Amplifying *Laudato Si'* With the Science of Epigenetics

Ferdinand D. Dagmang♦

Abstract: This paper illustrates how a trans-disciplinary research may broaden the thought horizons of Pope Francis' *Laudato Si'*. Judging from the way epigenetics has challenged the long-standing assumptions held by genetics and the medical sciences, this article will show that the findings of epigenetics have important implications for the way environmental ethics (including bioethical principles) and the language of sustainable development will be formulated in the coming years. Epigenetics showing the effects of environmental impingements on humans, especially on the middle-class/wealthy, provides some evidences that we may have to surrender our central position in the ecosystem because to give due admiration and respect to the ecosystem is really for the benefit of humans and not just of the planet. As it also expands judgment, the science of epigenetics could make us more aware of the limits of development branded as Sustainable.

Keywords: epigenetics, *Laudato Si'*, environmental ethics, sustainable development, interior ecology, impingements

Introduction

It is not the first time that the official Catholic Church has spoken about environmental problems,[1] but the theme of the cry of the poor being inextricably linked to

♦ Dr. Ferdinand D. Dagmang is a Professorial Lecturer at Ateneo de Manila University, De La Salle University, and Maryhill School of Theology. His current researches deal with Basic Ecclesial Communities, popular religion, ethics, sexuality, and the effects of structures/systems on theories and practices. His book/final report on *Basic Ecclesial Communities: An Evaluation of the Implementation of PCP II in Ten Parishes* was released in 2015.

[1] See, Natasha Geiling, "The Pope's Encyclical Isn't the First Time the Catholic Church has Spoken Out on the Environment," (June 17, 2015), https://thinkprogress.org/the-popes-encyclical-isn-t-the-first-time-the-catholic-church-has-spoken-out-on-the-environment-4b3ac6d03888/ [accessed 16 January 2020]

the cry of the earth is an unprecendented Vatican preoccupation in *Laudato Si'*. The "cry of the earth *and* the cry of the poor" has become Pope Francis' rallying cry:

> Today,…we have to realize that a true ecological approach always becomes a social approach; it must integrate questions of justice in debates on the environment, so as to hear both the cry of the earth and the cry of the poor. (LS 49)

Pope Francis, however, is not the first to speak out regarding this connection between environmental destruction and poverty. In 1996, Leonardo Boff published his book, *Ecología: grito do Terro, grito dos pobres.*[2] Obviously, it is in Boff, with his liberation theology background, where one could get the early academic theological treatment of the tandem 'cry'.

Some of the early non-theological voices are in this 1994 book: *At Risk: Natural Hazards, People's Vulnerability and Disasters*.[3] Goldberg cites the most vulnerable based on a UN report[4] on poverty and

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[2] Leonardo Boff, *Ecología: grito do Terro, grito dos pobres* (Madrid: Editorial Trolla, S.A, 1996); English: *Cry of the Earth, Cry of the Poor,* trans. Phillip Berryman (New York: Orbis Books, 1997).

[3] Ben Wisner, Piers Blaikie, Terry Cannon and Ian Davis, *At Risk: Natural Hazards, People's Vulnerability and Disasters,* 2nd ed. (New York: Routledge, 2003 [1st ed. 1994]).

See also, Lucy Scott, "Chronic Poverty and the Environment: a Vulnerability Perspective," *Chronic Poverty Research Centre Paper* 62 (London: Overseas Development Institute, 2006; L.C. Gray, and W.G. Moseley, "A Geographical Perspective on Poverty- Environment Interactions," *The Geographical Journal* 171/1 (2005): 9-23; Anup Shah, "Poverty and the Environment," *Global Issues*, (February 12, 2005), http://www. globalissues.org/article/ 425/poverty-and-the-environment [accessed 16 January 2020]; the United Nations Convention to Combat Desertification (UNCCD), *Global Land Outlook,* 1st ed. (2017) has been written based on previous reports/publications that predate *Laudato Si'*.

