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The Biology of Secularization

Jay R. Feierman

University of New Mexico (retired)
Rio Rancho, New Mexico 87144, USA

e-mail: jay.feierman84@gmail.com

Abstract:
For the past 500 years, to varying degrees, the processes of religious secularization have been occurring in what today are the wealthy, highly educated, industrialized nations of the world. They are causing organized religion, as a social institution, to go from being a very important influence on the lives of people and the nations in which they live to being a smaller influence, or almost no influence at all. Various disciplines from theology to psychology to sociology have tried to explain secularization, each discipline contributing something unique. One discipline that has not contributed has been biology. From a *biological* perspective, based on observation and reasoning, at least one of the ultimate functions of the physical forms associated with religion appear to be that of in-group marker for a breeding population, which, as will be shown, is how all religions start. Religions structure larger human populations into smaller "clusters" that are separate in-group breeding populations. The clustering into smaller in-group breeding populations prevents the spread of contagious diseases and creates inter-group competition and intra-group cooperation, both of which have contributed to human eusociality, a very rare type of social organization that will be explained. As the physical forms of religion are losing this in-group-marker function of clustering populations with modernity, a general biological principle comes into play, which is "form follows function, and as function wanes, so does form." When applied to religion, "form" means the physical components by which all religions are built. The specific meaning of "physical," as used here, will be explained in the article. This biological perspective, which is counter-intuitive and can generate testable hypotheses, should complement, not compete, with perspectives from other disciplines. Physical forms in biology can and often do have more than one function, so the same form with a biological function can also have psychological and theological functions. The physical forms of religion are its objects of natural (genetic and cultural) selection. As socio-economic modernity spreads through the world, the evolutionary biological trajectory suggests that religion, as a social institution, will eventually become extinct.
Keywords: biology, breeding population, eusocial, evolution, extinction, gene-culture co-evolution, in-group marker, marriage, natural selection, religion, secular, secularize, secularized, secularization.

1. Introduction

The common meaning of the transitive verb "secularized", which requires an object, is to make secular; separate from religious or spiritual connections or influences. The word "secular" is an adjective, which must modify a noun. Something has to be secularized or be secular. Both "secularized" and "secular" are not stand-alone concepts. They both tell us something about something else. There are related terms as well, such as the noun "secularization," which is used in the title of this article and means the physical processes of secularizing. There are other related noun words as well: "secularity" (a view or position that is secular), "secularism" (indifference and rejection of anything religious) and "secularist" (an individual who advocates the separation of the state from religious institutions). Secularization is a series of processes, marked by gradual changes that lead toward a particular result.

From a *biological* perspective, "a particular result" is not a goal or purpose of the processes of secularization, as natural selection has no goals. It only operates in the present and has no brain to think about the future. To presume it can have a goal or purpose sometime in the future is called teleological thinking, which is discouraged in the life sciences. Where the processes of secularization are heading can only be predicted, almost to within the realm of scientific certainty, by looking back over the past 500 years. But, hindsight-generated foresight does not a scientific theory make. Any prediction made by hindsight is one made by simple observation of what has been occurring over the past 500 years and then applying deductive reasoning that the trajectory will continue in the future.

Before one writes about these secular-related terms from the perspective of biology, one must know what is/are the noun(s) object(s) to which they will refer?" There are many possibilities. Examples include views, positions, beliefs, experiences, paradigms, individuals, families, in-groups, polity (political entities from tribes to nations), social organizations, social institutions, and even historical ages, as in Charles Taylor's *opus magnus*, "A Secular Age" [42].

Although "religions" can be defined in many different ways, in this article, religions are human-made social institution, as compared to "religiosity" which is a more anthropological term that reflects how people practice religion and includes such things as religious feeling, thoughts and beliefs, spirituality and other private religious experiences. There are also secular social institutions, such as political parties and secular states. In much of the modern world today, (generic) church and state imply two separate social institutions. But in other parts of the world, such as some Muslim theocracies and many tribal societies, the two are not separate. At other times, the distinction between what is religious (sacred) and secular (profane) breaks down [12]. For example, in many historical and some extant cultures, religion is not even a separate category from all that makes up the culture. In some societies people do not even have an equivalent word in their language for what people of the Abrahamic faiths in English call "religion." The Old Testament and the Qur'an are both religious and law books. Sharia Law is religious law.

Although it is difficult to speak generally about "religion", given the diversity of world religions, the article is not about theistic religion any more than deistic religion, which really has to do with whether a god who is believed to have made the world, intervenes in it or not. What is being said has as much to do with animist tribal religions as it does with the post-axial world religions. That being said, many of the examples come from the theistic, Abrahamic religions primarily because of better author-familiarity. To understand what is secular, one must first understand what is religious, although almost any single definition of "religion" will have exceptions and fail. With that understood, there is the concept of "a-religious", which means non-committal or professedly neutral concerning religious matters. A-religious is in contrast to atheism ("I don't believe there is a God") and agnosticism ("I don't know if there is a God, but at least I've thought about the question"). On census forms in some jurisdiction, when one's "Religious Preference" is queried, there is now often one choice called "None". Sociologists of religion have studied "Nones" [47], who are not necessarily a-religious, atheists, or agnostics. Many "Nones" claim that they are religious but don't profess to any particular organized religion or denomination

within a particular religion. Some just refer to themselves as "Christians" or "believers". There are also those who claim to be spiritual but not religious [19], religious without God [10], and to believe in God without religion [38].

From a biological perspective, the physical forms that make-up human culture can evolve. They are considered a part of human biology. Genetic and culture selection are two kinds of Darwinian natural selection. Although the mere mention of the word "evolution" can sometimes cause great distress in religious fundamentalists in all three of the Abrahamic faiths, this article is not about whether God or natural selection created life in general and human life in particular. Rather, the article just uses Darwinian evolution by natural selection as a well tried and tested general biological theory with good predictive potency to understand a small component of the processes of secularization.

