variations can be transmitted in cell and organismal lineages broadens the concept of heredity and challenges the widely accepted gene-centered neo-Darwinian version of Darwinism.” (Jablonke, pg. 82)

Epigenetic markers have actually been known to scientists since the 1970s, however DNA was the main interest of the scientific community at the time, and the importance of these markers in explaining gene expression has only in the past 20 years begun to be explored. In fact, “researchers have begun to realize that epigenetics could also help explain certain scientific mysteries that traditional genetics never could: for instance, why one member of a pair of identical twins can develop bipolar disorder or asthma even though the other is fine. Or why autism strikes boys four times as often as girls. Or why extreme changes in diet over a short period in Norrbotten could lead to extreme changes in longevity. In these cases, the genes may be the same, but their patterns of expression have clearly been tweaked.” (Cloud, pg. 3)

### **Epigenetics and Ritual**

Such epigenetic markers can have far reaching effects on human existence, as they make it possible for consistent environmental behavior and interaction, and their consequences, to be passed on from parent to offspring, creating a higher likelihood that the offspring will continue the behavior of the parent, and thus hand the same marker to future generations. Current research has shown that the environmental stressor need not be extreme, as in the case of Dr. Bygren’s starvation and gluttony study. In fact, “there’s evidence that lifestyle choices like smoking and eating too much can change the epigenetic marks atop your DNA in ways that cause the genes for obesity to express themselves too strongly and the genes for longevity to express themselves too weakly. We all know that you can truncate your own life if you smoke or overeat, but it’s becoming clear that those same bad behaviors can also predispose your kids — before they are even conceived — to disease and early death.” (Cloud, pg. 2) These same

epigenetic markers can feasibly explain the propensity toward the consistent practice of ritual throughout the world, and the seemingly inherent need to carry out these rituals from generation to generation. To make this connection, an understanding of the origin of ritual is necessary.

### **The Mystery of Ritual**

While placing a concrete definition on ritual is elusive at best, it is possible to explore and understand the reasons for the presence of ritual in human life. At the dawn of cognitive man, the world was a dangerous and confusing place. By nature, man was compelled to endow this unknown landscape with meaning, and to carve out a distinct place for himself within it. Individuals came to understand the value of strength in numbers, and rituals were born to help cement their sense of community. For unknown reasons, the sky wept and the ground trembled, and rituals were born to explain why. As man's capacity for reasoning grew, so did his need to master his environment, to control and organize it. In order to satisfy this cognitive imperative, this need to know, man created myths to explain that which he did not understand, and created rituals as an active solution to the problem of the myth.

As part of an active solution to that which is unknown, ritual became, in a sense, a teacher, a fount of perception and realization, and as such it is indispensable:

[Ritual] enlivens the memory and links the present with the relevant past. In all this it aids perception. Or rather it changes perception because it changes the selective principles. So it is not enough to say that ritual helps us to experience more vividly what we would have experienced anyway. It is not merely like the visual aid which illustrates the verbal instructions for opening cans and cases. If it

were just a kind of dramatic map or diagram of what is known it would always follow experience. But in fact ritual does not play this secondary role. It can come first in formulating experience. It can permit knowledge of what would otherwise not be known at all. It does not merely externalize experience, bringing it out into the light of day, but it modifies experience in so expressing it. (Douglas, pg. 79)

Humans by nature are individualistic, yet the desire to be included in a social group has been ingrained to the point that most people must experience a significant level of social cohesion in order to maintain a physically and psychologically healthy lifestyle. “In fact, social unity is a common theme running through the myth associated with most human rituals.” (D’Aquili, pg. 135) It can be argued that this need for social cohesion first came about as a defense mechanism against the harshness of early man’s environment, and was ingrained generation to generation via the mechanism of epigenetics. The structure and dynamics of ritual proved a powerful means by which humans could supersede their individuality and participate comfortably within a close-knit social network. “[Ritual] follows highly structured, standardized sequences and is often enacted at certain places and times that are themselves endowed with special symbolic meaning. Ritual action is repetitive and, therefore, often redundant, but these very factors serve as important means of channeling emotion, guiding cognition, and organizing social groups.” (Kertzer, pg. 335) Ritual’s formality allows a continued sense of individualism and distance, while its repetition allows for a strong sense of social cohesion. Rhythm and repetition are integral to the ritual experience: “the various ecstasy states that can be produced in man after exposure to rhythmic auditory, visual, or

