

GMO FOOD: BOON OR BANE?

A Critique of the Pontifical Academy of Sciences Recommendations on Genetically Modified Food from the Perspective of Catholic Theology, Philosophy, and Natural Science



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I. Introduction: The Pontifical Academy of Sciences and Genetically Modified Food

During the past ten years, the Pontifical Academy of Sciences (PAS) has hosted at least three conferences on genetically modified food in relation to the problem of world hunger. The scientists who have participated in these conferences have concluded that genetically modified food is merely an extension of the same kinds of genetic changes that occur in nature and in the laboratory, that genetically modified food is safe, and that it should be used to combat world hunger. The conference proceedings published by the PAS have recommended an easing of restrictions on the development of genetically modified food crops and a liberal use of genetically modified food crops to combat world hunger and environmental pollution.

This paper offers a critique of the PAS conclusions and recommendations from the perspective of Catholic theology, philosophy, and natural science. It demonstrates that PAS members' support for GMO food flows from their acceptance of a false evolutionary paradigm which conflicts with Catholic doctrine, traditional Catholic philosophy, and the latest evidence from the natural sciences. It further demonstrates that GMO food crops have been inadequately tested and poorly regulated but that the available evidence suffices to show that GMO food crops pose a grave threat to human health and to the environment,

The paper concludes with a set of recommendations for Church leaders, academics, and members of the PAS, which, if followed, may help to prevent a looming moral, medical and ecological catastrophe.

II. The scientific weakness of the evolutionary framework used in PAS reports on GMO food

Definition of terms

“Evolution” will be defined in this paper as the development of all living things through natural processes from one or a few simple life-forms by a process of horizontal gene transfer,¹ genetic mutation and natural selection

“Special Creation” will be defined as the creation by God of all of the different kinds of spiritual and corporeal creatures and man, with subsequent adaptation and variation within pre-determined limits.

A) Evolution not supported by evidence

It is apparent that virtually all of the scientists who have contributed to Pontifical Academy of Sciences papers on genetically modified food accept an evolutionary framework unquestioningly. Typical of the acceptance of evolutionary presuppositions was the statement of Dr. Richard Flavell who wrote:

Progress in evolution by natural selection depends on genetic variation. This variation has its origins in genetic mistakes that survive in individuals and are inherited.²

Crops did not evolve to serve man. It is to be expected that many crops are not well designed for agriculture. Man must continue to seek to make the crops he needs. Such advances will enable mankind to avoid relying on natural biodiversity for food.³

Dr. Werner Arber recognizes that most mutations are harmful, but assumes that biological evolution has taken place through a process of mutation and natural selection. Thus, he concludes that since living things have evolved through mutation and conventional breeding involves “similar amounts of DNA sequences” as those involved in genetic modification of food plants, there is a “low probability” of “disasters” from genetic engineering:

It is generally known that altered nucleotide sequences turn out to be only rarely favourable, useful for the organism that has suffered the mutation. Often, a mutation provides selective disadvantage by inhibiting to some degree the life processes. In extreme cases this can be lethal. Also quite often a new alteration in the nucleotide sequence has no immediate influence on the life processes. These are neutral, silent mutations. Consequently, we cannot identify evidence for a

¹ Horizontal gene transfer refers to the transfer of genes between organisms by means other than reproduction.

² FLAVELL, R. *New Biotechnology* _ Volume 27, Number 5 _ November 2010, p. 509.

³ FLAVELL, p. 514.

directedness of spontaneous mutations and the rates of spontaneous mutagenesis must be kept quite low under natural conditions not to eradicate life.⁴

Both in genetic engineering and in natural biological evolution, similar amounts of nucleotides are thereby generally involved, ranging from one letter to one or at most a few pages of the genomic encyclopaedia. In view of the implication of similar molecular mechanisms and similar amounts of DNA sequences involved in these genetic variations, one can expect that conjectural risks are also comparable for the natural biological evolution (including classical breeding techniques) and for genetic engineering. There is no scientific reason to claim that genetic engineering, as an efficient research strategy, would bear particular conjectural evolutionary risks. From our long-term experience, we know that neither natural evolution nor classical breeding activities have caused major, noted disasters in the living world. It is thus highly unlikely that such disasters could result from genetic engineering.⁵

It is apparent that Dr. Arber has *assumed* that biological evolution has taken place, and has then used the survival of plants that have undergone extensive mutation in the course of their evolutionary history as *proof* of the low probability that genetic engineering will cause disasters in the future. This is circular reasoning! Moreover, one could answer that there are many examples where successful classical breeding for desired characters in plants or animals simultaneously led to the damage of other characters or to increased susceptibility to diseases, as in the case of poodles and other highly bred animals.