Because several different disciplines study the processes of secularization, it is important to appreciate that "explaining" these processes, which is what each of the disciplines try to do, is not a one-zero sum game, where for one explanation to be useful all others have to be rejected. There are many different biological, psychological, and theological perspectives that can address the question of why the wealthy and well-educated industrialized nations of the world are in varying stages of the processes of secularization. Each discipline that studies secularization acts like the blind man touching only one part of the elephant. Only a fool would believe that a single discipline-generated explanation about features of the elephant's tail could give one a comprehensive explanation of this elephant in particular, or worse, all elephants in general. Hopefully, the collation of all of these different discipline-generated explanations of the processes of secularization will one day give a broader picture than what can be achieved from any one discipline alone.[1]

Only scientific theories whose predictive potency have been well tried and tested should be used as explanations for empirical data on secularization. Otherwise, all we have are *post hoc* "just so" stories being explained by the currently in-fashion paradigms *du jour*, most of which rarely stay fashionable for more than a few academic generations. A discipline-specific scientific theory of the processes of secularization with predictive potency need not be applicable across all the disciplines that study the processes of secularization. There can be biology, chemistry, and physics theories of a bending knee joint, each theory useful primarily to the particular discipline.

One should already appreciate the complexity of what we call "religion," and as a result, the complexity of what is called "secularization". Irrespective of how "religion" is defined, it is presumed that all readers believe that the three Abrahamic faiths – Judaism, Christianity, and Islam – are "religions." In the next Section we will explore some extant religion-like social institutions that are, so to speak, around the edges of religion and that blur the distinction between the sacred and the profane. This must be taken into consideration in understanding secularization, as these types of institutions could very well continue to exist even when the more formal, recognized religions eventually give way to secularity.

2. Religion-Like Social Institutions

Quakers (or The Society of Friends) [2], which has several divisions, believe that God is within everyone; and when one speaks sincerely from the heart, it is the "Word of God." A minority of Quakers have unstructured "Meetings for Worship" services with no clergy or leader. The congregants walk in to a plain, unadorned-walled room, except for a large clock on the wall. They sit for an hour on chairs around the four walls facing inward and looking at each other. There is total silence in the room. At any time within the hour, anyone can stand up and speak for as long as he or she wants. Or, no one can speak at all for the hour. Based on the time on the clock, everyone stands up and leaves one hour after the meeting started. Is it a religion?

There is also secular humanism [23], which acts like a religion without a deity and which is contentious for religious tax-free status as a religion in various jurisdictions.[2] Although there are many other religion-like examples that could be given, including what some people would include "the new religion" of environmentalism and global warming [42], Alcoholics Anonymous ("AA")

is a good place to end the religion-like discussion. AA is an international, non-profit, free of charge fellowship, started in 1939, by and for persons who need help because of their use of alcohol. They believe in a non-specified "power greater than ourselves" who can restore the alcoholic to sanity. According to AA's own data, their "Big Book," which is analogous to a canonical sacred text, has sold more than 30 million copies in the English language alone and can even be downloaded free of charge [3]. It has been translated into 67 languages. AA exists in over 170 countries and claims a membership of at least 2 million. The fellowship considers themselves spiritual but not religious.

3. The Noun Object(s) of Secularized and Secular in This Article

Given the above discussions of religion-like social institutions, it should be obvious that secular is not a mutually exclusive category from religious. Secular is one end of a continuum with strict religiousness or religiosity at the other end. One could even say, although there would be objections, that secular is part of a normal distribution of religion with secularists with little religion in the left tail of the normal distribution and religious fundamentalist extremists (in any of the Abrahamic faiths) with too much religion in the right tail. We now need to determine what the noun-object(s) of secularized and secular will be in this article, given the large number of choices. Because this a biological and methodological naturalism approach, the noun-object(s) of secular and secularized has or have to be a form or forms that are observable with the senses. The term "form", which is distinct from "function", will be discussed in the next Section. In this article *the noun-objects of secularized and secular will be human persons and also the nations in which they live*.

The nations are important to consider because some of the demographic data on secularization refer to particular nations and the percentage of the population who consider themselves to be secular, measured in many different ways. As an example, in 2018, The Pew Research Center found that only 8% of Swedes went to church at all [32]. Compare that to the Philippines, considered to be one of the most religious Christian nations in the world. Although church attendance is declining, especially among young people, 41% of Roman Catholics in the Philippines still attend weekly Mass [44]. Obviously, Sweden is a more secularized nation than the Philippines.

4. Forms, Functions, and Ontological Realms

To better understand the relationship between forms and functions and why only forms but not functions can be objects of selection, it helps to realize that form and function are the life sciences' two different ontological realms. It is the life sciences' version of ontological dualism that has very little in common with Cartesian ontological dualism. Forms are what things are. Forms exist in the "physical" ontological realm that contains mass, energy, force, space, time and information. Functions are what the forms do conceptually and usually are expressed as present participle verbs that end in "ing," as in "praying". Functions do not exist in the "physical" ontological realm. Functions come into existence (or come "to be") by how they are formally defined and how they are used in discourse.

As an example, the human heart is a form. "Pumping" blood is the non-material conceptual answer to the question, "What does the heart do?" which a less precise way of asking, "What is the function of the heart?" Functions are the answer to "What?" questions. They have to be distinguished from the answer to "How?" questions, such as "How does the heart pump blood?" The answer to this "How?" question will use what is known from physiology and biochemistry and will contain anatomical forms (also called anatomical structures) and their interactions in the "physical" ontological realm.

5. The Initial Objects of Study

In all of the natural sciences, there has to be an initial object of study that is observable with the senses. Sometimes, the initial object of study is chosen to learn something about something else, which is being done in this article. One might ask, "Why are religions themselves not the initial object of study to understand secularization? They seem to be observable with the senses". The reason is that although religion evolved by natural selection, different religions themselves are too heterogeneous and complex and contain to many functional and purely subjective features that are not all forms that potentially can be objects of selection and adaptations. The transition from religion to secular is through a series of evolutionary processes, but they are not acting on religion itself as a whole, just certain aspects of religion that are forms.

Religion has some components that are not forms but are completely subjective (e.g., the "feeling" of God's presence), which in the author's opinion, are wrongly called an "illusion" [45] or delusion [8] by some authors. Subjectivity and function-only defined concepts, which are not forms, cannot be "objects of selection," which have to be forms. If we are to understand how religion's evolutionary trajectory is heading towards secularity as a by-product of the decreasing positive natural selection pressures on religion's forms in the wealthy, highly educated, industrialized nations (with of course exceptions), our initial objects of study must be forms that can also be "objects of selection." In summary, forms within religion can be direct objects of natural selection, but religion as a whole, just like people and nations as a whole, cannot be.