[4] Cf. United Nations Convention to Combat Desertification

environment:

> Pensioners left on their own during a heatwave in industrialised countries. Single mothers in rural areas. Workers who spend most of their days outdoors. Slum dwellers in the megacities of the developing world.[5]

The UN report further claims that although the poor are the ones who did the least to produce climate change,[6] they are first in the line of fire. Some guru-representatives of the wealthy nations, however, would insist on a "global energy poverty"[7] and for them the proper thing to do is to focus efforts to alleviate energy poverty. Despite its disastrous impact on the poor, especially on those who are living in the sub-Saharan regions of the world, this "global energy poverty" perspective also highlights the sustainable paradigm approach of industrialized nations even if sustainability of resources, in the long run, is really problematic. As people become more aware of the disastrous effects of the human beings' built environments, environmental thought has become more critical and suspicious of any project or pursuit that still serves human progress or

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(UNCCD), *Global Land Outlook,* 1st ed. (2017).

[5] Suzanne Goldenberg, "Climate change: the poor will suffer most," *The Guardian* (March 31, 2014) https://www.theguardian.com/environment/2014/mar/31/climate-change-poor-suffer-most-un-report [accessed 16 January 2020]

[6] "The drivers of food waste vary: in poor countries, this is primarily due to lack of capacity to store and transport food early in the process, while in wealthy nations, it is caused mainly by retail marketing decisions, consumer profligacy, and the inefficiencies of mass production towards the end of the food supply chain." (*Global Land Outlook*, 127).

[7] Energy poverty refers to the lack of access to modern energy services. See, Suzanne Goldenberg, "Jeb Bush joins Republican backlash against pope on climate change," *The Guardian* (June 17, 2015), [accessed 16 January 2020];

development which also "tended to blame the poor for environmental degradation, ignoring the role of other processes and actors at various scales in causing environmental degradation."[8] Eventually, the language of sustainable development has been seen to justify and mask the perpetration of the historically pathological modern project of progress.[9]

Sustainable development and its fight against global energy poverty have pushed the whole world into these developments:

> …global material use has tripled over the past four decades, with annual global extraction of materials growing from 22 billion tonnes (1970) to 70 billion tonnes (2010).[10]

Instead of riding on the sustainability paradigm, Pope Francis has criticized one of the main drivers of the

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[8] L.C. Gray, and W.G. Moseley, "A Geographical Perspective on Poverty- Environment Interactions."

[9] See, Vandana Shiva, *Staying Alive: Women, Ecology, and Development in India* (London: Zed Books, 1988); Paul Kennedy, *Preparing for the Twenty-First Century* (New York: Random House, 1993).

In the years of Hurricanes Katrina, Rita, and Typhoon Ondoy, the deep ecological, biocentrist, or ecocentrist perspectives became the ultimate positions that insisted on the idea of the ecosystem as a functional unit (Eileen Crist and H. Bruce Rinker, eds. *Gaia in Turmoil: Climate Change, Biodepletion, and Earth Ethics in an Age of Crisis* (London/Cambridge, Mass: The MIT Press, 2010). Following this logic, later environmental ethics has upheld the ecosystem's centrality. Humans have to finally recognize their position in the fringes of the whole autonomous living ecosystem.

[10] United Nations Environment Programme, *Global Material Flows and Resource Productivity: Assessment Report for the UNEP International Resource Panel* (2016), https://wedocs.unep.org/bitstream/handle/20.500.11822/21557/global_material_flows_full_report_english.pdf?sequence=1&isAllowed=y [accessed 19 January 2020].

wealthy nations' habitual pursuit of products: consumerism.[11]

> People may well have a growing ecological sensitivity but it has not succeeded in changing their *harmful habits* of consumption which, rather than decreasing, appear to be growing all the more. A simple example is the increasing use and power of air-conditioning. The markets, which immediately benefit from sales, stimulate ever greater demand. An outsider looking at our world would be amazed at such behaviour, which at times appears self-destructive. (LS 55; italics supplied)

The UN report has this to add:

> In many developed countries, consumer and retail food waste is exacerbated by the rejection of misshapen or blemished but perfectly edible fruit and vegetables, short sell-by dates, and bulk offers that encourage over-purchasing. In the United States, about 70 million tons of edible food is wasted every year. With almost 1 billion people now categorized as obese, the excess consumption of food is now considered by some as a form of food waste. (GLO, p.128)

Nevertheless, the sustainable development paradigm and Pope Francis' *Laudato Si'* have just been looking at the biospheric or eco-systemic picture. They have not paid attention to something that also requires due consideration: the biopsychological dimension of the problem. Many of the depleting and degrading pressures exerted on the planet's biosphere are observable today

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[11] Cf. Pope Francis where he untiringly bemoans the world's proclivity to hedonism and consumerism in *Gaudete et exsultate. Apostolic Exhortation on the Call to Holiness in Today's World.* Vatican: Libreria Editrice Vaticana, 2018; see also, John Paul II, *Centesimus annus. Encyclical letter On the Hundreth Anniversary of Rerum novarum* (Vatican: Libreria Editrice Vaticana, 1991), 36.

and the way these depletions and degradations have turned against humans (whether rich or poor) and other living beings have been documented on broadsheets and projected into our TV screens. As early as 1962, Rachel Carson already argued that pesticides have detrimental effects on the environment and on humans. Her work, however, did not have the cellular-level evidences provided by the science of epigenetics.[12]

It is easy to say that these problems will be solved if we cease treating the biosphere like the way industry, commerce, and consumers do. But human behavior does not always pay heed to advice—even one coming from *Laudato Si'*—for as long as there are still remaining sources of energy that support households and industries.[13] In the meantime, investors will look for more innovative managers and entrepreneurs who will be able to maximize the use of what remains of fossil fuels under the earth and the seabed.[14] It is only when the breaking point of energy source is felt by motorists, by homemakers preparing for lunch, by elderly people turning on the heaters, etc., that the message is finally grasped.

It is thus necessary to question the directions of humanity's economic and industrial programs that constantly bombard the biosphere and humans themselves. Environmental ethics have done this but not enough to point out how impingements are seen by the science of epigenetics.

This article will argue that in the light of the science

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[12] Rachel Carson, *Silent Spring* (Boston: Houghton Mifflin, 1962; New York: Mariner Books, 2002).

[13] See, Ferdinand D. Dagmang, "Praxis and Theory of Environmental Marxism," *Journal of Dharma 39/4* (October-December 2014): 319-334.

[14] See, Peter Tertzakian, *A Thousand Barrels a Second: The Coming Oil Break Point and the Challenges Facing an Energy Dependent World* (New York: McGraw-Hill Education, 2007).

of epigenetics, sustainability ethics and *Laudato Si'*s moral position may have to be challenged and, thus, rethought in the spirit of "consilience"—"a 'jumping together' of knowledge by the linking of facts and fact-based theory across disciplines to create a common groundwork of explanation."[15] This presupposes that "the basic assumptions of any particular science should be consistent with the basic body of knowledge understood by other sciences."[16]

That is why there is a need to enlighten ourselves about the findings of epigenetics: Because it is in its findings that one may show the evidences and putative solutions to the pathological links between the environment and the body's reaction (especially in its *deepest* interior ecology) and adaptation to it. Through epigenetics' light, *Laudato Si'*s point may have more appeal on the wealthy's ears since their interior ecologies are probably the ones most affected by the industrial development's 'gains'.

Impingements on the Rich and the Poor—on the Richest and the Poorest

Human activities involve the exploitation and utilization of the natural environment; not to mention the unnecessary destruction in times of war. When people work and build things, nature is impinged upon and altered; when people consume things, nature is drawn in and transformed; when people interact with one another, nature is in many ways implicated. Somehow, nature is always impinged upon when humans efficiently exploit or adapt themselves to their environment. Cultures

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[15] Edward O. Wilson, *Consilience: The Unity of Knowledge* (New York: Vintage Books, 1999), 8.

[16] Kozo Mayumi, *The Origins of Ecological Economics: The Bioeconomics of Georgescu-Roegen* (London: Routledge, 2001), 2.

around the world and the sciences of the many modern and post-modern areas of the world have been shaped by humans interacting with themselves and their environment.