Breeding involves the isolation of individuals with desired traits and therefore depends on the accumulation of selected genetic material by excluding other material. If such a simple reduction of allele frequencies leads to serious defects, how much more should one expect serious defects if alleles from foreign genes are introduced of which the entirety of interactions with the host are unknown. Breeding research teaches us that even if a certain genetic goal has been reached and a desired property in the phenotype has been established there are usually unforeseen interactions with other genetic functions that cause unexpected difficulties in other non-related phenotypical properties.

Furthermore, Arber does not mention that, if evolution has taken place, there have indeed been many major disasters in the biosphere—not for the species that “evolved” to a higher stage, but for the many unfit individuals that were de-selected to death because they had the wrong mutations. Clearly, the assumed natural process of genetic flux means harm for far more individuals than the few who benefit from an occasional “beneficial mutation.” In the same way, one would expect that genetic engineering performed by man would always be accompanied by harm to most of the individuals involved. It is reasonable to assume that this applies to all creatures involved in the food chain with such genetically modified food, including man.

⁴ ARBER, W., “Genetic Engineering Compared to Natural Genetic Variations,” *New Biotechnology* _ Volume 27, Number 5, November 2010, p. 519.

⁵ ARBER, p. 520.

It is tragic that the brilliant scientists at the Pontifical Academy of Sciences accept unquestioningly an evolutionary framework that has proven to be incompatible with the traditional metaphysics and theology of the Church, as well as with the scientific evidence, especially in the field of genetics. This section will offer a brief discussion of the scientific evidence which has exposed the inability of genetic transfer, mutation and natural selection to account for the different kinds of life-forms on earth. As documented by Dr. Lee Spetner,⁶ Dr. Maciej Giertych,⁷ and Dr. John Sanford,⁸ among others, these mechanisms can at best account for the spread of advantageous characteristics among existing populations. They cannot account for the origin of new organs or complex physiological systems.

Moreover, since, as Arber acknowledges in the passage just quoted, “altered nucleotide sequences turn out to be only rarely favourable,” the failure of these mechanisms to produce new complex structures is compounded by the degradation of the genome by increasing genetic load. In addition, the discovery of functionality in the so-called non-coding “junk DNA,” has demonstrated that new functions that do arise in plants or animals are in virtually every case the result of pre-programmed responses triggered by changes in the external or internal environment of the organism.⁹ In spite of many decades of attempts to produce new functions in organisms like the fruit fly through mutagenesis, there has not been a single observation in nature or in the laboratory that would support Arber’s faith in the evolution of new organs or complex physiological systems through horizontal gene-transfer, mutation and natural selection.

Lenski *et al.*’s experiments with *E. coli* show that very limited new functions can occasionally emerge through the combination of pre-existing elements but a huge gulf separates these minute changes from the kinds of systematic, coordinated and purposeful genetic changes that would be required to transform a reptile into a bird or the hypothetical common ancestor of chimps and humans into a human being. As explained above, time is the enemy, not the friend, of the evolutionary model, since, as Dr. Arber notes, most mutations are destructive of the genetic integrity of the organism, and, therefore, the rare “beneficial” mutation is helpless to stop the build-up of genetic load over time, which makes any realistic scenario for the evolution of new organs or physiological systems quite untenable.

⁶ SPETNER, L., “The Myth of the Natural Origin of Life,” in *Evolution Theory and the Sciences: A Critical Examination*, edited by Albrecht Graf von Brandenstein-Zeppelin and Alma Von Stockhausen. 2012. Gustav-Siewerth-Akademie.