In this article, the initial "object of study", which will be used to understand the biology of the processes secularization of people and nations, which are the noun-objects of "secular" and "secularized," will be certain forms within religion that are called *Structural Design Features*, hereafter referred to by the acronym, *SDFs*. They are animate or inanimate forms that have static or moving architectural mass by which they can be defined (not just described). *Architectural mass* means a deliberately-constructed, function-related form. To help understand the word "form", animate forms are the same as "anatomical structures."

There are other evolutionary processes on the path from religion to secular that don't necessarily produce adaptations in populations, like immigration, emigration, cultural imposition, and what is called "genetic drift" and its analog, "cultural drift." Genetic and cultural drift are caused by random (in genetic evolution) or sometimes by mistake or deliberate (in cultural evolution) changes in SDF forms, usually with the same functions, as they are passed across or (with cultural evolution) ~~also~~ within generations. In cultural evolution such changes, when deliberate, usually lead to technological advances with new devices doing the same function (e.g., communicating) better.

In terms of inanimate forms, a piece of black volcanic obsidian is not an inanimate SDF form but an arrowhead made from the obsidian with human hands and flaking tools is. The compilation of letters "mosidu" is not an inanimate SDF form but "sodium" is, as the same inanimate letters are "deliberately constructed" in a specific order to be an agreed-upon linguistic symbol in the English language for a particular chemical-element referent. The linguistic symbol "sodium" can be used in speech or writing to functionally answer a question, such as "What is the metallic element in table salt?"

The value of SDFs is that they can be inanimate or animate, objects of both cultural and genetic natural selection, and potential adaptations. The term "Structural Design Feature", which was first used by Feierman in 2009 [14], gives one a common terminology by which to understand genetic and cultural natural selection as well as their important interaction as gene-culture co-evolution.

6. Secularization of People and Nations as By-Products of Changing Selection Pressures on Religious SDF Forms

First, some terminology. “Ultimate function” is what SDF forms, such as the tails of monkeys or the various animate and inanimate religious SDF forms, were doing when they were first under positive natural selection pressures in an ancestral environment and where they increased in frequency in the population over time. “Proximate use function” is what the SDF form is doing in the current environment. If the environment changes from ancestral times to the present, the proximate use function of an SDF form could have diminished usefulness, compared to its usefulness at the time of the ultimate function. With diminished usefulness, positive natural selection pressures, which kept the SDF form common in the population in the ancestral environment, get reduced. When that occurs, the SDF form reduces in frequency in the population and sometimes in size or complexity in the individuals harboring it, whether the form is animate or inanimate. If there are no positive selection pressures at all on an SDF form, it could eventually disappear, like the inanimate, SDF-form telegraph keys.

The argument in this article is that human persons and nations secularize as a by-product of the reduction of positive natural selection pressures on the animate and inanimate religious SDF forms within religion and upon which religions are built. Appreciate that a reduction in positive natural selection pressure (i.e., it is of little use but does no harm) is very different from the presence of negative natural selection pressure (i.e., it does harm). In biology, “harm” is short for that which produces a reduction in survival and reproductive success, especially of the in-group breeding population to which in-group members belong.

With that as background, it should not be too difficult to appreciate that “secular” (of persons and nations) can result from the relative decrease of proximate use function in previously ultimate functioning animate and inanimate religious SDF forms. Clearly, the ancestral environment in which pre-doctrinal religions first evolved was a very different environment from the current environment in a wealthy, highly educated industrial nation in which doctrinal religions exist [9]. And, as the (ultimate to proximate) function of the religious SDF form decreases, so does its frequency in the population as well as how often it is carried out in individual persons in the population. As an example, even in persons who are relatively secularized, religion can play a small part in their lives during major life changes, such as weddings and funerals. The reduction of religious SDF forms (i.e., how often they are seen or displayed in nations as well as in persons) as their proximate use function wanes is analogous to the reduction in the bones of the human coccyx (“tail bone”) when we lost our tails.

The human coccyx is the result of an evolutionary trajectory that started with our monkey-like primate ancestor’s tails. Around 20-25 million years ago, our monkey-like ancestors, whose descendants eventually became us, came down from the trees, where tails had been useful in grasping and balancing. Once life was no longer lived in trees, these primates became what are known as the savannah apes as well as the savannah-dwelling old-world tailless monkeys that we call baboons. When the ultimate function (grasping and balancing) of tails waned on the savannah, so did the size and shape of the bony SDF forms (i.e., vertebrae) that had formed the tail. What is left of our ancestral tail is the small vestigial group of fused vertebrae at the end of our spine called our coccyx. There is no reason for natural selection to put a lot of valuable time and energy into building an SDF form whose (ultimate to proximate) function is waning. Consider how this applies to the animate and inanimate SDF forms with which religions are built.

In reference to the vestigial concept as applied to cultural evolution, in “The Foundation of Ethology”, Konrad Lorenz [27] wrote about this vestigial principle in reference to changes in military uniforms over the centuries. Certain pieces of metal armor that were originally designed to protect the throat and chest of fighting knights in armor were changed over many centuries to smaller cloth-made status decorations on the front of the uniforms of officers.

This most general biological principle, which applies to both genetic and cultural evolution – “form follows function, and as function wanes, so does form” – is what is being used to

understand the secularization of people and nations in this article. The argument is that there is a reduction in the positive natural selection pressures on animate and inanimate, religious SDF forms in the wealthy, highly educated industrialized nations. These religious SDF forms are in varying stages of becoming vestigial (i.e., of secularizing). They have not acquired new proximate use functions to replace their waning ultimate ones. What these SDF forms are and what their functions are will follow.