tactile stimuli produce a feeling of union with other members participating in that ritual.” (D’Aquili, pg. 135)

Combined with formality and rhythmic repetition, mental imagery also plays an important role in the structure of ritual. The power of this combination within both myth and ritual allows members of a community and culture to face and conquer the unexplainable. The community believes, unquestioningly, the myth, and finds comfort and strength in the action of the ritual. Claude Levi-Strauss’ observations of the Puna Indian ritual wherein a shaman “cures” a female’s difficult birth exemplifies the power of a society’s ingrained belief:

The sick woman believes in the myth and belongs to a society which believes in it. The tutelary spirits and malevolent spirits, the supernatural monsters and magical animals, are all part of a coherent system on which the native conception of the universe is founded. The sick woman accepts these mythical beings or, more accurately, she has never questioned their existence. What she does not accept are the incoherent and arbitrary pains, which are an alien element in her system, but which the shaman, calling upon the myth, will re-integrate within a whole where everything is meaningful. (Levi Strauss, pg. 374)

The Puna Shaman does not cure the woman with medicines or antibiotics, but rather “provides the sick woman with a *language*, by means of which unexpressed, and otherwise inexpressible, psychic states can be immediately expressed.” (Levi Strauss, pg. 374) Considering this, it cannot be underestimated the power inherent in ritual and its

mental imagery in forging a bond which can hold together and strengthen a culture for centuries and even millennia.<sup>1</sup>

### **Epigenetics and Religion**

The most apparent cultures bound together for millennia, and arguably the most consistent and frequent enactors of ritual, are the world's many religions. Religion relies upon the ability of ritual to hold its communities together. "Religion was made up of a series of acts and observances, the correct performance of which was necessary or desirable to secure the favour of the gods or to avert their anger....Religion did not exist for the saving of souls but for the preservation and welfare of society." (Robertson Smith, pg. 29) These rituals became integral to the community's belief in its ability to remain a going concern, and as such were interwoven into all aspects of communal life. As children were born into the community, religious rituals were performed at various stages to ensure the child's welfare and participation in the community belief system. "Religion was the driving force behind incorporation of an infant, a child, or an adolescent into the community of believers. It determined what rites were needed, who could preside over them, the location, the participants' script, the equipment used, and the age and gender of the initiate." (Pleck, pg. 162)

It has been generally accepted in the anthropologic and sociologic sciences that the propensity toward adopting a particular religious preference throughout an individual's life is due to the devout practice of that religion's rituals with family members, and participation in that religion's community during the individual's

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<sup>1</sup>Excerpt from: Hennigan, Brad. *Mental Imagery and Ritual: Building Blocks of Social Consciousness*. 26 February, 2010.

formative younger years, coupled with an inherent fear of supernatural punishment fostered by the authority figures in the church and the family. “Considerable ethnographic evidence suggests that the threat of supernatural punishment for norm transgressions exerts a powerful effect on people’s behavior—believers literally alter their everyday decisions in order to avoid supernatural retribution. Not only is supernatural punishment commonly feared in diverse cultures around the world, both ancient and modern, it is also commonly linked to taboos concerning life or death collective action problems, such as scarce resources, food sharing, hunting, who can have sex with whom, divisions of labor, defense, or warfare.” (Johnson, pg. 31)