Humans, in their adaptive and exploitative activities, have habitually interacted with their natural environment on unequal terms. They have treated it mainly as the storehouse of resources and the dumping space of wastes; as such, nature is treated as man's extension and utility. From this way of treating nature as source and sink, the primary issues of depletion and degradation have come about. Such issues were eventually addressed by people who were part of what became a movement that generated a body of environmental thought and practices that either mitigated or challenged the habitual source-sink treatment of nature.[17] Thus, both practice and theory were born out of people's confrontation with the twin problems of depletion and degradation. Green activism and green theorizing developed and evolved as people preoccupied themselves with issues arising from the complex relations between social organizations and activities, on the one hand, and the natural environment, on the other hand.

The awareness about the injurious impact of today's industry and commerce on the natural environment has expanded into an awareness that puts the ecosystem at the center of discussions.[18] This concern for the natural environment's destruction is, however, not evenly

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[17] See, Charles T. Rubin, *The Green Crusade: Rethinking the Roots of Environmentalism* (New York/Oxford: Rowman & Littlefield Publishers, Inc., 1994); Roderick Nash, *The Rights of Nature: A History of Environmental Ethics, History of American Thought and Culture* (Madison, Wisconsin: University of Wisconsin Press, 1989).

[18] See Arne Næss, *Ecology, Community and Lifestyle: Outline of an Ecosophy* (Cambridge: Cambridge University Press, 1989); Cf. Bill Devall and George Sessions, *Deep Ecology* (Layton, Utah: Gibbs Smith, 2001).

balanced by an awareness of the deeper and invisible injuries that economic practices (which bring havoc to the environment) have inflicted on human bodies. In other words, agents hardly acknowledge (while doing their 'job' or eating their *samgyeopsal* [삼겹살] or sending text messages or listening to Spotify) that work *and* consumption could really boomerang on their bodies. Nevertheless, we have our everyday words which are work-related: stress, fatigue, burnout, overwork, *karoshi* (過労死), literally "overwork death" in Japanese. Not everyone, however, would realize the intimate connection of their activities (including 'fun-related activities' that put pressure on both the natural and bio-psychic environments) with their biopsychological ailments.

As we shall see, people's perceptions and interests are more focused on 1) the benefits gained through their efforts in, for example, building environments and 2) the costs that the natural environment had to 'sacrifice' for such efforts. Computable costs and benefits preoccupy people's consciousness as they treat nature as source of means and sink for their trash. Although the costs imposed on nature by industry and commerce are too visible and numerically computable to ignore, the more invisible and hidden biopsychological costs are not accounted for simply because these are hidden or less visible; if observable symptoms arise, they are not properly linked to costs of human work and consumption habits.

Epigenetics and its Evidences

The sustainability argument will always be disturbed by its own practices: the ecosystem being consistently treated as both a source and a sink both by industries and households. All sustainability arguments cannot escape this source-and-sink problematic as it relies on the

ecosystem. Our assumption is that the biopsychological environment is, in effect, treated by industry, commerce, and consumers as the inner-worldly source-and-sink. This is an issue; a bio-psychological issue that must be given enough attention. The science of epigenetics, with its findings, will help to show how the human body reacts when it is also being treated like a source-and-sink.

Genetics has relied on the theory propounded by Darwin and associates. It has gained much success in explaining things such as heredity and evolution. However, it has failed to explain some things that cannot be answered by genetics' assumptions. How come chimpanzees and humans who have essentially the same DNA sequence differ so widely from each other? How come bees who are fed with royal jelly grow differently (and become queens) from those who are fed with beebread (and become workers)?[19] Obviously, it is not just about DNA sequence that account for differences among species. There is something else: epigenetics.

Epigenetics also relies on molecular approaches to study the relationships and interactions between human genes and the environment. Its research focuses on the activities on and 'above' the genetic level. Environ-mental ethics today may have to catch up with the findings of epigenetics to make its language more integrative or holistic.