7. What Are Some Animate and Inanimate Religious SDF Forms

Religious SDF forms can be *animate*, as in parts of the body, including the brain. They can also be movements of the body. Religious ritualized behaviors (movements) are also animate religious SDF forms. Examples include the "signing of the cross" in most branches of the Christian religion and even the stylized non-vocal behavioral aspects of a priest presiding at a Roman Catholic Mass. The vocalizing behaviors used to produce oral prayers and oral hymns, but not the sounds of the oral prayers or hymns themselves, are animate, religious SDF forms. Similarly, the behaviors used to write sacred texts, but not the written words themselves, are animate religious SDF forms. Religious facial hair, like the Muslim "religious beard", the Orthodox Jewish curled sideburns ("payot"), the Medieval-originated tonsure (bald shaving of the top of the head) of monastic Christian monks and friars, the bald, shaved heads of Buddhist monks, and the circumcised penises of Jewish and Muslim males are all animate religious SDF forms.

Religious SDF forms can also be *inanimate*. Written sacred religious texts containing religious mythical stories, belief-word-prefaced propositions, and the written words of hymns and prayers are all inanimate religious SDF forms. If spoken and when between mouths and ears, the vocalized words in religious mythical stories, belief-word-prefaced propositions, hymns, and prayers are all inanimate religious SDF forms, as they are really just patterned vibrating air molecules. Religion-specific identifying pieces of clothing are inanimate, religious SDF forms. This would include the Roman collar, the vestments worn by priests saying mass, the Muslim hijab and bourka, the Jewish skull cap, etc. The currently fashionable small gold crosses with religious symbolism worn around the neck on delicate gold chains of some Christian women also are inanimate religious SDF forms. In centuries to come, it would not be surprising if small gold-crosses on delicate gold chains around a woman's neck and without any religious meaning became the last vestige of a religious, inanimate SDF form in a previously Christian nation. One can see that today in Japan, where many non-Christian teenage girls wear small gold crosses around their neck purely as jewelry and as a Western-emulating fashion statement.

8. Religious SDF Forms as In-group Markers for Breeding Populations

If we just consider the western, industrialized democracies, especially the heterogeneous "melting pot" ones like the United States, how does one tell the religion of someone else? For some religions, like Islam and Orthodox Judaism, inanimate SDF dress and animate SDF hairstyle are easy give-a-ways. However, for mainline Protestants, Catholics, and non-Orthodox Jews, one usually can't tell someone's religion just by outward appearance other than by racial and ethnic clues and the religion most common among such groups. However, subtle signs, like the inanimate-SDF form small gold cross on a gold chain around a woman's neck, although not able to say which Christian denomination to which the woman belongs, gives an appearance, at least in the present time, that she is not a Muslim or Jew. "Appearance" is the correct word rather than "indication", as a number of Jewish women, who passed as Christians during the Holocaust, wore small gold crosses around their neck. In the language of behavioral ecology, a gold cross around a woman's neck is not a costly nor a hard to fake signal.

In the men's locker room, it used to be possible to determine someone's religion as Jew or Muslim in Europe by their circumcised penis's SDF form, something that did not go unnoticed for Jewish males during the Holocaust, where Jewish women had a better chance of surviving by

passing as Christian than Jewish men. However, in a country like the United States today, about 50 to 60% of all male babies born are circumcised, even though Jews and Muslims make up only 1.4% and 1% of the total population, respectively. So, in the United States, circumcision is no longer a religious SDF in-group/religion marker. And realistically, the presence or absence of a foreskin is not the usual way in any country for casual friends and acquaintances to determine someone else's religion. The same issue applies to female genital mutation, a grotesque animate SDF form that is peculiar to mainly Muslim countries and a few small animist groups. Although theoretically not a religious SDF form, it still acts as one, as the practice is unheard of among people of non-animists, non-Muslim religions. In terms of circumcision, although it is not an outward in-group marker, when a man and a woman get sexually intimate with one another, a Jewish or Muslim woman can identify the man with whom she is with as part or not part of her in-group. And, when the Nazis were suspicious that a man might be a Jew during the Holocaust, they made the man take down his pants to see if he had or did not have a circumcised penis.

For mainline Protestants, Catholics and non-Orthodox Jews, apart from knowing if someone attends a particular religious institution, the usual way that one determines someone else's religion is based on what they say in terms of their expressed belief-word-prefaced propositions, values, etc. And, that is also a relatively easy thing to hide or fake. There are few times in one's life where one has to verbally declare one's religious beliefs to others involuntarily. However, when people do say things that reveal their religion, it is usually in the form of belief-word-prefaced propositions which occur during conversation. This supports the argument about how religious SDF forms act as in-group/religious markers for breeding populations.

In earlier times, especially when humans lived in tribal societies, everyone was of the same religion. There were many in-group markers from language to dress to hairstyle to adornments to religious behaviors and rituals. Religious SDF forms were just one of many intra-tribal SDF forms that signified tribal in-group identity. Orally transmitted religious mythical stories bound the in-group together along with religious behavioral rituals.

9. The Waning of Assortative Mating by Religion

Clergy of all religions are notorious for advocating, in the strongest of terms, that their congregants should only marry people of the same religion. This is especially true among Orthodox Jews [39] and Muslims [22], even though Sharia Law reluctantly allows a Muslim man to marry a Jewish or Christian woman but not a Hindu woman, as she is considered an idolater. However, according to Sharia Law a Muslim woman can only marry a Muslim man. Sunni-Shia marriages are still strongly discouraged as are Roman Catholic-Protestant marriages. In recent times, things are changing in the wealthy, highly educated, industrialized nations. Christian and non-Orthodox Jewish clergy are losing their ability to dissuade their congregants from marrying someone of another faith. Perhaps their advice, at least among the not-yet-secularized, should be considered if one puts a high value on long term marriages. With a few exceptions, evidence supports that same-faith marriages, at least in the United States, have a longer duration than inter-faith marriages [24].

The important thing to appreciate about all these religion-associated SDF forms is that they identify people with a particular religion/in-group within which almost everyone, at least historically, married. Even today in most of the relatively non-secularized world, religion's influence is similar to age, race, socio-economic status, and ethnicity in terms of who marries whom. This especially applies to people of different religions who live in close proximity to one another, often in the same neighborhood, and when there are no physical barriers between them. The preference to marry someone with a feature similar to one's own is called "assortative mating". Religion is one of the main features determining who marries whom in both Western [46] and Asian [20] samples. The barrier to gene flow can be completely cultural, given that particular religions are cultural social institution.