⁷ GIERTYCH, M., “Race Formation vs. Evolution,” in *Evolution Theory and the Sciences: A Critical Examination*, edited by Albrecht Graf von Brandenstein-Zeppelin and Alma Von Stockhausen. 2012. Gustav-Siewerth-Akademie.

⁸ SANFORD, J., *Genetic Entropy and the Mystery of the Genome*, FMS Publications, Waterloo, NY, 2005.

⁹ Cf. AGRAWAL, A.A., LAFORSCH, C., TOLLRIAN, R., Transgenerational induction of defences in animals and plants, *Nature* **401**(6748):60-63, 2 September 1999. HAUKIOJA, E., Bite the mother, fight the daughter, *Nature* **401**(6748):22-23, 2 September 1999.

A recent study of mutations in nematode populations tested the effects of sequentially inhibiting hundreds of individual genes to determine the effects of these mutations on nematodes over eight generations. In most cases, the inhibition of individual genes measurably reduced the fitness of the nematode populations with a cumulative negative impact over successive generations that would eventually lead to extinction. The researchers noted that almost every gene tested was important to the worms' survival and that single mutations disrupt entire gene networks. They concluded:

In contrast to previous estimates, we find that, in these multigeneration population assays, the majority of genes affect fitness, and this suggests that genetic networks are not robust to mutation. Our results demonstrate that, in a single environmental condition, most animal genes play essential roles.¹⁰

These empirical findings support the traditional Catholic doctrine of special creation and contradict the view of Arber *et al.* that mutation and natural selection can produce new organs or biological functions. Indeed, the evolution of a new organ would require the succession of thousands of coordinated mutational steps in the same lineage. In order to fix each one and spread it among the entire population, an extensive isolation process via natural selection would be necessary each time. At each step, this implies, as in breeding, the random loss of alleles and corresponding malfunctions in other aspects of the organism. Therefore, it is very unlikely that such a scenario could have led to the production of a new kind of organism that was able to survive. Furthermore, selection steps are aiming at increasing the fitness of a given structure, not at constructing a fully-formed new organ in the end. Adding thousands of such short-term selection steps of which none "knows" the pathway towards a new organ cannot account for the impossible entropy decrease associated with the completion of a fully-formed complex function. Finally, neither in the fossil record nor in nature do we see a single one of the millions of incomplete organs that should have existed and still exist today if evolution were more than a speculative hypothesis. To argue that they didn't find a survival niche does not solve the statistical difficulty: Those at the bottom of the evolutionary chain—those, for example, with no eyes, no ears, and no wings—survived, although they were the least fit within the evolutionary scheme.

In short, special creation of the different kinds of living things is a much better explanation for what scientists observe in nature and in the laboratory than the evolutionary framework accepted so unquestioningly by Flavell, Arber and their colleagues.

¹⁰ RAMANI, A. K. et al. 2012. The Majority of Animal Genes Are Required for Wild-Type Fitness. *Cell*. 148 (4): 792-802.

B) Faith in Evolution Harmful to Scientific Research

As has been demonstrated in detail elsewhere, faith in evolution has been detrimental to scientific and medical research.¹¹ The Catholic Church gave the world a marvelous framework within which to investigate nature—one that recognized the existence of a lawful universe of well-designed creatures marred (but not ruined) by the effects of Original Sin whose function (but not their origins) could be discovered through rational investigation. This proved to be an extremely fruitful framework for natural scientists and medical researchers for most of the past two millennia. For example, when Sir William Harvey was asked how he discovered the working of the circulatory system:

He answer'd . . . that when he took notice that the Valves in the Veins of so many several Parts of the Body, were so Plac'd that they gave free passage to the Blood Towards the Heart, but oppos'd the passage of the Venal Blood the Contrary way: He was invited to imagine, that **so Provident a Cause as Nature had not so Plac'd so many Valves without design; and no Design seem'd more probable** than that, since the Blood could not well, because of the interposing Valves, be sent by the Veins to the Limbs; it should be sent through the Arteries, and Return through the Veins,, whose Valves did not oppose its course that way (emphasis added).¹²

Thanks to the Catholic doctrine of creation, even after the Protestant revolution, in Harvey's Christian, pre-Darwinian world, biology operated on a presumption of stable form and function. If a biologist encountered an organ or bodily system in an organism whose function he could not identify, he presumed that it had a function and he sought to discover it. Darwinian evolutionary biology replaced this presumption of stable form and function with a presumption of flux and dysfunction, with disastrous consequences for scientific research.