Epigenetics has been called the "Ghost in our genes" by Rothstein, et al.[20] They describe how genetic and

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[19] R. Kucharski, Maleszka, J., Foret, S., and Maleszka, R. "Nutritional control of reproductive status in honeybees via DNA methylation," *Science* 319 (2008): 1827–1830, cited in Sang-Woon Choi and Simonetta Friso, eds., *Nutrients and Epigenetics* (Boca Raton, FL: CRC Press, 2009), 167.

[20] M.A. Rothstein, Cai, Y., and Marchant, G.E., "The Ghost in our Genes: Legal and Ethical Implications of Epigenetics," *Health Matrix Cleveland* 19/1 (2009 Winter): 1–62; available at https://www.ncbi.nlm.nih.gov/ pmc/articles/PMC3034450/ [accessed

environmental factors affect the well-being of individuals and their offspring. The concept originated from Conrad Waddington who, in 1942, referred to it as "the interaction of genes with the environment, which brings the phenotype into being." It has been understood to be an amalgam of both stable and changing DNA structures. Epigenetics today is better understood as transformations or alterations in genetic expressions and not the modification of the DNA itself. Adrian Bird proposed a revised definition that embodies contemporary usage of epigenetics: "the structural adaptation of chromosomal regions so as to register, signal or perpetuate altered activity states."[21]

In biology, the term refers to gene expression (observable appearance) produced by mechanisms other than changes in the DNA sequence. Epigenetic activities (*epi* = over; above) are shown in cell differentiations during early fetal development. Some heritable processes where chemical clusters attach to the genes (methylation, phosphorylation, acetylation, etc.) are responsible for the regulation of the DNA's standard expressions. In most cases, these chemical attachments in ideal amounts regulate by mitigating DNA expressions. Other epigenetic mechanisms are histone (protein) modifications and chromatin remodeling. The way DNA wind around proteins determine the expression of genetic characteristics; DNA accessibility also depends on the way chromatin is packed. Changes in the chromatin packaging affect DNA accessibility and the normal expressions of its essential functions.

The appropriate methylation process, for example, will produce the proper characteristic common to humans even if humans share the same number of chromosomes

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[21] Cited in Moncel Zouali, ed., *The Epigenetics of Autoimmune Diseases* (Oxford: Wiley-Blackwell, 2009], xiii.

with chimpanzees.[22] In other words, the desirable human characteristics produced as typical DNA expressions are well regulated through various epigenetic processes. Moreover, in cell divisions happening during the remainder of an organ's life, epigenetic activities continue to take place. If nothing disturbs this process, the typical DNA expressions would continue. The organism's 'normal' development depends on those typical gene expressions. However, some cases of decreased or increased methylation happen because of environmental factors. This 'abnormal' methylation process would produce negative effects. Methylations within gene regulatory elements such as promoters, enhancers, insulators, and repressors generally suppress the function of the gene. These methylations, which compromise the structure and integrity of chromosomes, have negative effects which used to be referred to (in fact, still referred to by some) as either effects of DNA mutations (which are not reversible) or inherited DNA abnormalities. Today, current research has accurately identified such negative or unhealthy expressions as epigenetic expressions which are reversible and modifiable by some newly-manufactured drugs *or nutrients associated with healthy lifestyles*.

The normal processes of methylation, phosphorrylation, acetylation, could produce modifications either by their reduction or hyper-activation and give chance to unexpected alterations on the level of the cell, bringing about untypical processes and expressions. Environmental factors that impinge on the body, up to their molecular components, disturb some DNA structural processes responsible for the enduring expressions of what is considered as typical human characteristics. There are both positive and negative implications of

[22] See W. Doerfler and P. Böhm, eds., *DNA Methylation: Basic Mechanisms* (Heidelberg: Springer, 2006).

epigenetics for humans. Although adaptive reactions and responses to the environment serve an organism's development, some reactions produce epigenetic transformations which are aberrant. Much of what results from these negative genetic expressions are the still less understood ailments of today.