In the United States, which is secularizing slower than Europe [54], assortative mating over the past half century on the basis of religion has been slowly declining among Protestants, Catholics

and Jews with the largest decline among Jews. [36] According to a 2013 Pew Research Center survey [27], between the years 2005 and 2013, 58% of American Jews married non-Jews. Before 1970, it was between 11 and 17%, and in the 1950 census it was only 7% [34].

In Canada, a predominantly Christian nation, only 6% of marriages were inter-faith in 1927 but by 1967, it had risen to 16% [5]. By 2001, the percentage of inter-faith marriages in Canada had only increased to 19%, not much higher than in 1967. That surprisingly small change is because of the sharp rise in religious: non-religious marriages, which do not count as "inter-religious marriage." The population of Canadians who profess "no religion" has increased from 7% in 1981 to 17% in 2001. Ironically, marriage between a person who professes a religion and someone who professes no religion in Canada was higher in 1981 (38%) than in 2001 (25%). That lowering of percentage is thought to be because people who profess no-religion, who are becoming more numerous in the Canadian population, also have assortative mating and tend to marry one another. According to the 2001 Canadian Census, people of almost all religions, living in communities with a low concentration of co-religionists of the opposite sex, are more likely to be in interreligious unions than people in communities with high concentrations of co-religionists [7].

10. Religious Diversity, Not Amount of Religion in a Nation, Determines if Religious SDFs Will Be Significant In-Group Markers

Even though there are large differences between most irreligious [50] and most religious nations of the world [49], SDF forms are acting as in-group markers for a breeding population as a function of the religious diversity within a nation. Religious SDF forms are not going to act as in-group markers for an in-group breeding population in a nation in which the population describes themselves as 98% religious where virtually everyone in the nation is of the same religion. The most religious nations in the world are the also poorest. Very few persons in these poor, almost single-religion nations have ever been outside of the nation to even see someone of marriageable age of a different religion.

In the countries in which 98% of the population considers themselves "religious", there is lots of variance among these countries in religious homogeneity. In Burundi, there are 67% Christian (62% Catholic and 5% Protestant), 32% indigenous beliefs, and 1% Muslim [11]. In Djibouti, 94.1% of the population are Muslim, almost all Sunni [13]. In Somalia, over 99% of the population are Sunni Muslims with 0.01% Christian, 0.01 % traditional religion animists, and 0.1% Hinduism, Buddhism, or unaffiliated.

11. Modern China as an Example of the Difficulty in Evaluating Religious SDF Forms as In-Group Marking Barriers to Gene Flow

In the country claimed by many studies to be the least religious (or most secularized) in the world, China (although it sometimes ties with Sweden) with 90% of the 1.4 billion people claiming to be "irreligious", still has 140 million claiming some religious affiliation. The other problem is simply claiming to not have a religion does not mean one practices nothing that could be considered religious. Just because one claims to not have a religious affiliation, does not mean that one does not have religious feelings, beliefs and behaviors. This applies to Europe as well as to China. By a 2015 Gallup poll, there are five state-recognized religions in China: Buddhism, Catholicism, Daoism, Islam, and Protestantism [1]. One can be imprisoned for practicing a "non-approved" religion.

Religion in China is very complex, which makes understanding secularism even more difficult. In a 2005 survey of five major Chinese cities, only 5.3% of the surveyed population actually belonged to a religious organization while 51.8% belonged to no religious organization and could be by some definitions considered to be "non-religious". However, 23.8% of this so-called "non-religious" sample claimed to regularly worship venerated ancestors, 23.1% claimed they worshipped Buddha or at least self-identified as Buddhist, and 38.5% had beliefs and practices in

folk religions or celestial powers. Many Chinese also claim to have more than one religion and may practice both, one, or neither. Only 32.9% claimed to be committed atheists [52]. City dwellers are easier to systematically poll than rural farming peasants. With hundreds of millions of rural farming peasants left out of the polling, one can't generalize most studies to all of China.

In a 2007 book, Rodney Stark, one of the most respected sociologists of religion, claimed that there were "40 to 50 million devoted followers of Christ in China" [40, p.335]. Only a few years later, 2010 Pew Research Center publications estimated that there were 67 million Christians in China [30]. Whether such a rapid increase in Christianity is plausible in such a short period of time has to be evaluated in light of a number of non-Evangelical Christian religious scholars accusing the Evangelicals of being too optimistic in terms of the number of Christians in China.

It is difficult to get English-language data on the frequency of inter-religious marriage in China today. Most of the data released by the Chinese government are on "mixed marriages", meaning a Chinese national marrying a non-Chinese national spouse, although one can presume that many of these mixed marriages were also inter-religious. In 2006, there were 68,000 mixed marriages "registered" in China [53], a country of 1.4 billion people.

There is evidence that inter-religious marriages don't naturally or usually occur in some parts of China. The data (in English) come from Western China in Cherchen County in southern Xinjiang Province, population 10,000 of which 73% are Uighurs and 27% Han Chinese. The Chinese communist government is offering financial cash incentives as well as housing, schooling and health benefits for the Han Chinese (predominantly Taoists, Buddhists, and traditional religions) to marry the Turkic-speaking, Muslim Uighurs [25]. The issue is both a cultural difference and a religious difference, although, at least among the Muslims, it is difficult to separate the non-religious cultural factors from the religious ones.

It also was reported (in English) by Xing, using 1990 census data from 476 cities in China, that the urban Muslim Hui, who have adopted most of the majority Confucianism Han culture and differ primarily on religion, do marry occasionally with variance in frequency across different cities. Traditionally the majority Han have no restrictions to "out-marriages" but the Muslim Hui have strong taboos, prohibiting its members, especially women, from "out-marrying" with non-Muslims. The literature is conflictual as to how often such "out-marriages" within the nation of China occur [51]. In summary, the degree to which China is really the most irreligious or most secularized nation in the world is contentious given the control of information coming out of the country by the communist government.