In *Origin of Species* Charles Darwin speculated that small changes in living things as they adapted to changing environmental conditions could somehow be passed on to their descendants so that, over many generations, reptiles could change into birds, land mammals into whales and a subhuman primate into a human being. As evidence for his hypothesis, Darwin cited what he called “vestigial organs” in various species of animals, organs which once had a useful, adaptive function at an earlier stage of evolutionary development but which no longer had that function, had it only to a lesser degree, or had acquired a different function.

In the *Descent of Man*, Darwin cited several examples of such “vestigial organs” in man, including the appendix, wisdom teeth, muscles of the ear, the tail bone, body hair, and the

¹¹ Cf. OWEN, H., “L'impatto negativo dell'ipotesi evoluzionista sulla ricerca scientifica: una valutazione retrospettiva,” in *Evoluzionismo: il tramonto di una ipotesi*, editado por Roberto de Mattei. 2009. Ediciones Catagalli SRL y Consiglio.

¹² SCHULTZ, S. G., “William Harvey and the Circulation of the Blood” doi: 10.1152/nips.01391.2002 *Physiology* 17:175-180, 2002.

<http://physiologyonline.physiology.org/content/17/5/175.full> (accessed 1-13-13)

semilunar fold in the corner of the eye. Darwin held that the appendix was vestigial because it was small in comparison with the caecum of monkeys, a fact which Darwin took to be evidence that in the course of man's evolution his need for the caecum had diminished as his diet had changed so that the caecum and the appendix (or caecal appendage) had grown smaller in man through "disuse." Darwin's disciples continued the same line of reasoning and identified various organs, glands, and other features of the human body that seemed to have either lost or diminished their function during the course of human evolution.¹³

One of the foremost anatomists of his day and a Darwin disciple, Robert Wiedersheim, identified numerous vestigial organs in the human body, including the appendix. Wiedersheim's testimony played a part in the famous "Scopes Monkey Trial" in Dayton, Tennessee, when a zoologist from the University of Chicago, Prof. Horatio Hackett Newman, submitted expert testimony to the effect that:

There are, according to Wiedersheim, no less than 180 vestigial [sic] structures in the human body, sufficient to make of a man a veritable walking museum of antiquities. Among these [is] the vermiform appendix. These and numerous other structures of the same sort can be reasonably interpreted as evidence that man has descended from ancestors in which these organs were functional.¹⁴

Acceptance of the evolutionary hypothesis by most biologists and medical researchers insured that the actual function of the appendix in humans remained obscure for over a century after *Origin of Species*. According to an introduction to biology published in 1950:

Science has piled up still further evidence for its case. It has found a number of useless organs among many animals. They have no apparent function and must therefore be a vestige of a once useful part of the body. A long time back these vestigial organs must have been important; now they are just reminders of our common ancestry. One example is the vermiform appendix which not only is utterly useless in human beings but which often causes great distress.¹⁵

Noting that monkeys lacked an appendix but had a developed caecum for the digestion of plant matter, Darwin reasoned that the appendix in man was an appendage of the caecum and that the whole unit had degenerated through disuse as man evolved from an herbivorous ancestor. In this way, Darwin based his evaluation of the appendix on an evolutionary interpretation, then used the appendix as "evidence" for evolution—a classic example of circular reasoning!

¹³ Cf. DARWIN, C., *The Descent of Man*, Second Edition, 1874, Chapter One http://www.darwin-literature.com/The_Descent_Of_Man/3.html (accessed 3-10-09).

¹⁴ *The World's Most Famous Court Trial*, second reprint edition, Bryan College, Dayton, Tennessee, 1990, p. 228.

¹⁵ PERKEL, A., and NEEDLEMAN, M. H., *Biology for All*, Barnes and Noble, New York, 1950, p. 129.