The DNA condensed with basic proteins (histones) to form chromatin is disturbed by some environmental factors. These undermine the proper bundling of the genes around the histones. Yes, there is proper bundling—proper tightness along areas that should not be expressed or proper looseness along areas that need to be expressed or decoded. If there is over-tight twining around areas that should have bundled loosely this results in the prevention of the proper reading of codes; if there is loose twining around areas which are supposed to be tight, there will be more 'free' expressions of codes which ought to be more concealed or silenced. Due to 'abnormal' coiling around histones, the 'normal' reading of codes is no longer possible because of the impinged and impeded function of the reader regulators of codes. Epigenetics covers chromatin (DNA and associated proteins) modifications that do not entail a change in the DNA sequence, resulting in changes in gene expression. These modifications, of course, produce further negative consequences.

Some of the commonly observed negative effects of epigenetic activities are the abnormal expressions like tumor, cancer, diabetes, obesity, allergic reactions like lupus, arthritis, psoriasis and other system-dependent (epigenetic-induced) diseases. Aging is another factor promoting epigenetic alterations that speed up formations of ailments.[23]

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[23] See Alexander G. Haslberger, ed. and Sabine Gressler, co-ed. *Epigenetics and Human Health* (Weinheim, WILEY-VCH Verlag GmbH & Co., 2010); Jörg Tost, ed., *Epigenetics* (Poole, UK: Caister

Ecological factors which include diet, lifestyle, toxic substances, stress, and other environmental factors associated with work and consumption in the age of capitalism have mobilized the scientific community to better understand the relationship between and interaction of the different determinants of epigenetic expressions in disease.

Social-environmental factors that produce epigenetic transformations are abundant in stress-producing places, like war zones, workplaces that require higher outputs, and relationships like marriages not founded on mutual love but on pragmatic or economic considerations. Environments would include the body (like the uterus or an acidic body), the home, neighborhood, workplace, school, church, hospital, public places like streets and malls, state institutions, and the internet.

Fetuses deprived of healthy food have been found to be future victims of hypertension and diabetes. Those still in the womb who are exposed to smoking by their mothers are most likely to develop asthma and other allergic reactions like eczema. Some reactions to stress or maladaptive behavior like smoking also bring about changes in the smoker's body-environment which alter genetic behavior-expressions. Lung cancer is a case of epigenetic alteration caused by various mechanisms from a multilayered ecologies. It is provoked by smoking, a practice triggered by stress, a feeling induced by economic production, a process impelled by profit, an end maintained by the ideology of capitalist progress.[24]

It has been reported that in developed (i.e., affluent) countries, 1 out of 3 persons will most likely suffer from

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Academic Press, 2008); Zouali, ed., *The Epigenetics of Autoimmune Disease*.

[24] See, Ferdinand D. Dagmang, *Predicaments of Intimacy and Solidarity: Capitalism and Impingements* (Quezon City: Central Books, 2010), 4ff.

a certain form of cancer. Of these cases, 30% are preventable since these are cases exposed to known risk factors that could be avoided. Those risk factors known to pressure people are connected to the normalized ways and requirements of industry and commerce. If modern industry and commerce would be able to pursue sustainability in terms of *natural environment and agents' health*, the following risk factors could be avoided: tobacco, obesity, low fruit and vegetable intake, physical inactivity, alcohol, sexually transmitted infection, air pollution, loneliness and depression; plus some occupational risk factors like asbestos fibers, tobacco smoke, and benzene. Such risk factors impinge upon the body, altering a person's biopsychological environment to bring about aberrant epigenetic expressions.

Let me illustrate further this process of epigenesis through the case of carcinogenesis or the formation of cancer in humans.