12. Eusociality and the Biology of the Processes of Secularization

In order to understand the role of religious SDF in-group markers in the processes of secularization, one must understand eusociality, which is the most successful animal social system on earth. Eusocial animals make up about 1% of all animal species but they are more than half of the number of individual animals alive and their combined biomass is more than the other 99% of species. Most eusocial species are social insects, such as ants, bees and termites. There are only two eusocial vertebrates (teleost fish, amphibians, reptiles, birds, and mammals): two species of mole rats and human beings. There are a number of more-or-less agreed upon criteria for eusociality. They are (1) multi-generations living together, (2) defense of a home locale containing juveniles and often food stuff, (3) cooperative care of the young, and (4) a division of labor that is more than just between the two sexes. Eusociality can be divided into "loose" eusociality and "strict" eusociality. The difference between the two is that in strict eusociality, as part of the division of labor, there is a (potentially-reversible in some species) reproductively suppressed caste and what is called "reproductive skew", where the non-reproducing individuals within the "breeding population" outnumber the "breeders" to varying degree. As of today, human beings in the wealthy, highly educated, industrialized nations easily meet criteria for "loose" eusociality.

There is evidence that as a species, we (i.e., *Homo sapiens*) are moving toward a "stricter" eusociality, as we do have increasing sub-specialization as well as an emerging and growing group

of individuals who are reproductively suppressed by different mechanisms. They include religious celibates, homosexuals, asexuals, transsexuals, and the 30% or more of forty-year old women in many of the industrialized democracies who have never had a child. For all eusocial species, (1) individuals within the in-group breeding population have a way of identifying other individuals as members of their in-group, and (2) all individuals in the in-group breeding population put the welfare and survival of the in-group above that of self. Eusociality's evolution can be modeled by two different "book keeping" methods: kin selection (nepotism) and multi-level selection (selection on both the individual and the in-group breeding population) [48].

Eusocial ants, for example, use chemical pheromones to identify individuals as members of their in-group breeding population, even though they don't distinguish among individuals within the colony. The argument being proposed in this article is that humans use other in-group markers to identify individuals within their in-group breeding populations, but somewhat like ants, they don't always distinguish (i.e., recognize as familiar or know the names of) particular individuals. Among humans, think of soldiers in a large infantry division, who only recognize other in-group members by their uniform and not by personal recognition.

Recall that all religions started out as in-group breeding populations and today, there is still very strong assortative mating for the same religion, stronger in some religions (e.g., Orthodox Judaism and Islam) than others. All ingroup markers have to be SDF forms as they have to be recognizable with the senses. Human beings have many in-group breeding population markers. They include, not in any order of importance, language, dress, hair style, adornments, habits and customs, and many different religious SDFs, from clothing to hair to religion-identifying jewelry and even religion-identifying variations on the general postural theme used in the non-vocal aspects of petitioning prayer [15]. A knowledgeable person can tell, with a fair degree of certainty and by the behavior alone, if someone in petitioning prayer is a Jew, Christian or Muslim.

13. Human In-Group and Out-Group Relations

The argument has been made in the literature that one of religion's primary *biological* functions is clustering larger human populations into separate and smaller, non-gene-exchanging groups. There are two main reasons supporting why this appears to be the ultimate *biological* function of the religions SDF forms, the frameworks upon which religions are built. One reason is that clustering larger human populations into smaller non-gene-exchanging in-groups through taboos against inter-religious marriage, produces a reduction in the spread of contagious diseases for which humans are especially vulnerable. The density of religions (religions/area) increase in direct proportion to the amount of contagious diseases in an area globally [17].

Second is that religions, as in-group breeding populations, create competition between human in-group breeding populations. As a general biological principle, when resources get scarce, in-group breeding populations within the same species get competitive with one another. Competition also makes everything better, which is why free competitive market economies produce better goods and services and are more prosperous than socialism and communism. As a result of the competitive advantage, there would be positive natural selection pressures on the animate and inanimate SDF forms, whose functions lead to competitiveness. And ironically, inter-group competitiveness requires intra-group cooperativeness, so that in multi-level selection, there would also be positive natural selection pressures on the animate and inanimate SDF forms whose functions are in-group cooperativeness, sometimes also called altruism in humans. At times, different human in-group breeding populations also form coalitions to compete with a common enemy or threat. NATO (North Atlantic Treaty Association) is a good example.

The main natural selection pressures on human in-group breeding populations over the past 300,000 years have not been the environment or even predators. Rather, they have been other human in-group breeding populations. In competition for resources, human in-group breeding populations are continually trying to out-smart one another and garner more resources. One common form of human inter-group competition is warfare, where victory depends on the

development of better strategy, tactics, and technology, all of which improve with higher intelligence. Our extremely high intelligence for an animal species is thought to have evolved, at least in part, by sexual selection [29].

This is how sexual selection works. If nubile women preferred higher intelligent men, who usually become higher status men, higher intelligence in humans would evolve in both sexes by sexual selection. In contrast to natural selection, which does not have a brain, women do. A female brain is sexually selecting for a better a male brain, taking cultural factors into consideration. For example, in the 21st century, a mild-mannered, un-muscular certified public accountant has higher "mate value" in terms of being able to better provision a woman and her children than a large and brawny, somewhat aggressive, relatively un-educated brute of a man, who probably could have swung a club and protected the woman and her children better ten thousand years ago. Women's brains are faster than natural selection in keeping up with rapid cultural changes, especially in technology.

In summary, in all the above-mentioned examples, because we as humans are a eusocial species, especially in times of inter-group competition, individuals put the welfare and survival of their in-group over that of themselves.

14. The Emotional Need for In-group Identification and Membership

The argument has already been made that one of the obvious, main *biological* functions of religious SDF forms, which are the core upon which all religions are built, are that of in-group markers for religions/in-group breeding populations. Although this seems true in the early stages of religion's evolution, in the wealthy, highly educated industrialized nations, religious SDF forms are performing this in-group marking function less and less. That is because there are so many other in-groups to which individuals can simultaneously belong. In such wealthy, highly educated and industrialized nations, individuals, especially those with high degrees of eusocial specialization, can have many different in-groups besides religion to which they can belong at the same time and which often contain people with whom breeding (i.e., marriage) is not prohibited. Examples include nation (i.e., nationalism, whose origin is tribalism), state, neighborhood, job, profession, academic discipline, academic organization and society, trade association, union, political party affiliation, sports team, etc. Identification with and doing volunteer work for a political party with which one shares very strong political beliefs is a good example of an in-group that meets many of the same emotional needs of belonging that one has in a religion. That's especially true because of the many areas of commonality between politics and religion, which are still one in the same today in the Muslim theocracies.