Going back, however, to Darwin’s feeling that it is preposterous that mere external conditions could make such a dramatic impact on an individual’s behavior, it is plausible that, rather than being combined with the purely environmental factors of devout familial and community practice, the fear of supernatural punishment is coupled with an epigenetic predisposition toward following the rituals, and the forced devout practice of the rituals during formative years simply triggers this predisposed gene expression. This argument is supported in the workings of the education system, wherein repetitive, rote methods are devoutly utilized over long periods of time to teach subjects such as foreign language and mathematics, and yet many students still do not excel, and some utterly fail. If devout repetition were solely responsible for the ability of all students to learn mathematics, then all students would be rocket scientists. Clearly this is not the case. Rather, certain students have a predisposition, arguably epigenetic in nature, toward excelling, be it in math, science, art, or auto mechanics.

It is logical, therefore, that the son of a devout Catholic, who was himself the son of a devout Catholic, as was his father, his grandfather, his great-grandfather and so on, being raised immersed in the rituals and community of Catholicism, would be highly likely to embrace the community and teachings of the Catholic church, and that this likelihood is based on a combination of immersion and predisposition due to one or more epigenetic markers. As with many realities of human existence, this predisposition has been recognized, understood, and exploited for centuries, with modern science now able to offer an explanation into its mechanics.

### **Epigenetics and Catholicism**

Catholicism is one of the oldest and most prolific religions in the world. Since its inception two thousand years ago, the Catholic Church continues to thrive, indeed to see increases in its followers. “At a global level the number of baptized Catholics increased from 1.045 billion in 2000 to 1.166 billion in 2008, with a relative change of +11.54%, an increase only slightly ahead of the world's population growth, which stands at 10.77%.” (Worldwide, pg. 1) The leaders of the church would likely explain this phenomenon as indicative of the status of Catholicism as the one true religion, and newcomers flock to the church as they come to realize this. A more likely explanation is the environmental and epigenetic propensity of the ever-widening pool of offspring of devout Catholic family lines to “follow in the footsteps” of their predecessors. An examination of Catholic rituals and practices suggests that the church has long understood the power of hereditary behavior, without understanding the biological processes behind such behavior. With this knowledge, the church has exploited environmental factors it thought likely to be most influential in the control and manipulation of the masses.

## **Fear, Punishment, and Epigenetics in the Catholic Church**

Perhaps the most powerful means of affecting human behavior is through the implementation of fear: fear of the unknown, fear of punishment. In religion, the fear of supernatural punishment has been a controlling factor for millennia. “The idea of supernatural punishment is common in modern religions as well. Christians who act contrary to God’s will expect divine retribution either immediately, by sanctions (e.g. struck down with an affliction or some other misfortune), or later, in hell.” (Johnson, pg. 32) The history of the Catholic church is littered with institutions and doctrines designed to ignite extreme fear in the general population: the Crusades, the Spanish Inquisition, even the modern era of McCarthyism, often described as a modern witch hunt, headed by Senator Joseph McCarthy, a devout Catholic.

Indeed, Catholics are expected to live a life of fear and suffering, with redemption only being found in God, who can only be accessed through the church.

Accepting the rule of God meant radically changing one’s order of values. There must be no divided loyalty: every form of attachment, whether to family, property, business, or whatever, must be relegated to second place in the heart of one who aspires to follow Jesus....Service of the kingdom might even mean the complete renunciation of all material goods; when Jesus sent out his messengers to spread the good news he wanted to go as poor men, and he recommended celibacy for the sake of the kingdom. In any case, every follower of Jesus must deny himself, for the kingdom could not be brought in without suffering. (Bokenkotter, pg. 12)