Cancer is not just a disease. It is also a sign of modernity's pathology-producing environment; it is also an evidence of modernity's inability to deal with realities by means of its model of development centered around domination and control (of the natural environment or built environments). Much of what science knows about cancer two decades ago is based on assumptions about diseases as either caused by bacteria or virus or misbehavior of the bodily system or organs. The latter reason would actually translate like this: Our knowledge is not adequate to explain the cause of cancer; therefore, we cannot treat it. Thus, we can only provide a therapy based on what we know. We can only excise those abnormally growing tissues; pump chemicals into the body and hope for the best, and for the worst, including the exorbitant medical fees. Unfortunately, modern science's assumptions are wrong; and most of the therapies adopted today are mere measures to postpone

sure death or to prolong suffering until another form of science could find the right answers.[25]

There are control regions in the DNA structure. If this structure is disturbed because of alterations brought about by social-environmental factors, the appropriate gene activities (like controlling transcription, replication, recombination and repair) become unreliable or totally aberrant. The hypo- and hyper-methylation or de-acetylation processes produce this kind of aberration and it is brought about by the built and socially-produced *social* environments of humans. Humans have built things or environments with the intention of improving culture or enhancing human life. Many of these built environments have altered the natural environment. The way humans behaved and interacted among themselves have been transformed because of the built environments which have also impinged negatively on the natural environment and the biopsychological environment. These series of impingements have clearly impacted on human nature; negatively, in many instances.

Nutrition is another modulator of genetic expressions. We are not just talking about the effects of clearly toxic substances on living organisms, producing abnormalities. I am referring to what many of us have considered as part of normal consumption and its connection with some diseases are not yet clearly established. Some ailments like cancer, arthritis, psoriasis, and lupus are yet to be adequately explained by current scientific models to make way for some cures. The current and mainstream models, however, are clearly inappropriate to provide explanations since these cannot yet establish the mechanisms and cures of those diseases. Some alternative models provide answers that

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[25] Stephen B. Baylin and Peter A. Jones, "Epigenetic Determinants of Cancer," *Cold Spring Harbor Perspectives in Biology* 8/9 (2016 Sep); a019505. doi: 10.1101/cshperspect.a019505

are still approximations of mechanisms. In the meantime, millions of humans are subjected to irreparable sufferings.

Some drugs developed with epigenetics in mind have been tested to patients, like Dacogen (decitabine), approved in 2006 to treat myelodysplastic syndromes. It's part of a class of drugs known as demethylating agents that work on the concept of epigenetics by stripping the methylation patterns in the genome, preferentially affecting cancer cells. We have the following case:

> Stanley took the drug for two years. "I improved almost immediately," she says. Her side effects were negligible during the months on the drug. She has resumed her normal life in south Texas, where she is writing a murder mystery and spending time with her grandchildren and great grandchildren. Dacogen, along with an epigenetic therapy approved in 2004 called Vidaza (azacitidine), works by preventing methylation. (Vidaza is also approved for myelodysplastic syndromes.) Freed from the excess methylation, tumor-suppressing genes can function again. Clinical trials have found that about 20 percent of patients respond to the drugs, with a drop in white blood cells reported as the most common serious side effect.[26]

Conclusion

The position of *Laudato Si'* and other theological treatment on the "cry of the poor, cry of the earth" will be

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[26] Laura Beil, "Medicine's New Epicenter? Epigenetics," http://www.curetoday.com/index.cfm/fuseaction/article.show/id/2/articleid/949; [accessed 20 February 2010]; see also, F.P. Santos, Kantarjian H., Garcia-Manero G., Issa J.P., Ravandi F., "Decitabine in the treatment of myelodysplastic syndromes," *Therapeutics and Clinical Risk Management* 3/5 (2007 Oct): 807–817; https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2376088/ [accessed 16 January 2020]

better strengthened if we supplement them with the discoveries of epigenetics—about human beings' deep interior ecologies being bombarded by injurious elements coming from industry and households which habitually treat the earth as source and sink.

Some appropriate and profound alterations of humanity's plans and its built environment to prevent epigenetic impingements should be part of every ethical consideration. The proper course of action, the right attitude and character of agents, and the life-promoting character of the environment must be taken into account in all considerations about what is good for humans and the ecosystem.

The sustainable development view(s) must listen to what epigenetics is saying: that it cannot continue to reduce people into injured agents while relying on them to work for extrinsic benefits that continue to destroy the ecosystem. One cannot speak of sustainable development when those who should benefit from it are actually being harmed in the process.

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