15. Form Follows Function, and As Function Wanes, so Does Form, with Special Reference to Religion

To review, one of the most general principles of *biology* – and especially true of comparative anatomy where one traces the evolutionary history of forms through different species – is that *as the function of a form wanes (especially if not replaced by another function), so does the form whose function it is*. The form becomes vestigial, as applied to religion, the forms are the animate and inanimate SDF forms associated with particular religions. There are many reasons why religious SDF form's functions as in-group markers for breeding populations are waning. One of them, which is being emphasized in this article as it has the most biological salience, is the fact that in the wealthy, highly educated industrialized nations, religions are now competing with other social institution in-groups that meet the human need of in-group belonging. That was covered in its own Section above.

When children get to middle school, high school, and for some the university, they have to weigh these simple religious answers against what they are learning in biology, chemistry and physics. They also have to compare these simple answers they were taught in religion classes based

on religious mythical stories to what they see and learn on the internet, from teachers and then professors, from talking to other children of different religions or who are secularized. They also have to weigh what they learned once they realize that they can think for themselves about the big questions in life. So now, in the wealthy, highly educated, industrialized nations, religion is competing with science for answers to life's big questions. By the time that children get out of elementary school and begin to learn science, many come to believe that science provides better answers than religion. That might cause at least some of them to doubt other things they were taught about life and other aspects of living by their religion.

As one specific example, on page 7 of the New Saint Joseph Baltimore Catechism [37], under the Section, Prayers for Every Day, it says, "after an ejaculation, boys are supposed to say a particular prayer: 'My Jesus, mercy. Most Sacred Heart of Jesus, have mercy on us, Mother of mercy pray for us. Jesus, Mary and Joseph, bless us now and at the hour of our death.'" Appreciate that this is being taught to "upper elementary school children", who probably don't even know what the word "ejaculation" means. By the time that these children get to middle and high school, the presumption for adolescent boys (but not for adolescent girls, who don't ejaculate but who also masturbate, almost as often) is that orgasms outside the "benefit of marriage" and not open to procreation are bad. Appreciate that this book was published in 1969, in the middle of the sexual revolution.[3]

By the time these previously catechized Roman Catholic teenagers became middle age in the United States, according to a 2006-2008 National Survey of Family Growth by the Guttmacher Institute [35], among a sample of over 13 million Roman Catholic women who had ever had sex, married or not, 98% of them had used a contraceptive method other than natural family planning, which according to the Magisterium of the Roman Catholic Church, constitutes "gravely sinful matter" that is "intrinsically immoral" and "is thus never permissible for any reason or purpose whatsoever" [6].

Historically, one of the most important theological, proximate use functions of the written teachings (which are inanimate SDF forms) of the Roman Catholic Church has been to teach and guide its members toward behavior considered to be moral. However, in modernity, at least since the sexual revolution of the 1960s, that function of the Church is waning both for the issue of masturbation, which is virtually universal among all young teenagers, and for what is called "artificial contraception", which at 98% use among Roman Catholic women who have ever had sex, is even more universal.

In earlier times, even a few centuries ago, religious SDF forms found in religious mythical stories were culturally isolated from individuals who believed other religious mythical stories. Today, educated persons, certainly at the post high-school level, have knowledge of more than one religion's mythical stories, even if just cursory. However, that's enough information to know that if two religions opine differently on the same topic, one must be false if the other is true. An educated person realizes that her religion might not be true. An example is whether or not Jesus is considered a deity or just a prophet, about which Christianity and Islam are not in agreement.

Another reason for the waning of religion's functions in the wealthy, highly educated industrialized nations is economic security. With a few exceptions, the most religious nations in the world, most of which are now in the peri-equatorial parts of the world between the Tropics of Cancer and Capricorn, are very poor. People have lots of economic insecurity. There are many sociological studies of religion that show that the most economically insecure nations are the most religious. The opposite is also true. Being the most economically secure correlates with high degrees of secularism with socialist democracies in Scandinavia being good examples.

Starting in the 1960s, with the so-called sexual revolution, primarily because of the discovery of oral contraceptives for women, what was once a religious in-group breeding population turned into a contracepted mating population with much "looser" borders that were no longer constructed by religion. If one is not going to have a baby as the result of sex, then the religion of the person with whom one is engaging in sex becomes irrelevant. Once sex became uncoupled from the probability of pregnancy, religion's function of regulating with whom and

under what conditions (i.e., “the benefit of marriage”) one could be sexual with someone else waned.

As a part of the sexual revolution, homosexual sexual relations, which were condemned so heavily by organized religion, especially the more conservative factions thereof, became socially acceptable even to the degree of legalizing homosexual marriage in some nations. The objection to “same sex unions” by all but the most liberal religious denominations, were discordant with the values of many young people today, causing them to question religion’s function regarding sexual morality. And, causing even more doubt on the purveyor of sexual morality function of the Roman Catholic Church clergy has been the sexual abuse scandals, starting in the 1980s, of celibate male clergy's sexual behavior mostly with peri-pubescent boys.

In more heterogeneous nations, such as the United States, which contains people of hundreds of different religious denominations, the situation is different from the primarily one-religion nations and one-religion parts of nations in Northern Europe. There are so many different religions in the United States because, apart from all of the standard and mainstream world religions, there is a current trend of free-lance, entrepreneurial “Christian” churches that are not centrally-controlled and franchised branches of more established religions (e.g., Catholic, Lutheran, Baptist, Methodist, etc.). These freelance churches have nondenominational-identifying names. Some of the more entrepreneurial pastors in the large “mega-churches” become multi-millionaires from their non-taxable church “businesses”. These one-of-a-kind, nondenominational Christian churches do not have the same cultural barriers against marriage between their congregants and members of other similar freelance, one-of-a-kind congregations, again causing a waning of the in-group marker function of SDF forms within particular religions.