One of the Catholic Church's most significant and long lasting campaigns for the instillation of fear were the Crusades, which began with Pope Urban II's proclamation at Clermont in his home country of France on November 27, 1095, and continued in a storm of violence and bloodshed for two hundred years. Before Urban II could make his proclamation, however, the seeds of the rights of the church to call its believers to arms were sown earlier in the 11<sup>th</sup> century with Pope Leo IX's self-led military campaign against the Normans in southern Italy. "His army, summoned to a war which he stressed was defensive, was a papal army, led under the papal banner, and the soldiers in it were offered remission of penance and absolution from their sins." (Smith, pg. 5) Though Leo IX was criticized for his actions, each of his successors also called upon the faithful to defend the faith. Pope Gregory VII was the first to see the wisdom in proving the Holy See had the right to call to arms, and commissioned the scholar Anselm of Lucca to "put forward a strong theoretical justification for Christian holy violence with reference to precedents and authorities, drawn especially from the Fathers, above all St. Augustine of Hippo." (Smith, pg. 6) Anselm was ultimately successful in culling together such a justification through the writings of Augustine, and "he was able to present a coherent body of thought emanating from one the most powerful intellects Christian civilization has produced. And among Augustine's ideas cited by him was that of warfare approved of and even directly commanded by God, who could intervene physically on behalf of his chosen instruments." (Smith, pg. 6)

The promise that fighting and killing in defense of the church would result in remission of penance and absolution of sins was carried through from Leo IX and into the Crusades, becoming one of the church's most influential means of recruiting soldiers.



*Protestants burned at the stake for refusing to deny their faith (Heritage Images)*

The fact that laymen would kill for the church in order to be absolved of their sins fits well with the theory of the fear of supernatural punishment. The participants in the crusade not only inflicted terror upon those they forced Christianity onto, but in doing so relieved themselves of the fear of supernatural punishment. Thus the Catholic church succeeded in using fear in many forms to exert control and influence over the masses, and because the campaign of fear

lasted for centuries, and the honor of

participation in the Crusades was commonly handed down from father to son, the possibility that epigenetics played a role in the perpetuation of an extreme commitment to the church must be considered.

The premise that the Catholic Church was aware of the power of ritual in controlling the masses is supported by the church's combination of first, the instillation of fear, and second, its rites of punishment. The church created a doctrine of specific punishments, called penitentials, for each and every offense it could imagine, and incorporated these punishments into its ritual, to be handed down from generation to generation.<sup>2</sup> The ritual aspect of the punishment occurred in two ways: private penitence,

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<sup>2</sup> Far too extensive to be listed here, for reference see: *Medieval Handbooks of Penance* by John T. McNeill.

in which sins were confessed in private to a priest or higher clergy; and public penitence, which was reserved for matters of public wrongdoing. The latter was used extensively in the early church, with the position that all sins against the church were sins against the public. Because the punishment for a sin requiring public penance actually took place in public for all to see, “it gave more consideration to the disinclination of human nature to undergo public shame.” (McNeill, pg. 176) Such a ritual is evidence of the ability of the church’s leaders to understand the psychological power of fear and punishment, although they were not aware of the possible biological result: epigenetic markers being placed by such constant and consistent environmental factors, resulting in a hereditary likelihood of generational offspring accepting the doctrines of the church due, in part, to a genetic expression of a fear of supernatural punishment.

## **Conclusion**

“Someone once said that he would rather have a bad hypothesis than no hypothesis. This is because a bad hypothesis at least stimulates thought and discussion, whereas no hypothesis is sterile and non-productive.” (Menger, pg. 259) With this in mind, it is important to note that the hypothesis presented in this paper is purely speculative. It is not the author’s belief that the paper puts forth a bad hypothesis, however there is no scientific evidence supporting the premise that, specifically, the leaders of the Catholic Church understood and used the epigenetic mechanism of heredity as a means of controlling large populations and of proliferating the numbers of the Catholic faithful. That said, the Catholic Church has, in fact, been successful for millennia at mass manipulation and adding to its ranks. The Catholic, non-scientific explanation of divine inspiration among its clergy and followers notwithstanding,

epigenetics offers a concrete basis for an as of yet only speculatively explained mass behavior pattern. At minimum, the hypothesis contained herein warrants further study to determine whether the possibility of a definitive biological mechanism with epigenetics at its core exists as a scientific explanation of such mass behavior.

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