16. Religion’s Diminished Function as an Authority on Sexual Morality

The institution of marriage itself is on the decline in the United States as well as the other wealthy, well-educated, industrialized nations, with of course variation among them. Going against centuries of organized religion’s control over people’s inter-personal sexual lives, an increasing number of people of marriageable age no longer feel the need to be married to someone with whom they live and with whom they are in a sexual relationship, without or with the creation of children. Even when the analysis is restricted to adults over the age of 30, self-identified atheists, agnostics and those whose religion is nothing in particular are still somewhat less likely than Mormons, Jews, evangelical Protestants, mainline Protestants and Catholics to be married [28]. According to the 2010 U.S. Census data, over 7.5 million unmarried couples live together (which translates into 15 million people). This is a 138% increase since 1990, and an increase in 13 % from 2009 alone. Forty percent of unmarried households have children [26].

To the woos of almost all organized religions, according to a 2017 Pew Research Center Study [41], as marriage rates in the U.S have fallen, the number of U.S. adults in cohabiting relationships has continued to climb, reaching about 18 million in 2016. This is up 29% since 2007, when 14 million adults were cohabiting, according to the U.S. Census Bureau data. Approximately half of cohabiters – those living with an unmarried partner – are younger than 35. However, an increasing number of Americans ages 50 and older are in cohabiting relationships, according to a new Pew Research Center analysis of the Current Population Survey. In fact, cohabiters ages 50 and older represented about a quarter (23%) of all cohabiting adults in 2016. Since 2007, the number of cohabiting adults ages 50 and older grew by 75%. This increase is faster than that of other age groups during this time period and is driven in part by the aging of the post-World-War-II born Baby Boomers.

Against all religious admonitions, with the United States as the example and based on the data above, the trend towards cohabitation “without the benefit of marriage” is steadily rising. Combine this trend with the fact that even among the Americans who marry, almost all have had premarital sex. Data from four cycles of the National Survey of Family Growth, 1982–2002 indicate

that by age 20, 75% had had premarital sex. By age 44, 95% of respondents had had premarital sex [18].

Given all of the above, if one of the main *biological* functions of the SDF forms within organized religion were, as its ultimate function and is as its proximate function, to act as barriers to gene flow between clusters of humans in stratified populations, then the behaviors that ordinarily, without the use of contraception, would lead to gene flow, are less and less under strong cultural selection pressures to be curtailed by organized religions. And as function wanes – prohibiting all sex, with self or others, outside of marriage and even within marriage, only sex that is open to procreation and with someone of the opposite sex to whom you are lawfully married and of your same religion – so does form, where the forms are the SDF forms around which organized religions are built.

The end results are the secularizing processes of persons and nations. The *biological* component, which is the in-group marker for a breeding population component, is just one among many. However, all together the forces diminishing organized religion's functions are strong and in a predictable trajectory heading for religion's eventual extinction. A sad reminder to the author was the magnificent medieval Bremen Cathedral, whose construction began in around 789 A. D. There is now a 1 Euro entrance fee. When the author asked a University of Bremen religious studies professor colleague, "Why do I have to pay to go into a church?" the colleague said, "Oh, no one prays here anymore. It is just a national treasure protected by Germany's Monument Protection Act".

It should also be mentioned that when people mate assortatively by religion, they are not necessarily getting the best mates any more than if they did not assortatively mate by religion. Within a particular religion, presuming the principle of female choice, there is variance among the reproductive values of males. There is some match in mate value between the couple. And, what counted as good mate value in a male hundreds of years ago is not necessarily what counts as good mate value today, as the brains of women know. In a secular society today, individuals are not so limited as to where they can look, as was the case when people assortatively mated more by religion. In Europe today, there is still strong assortative mating by religion among Muslims, who have more than enough religious SDF in-group markers by which they can identify one another. The same can be said of the Orthodox Jews, the few who are still left in Europe.

17. All Roads Lead to Rome Secularization

Art galleries, restaurants, and concert halls now occupy deconsecrated churches in Rome. Today in Western Europe 46% of people, who are now the majority, identify as "non-practicing Christians", 18%, who are predominantly older people, identify as "church attending Christians", and 24%, primarily the younger people, identify as "religiously unaffiliated" [4]. In Italy in particular, it had been widely thought that between 30 and 50% of Italians attended Mass more than once a month. However, a 2004-2005 study by The Patriarchate of Venice showed that the actual Italian church attendance at least once a month was no more than 22.7%, with 7.7% attending one to three times a month, and with only 15% attending every Sunday [21]. Based on all that has been presented in this article, and especially on the historical trend toward secularization that started around 500 years ago, when the time comes, religion will go. Religion's fond farewell says nothing about God, just about religion; and at least from the author's perspective, the transient role religion might have had in facilitating our species eusocial evolution [16].

18. Summary

The role of *biology* in the processes of secularization has been presented in this article with the disclaimer that the forms within religion that are of interest to biology have different functions in psychology and theology. Biology's unique contribution is that it can address how these religious forms can evolve by natural (i.e., genetic and culture) selection. Biology does not pre-empt any

other discipline in its attempt to understand the processes of secularization. Hopefully, it's contribution will complement those of other disciplines, most of which do not even address the issue of how forms in religion could have evolved by natural selection. Psychology and the Cognitive Science of Religion are more concerned with functions than forms, the meaning and significance of which hopefully can now be understood. Theology's contributions are best left to others to explain. Contributions by all disciplines are important and hopefully, one day will fit together into a more comprehensive understanding of the processes of secularization.

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Notes

1. Appreciate also the difference between "explanations" of secularization and a scientific theory of secularization. Most of what we believe today about secularization comes from discipline-specific explanations, none of which meet Popperian-like [33] criteria for a scientific theory: (1) be able to predict, within the realm of scientific certainty, that which has not yet occurred and which can't be predicted by common sense (i.e., the prediction has to be counter-intuitive), and (2) the prediction can't be made by simple observation and inductive reasoning.
2. In many jurisdictions religious institutions are given tax free status, meaning they do not have to pay taxes to the government, like a charity. Secular humanism is contentious in some jurisdictions as a religion, as it has no higher power or deity, which most governments consider one of the elements of a religion.
3. Other functions in the same Baltimore Catechism on page 9, which children had to memorize, address the "Big" questions in life for children, like "Who made us?" and after the answer, "God", the next question for the children to answer is "Why did he make us?" This is all just rote memorization.