The evolutionary interpretation of the appendix discouraged researchers from considering that the function of the appendix in man might be distinct from that of the caecum. This proved to be the case. In the 1960's, experimental evidence demonstrated that the appendix actually serves as a center for antibody-producing cells. By 1976, experimental knowledge of the appendix evolved to the point that a medical textbook on gastroenterology noted the following: *The appendix is not generally credited with significant function; however, current evidence tends to involve it in the immunologic mechanism.*¹⁶

In spite of lingering evolutionary bias, medical researchers came to recognize the appendix as an integral part of the Gut-Associated-Lymphatic-Tissue (or G.A.L.T.) which produces several kinds of antibodies: IgA immunoglobulins, which help to protect the bloodstream from infection from the contents of the bowel, and IgM and IgG immunoglobulins, which combat infections in the bloodstream. In 1995, a textbook on anatomy and physiology stated categorically that: *The mucosa and submucosa of the appendix are dominated by lymphoid nodules, and its primary function is as an organ of the lymphatic system.*¹⁷ It is now recognized that the lymphoid nodules appear in the appendix roughly two weeks after birth which coincides with the colonization of the bowel with bacteria. The appendix can be safely removed later in life because it plays its most important role in the body's development immediately after birth and because it is only one part of the Gut Associated Lymphatic Tissue system.

In spite of the overwhelming evidence for the functionality of the appendix, 150 years after *Origin of Species*, Darwin's dim view of the appendix continues to be upheld by respected information sources. For example, in the year of Darwin, a visitor to the British Broadcasting Corporation's "Science and Nature Home Page" can still read the following description of the appendix:

The appendix has no known function in humans. Evidence suggests that our evolutionary ancestors used their appendixes to digest tough food like tree bark, but we don't use ours in digestion now. Some scientists believe that the appendix will disappear from the human body.¹⁸

The extraordinary ignorance of this statement shows how much faith in the evolutionary hypothesis continues to influence leaders in the field of public information, even when the facts contradict their evolutionary presuppositions. But the statement also reflects the degree to which the conventional wisdom pins the blame for diseases of the appendix squarely on the "vestigial" and defective nature of the organ itself, without even considering the possibility that these diseases could be symptomatic of deeper disorders.

¹⁶ BOCKUS, H. L., *Gastroenterology*, 2:1134–1148 (chapter "The Appendix" by Gordon McHardy), W.B. Saunders Company, Philadelphia, Pennsylvania, 1976.

¹⁷ MARTINI, F. H., *Fundamentals of Anatomy and Physiology*, Prentice Hall, Englewood Cliffs, New Jersey, 1995, p. 916.

¹⁸ British Broadcasting Corporation's "Science and Nature Home Page"
<http://www.bbc.co.uk/science/humanbody/body/factfiles/appendix/appendix.shtml> (accessed 1-16-13).

By conducting an extensive study of non-modernized societies all over the world, Dr. Weston Price found that appendicitis was virtually non-existent in those who retained their traditional diet and way of life. Typical was the testimony of Dr. Romig who lived among the non-modernized Eskimos of Alaska and who stated that:

in his thirty-six years of contact with these people he had never seen a case of malignant disease among the truly primitive Eskimos and Indians, although it frequently occurs when they become modernized. He found, similarly, that the acute surgical problems requiring operation on internal organs, such as the gall bladder, kidney, stomach and appendix, do not tend to occur among the primitives but are very common problems among the modernized Eskimos and Indians.¹⁹

In the December 2005 issue of the *British Journal of Surgery*, in an article entitled “The Aetiology of Appendicitis,” Dennis P. Burkitt of the Medical Research Council argues that:

Extensive evidence from the geographical distribution of appendicitis and its rise in prevalence in economically developed countries in the early part of this century suggest that the change from a high to a low-residue diet is largely responsible for this disease.²⁰

By blaming diseases of the appendix on the defective condition of a vestigial organ, Darwin and his disciples up to the present time have helped to discourage researchers from following the traditional approach of Western natural science and medical research initiated by Hippocrates and the ancient Greeks which looked for the causes of human disease in the defective diet, habits, or environment of their patients rather than in some intrinsic defect of the body or of its component parts. By blaming diseases of a vestigial appendix on evolutionary degeneration, generations of scientists have lost their incentive to ask why these diseases did not exist among non-industrialized societies and to seek to prevent them through constructive changes in diet and life-style rather than by treating the symptoms of the disease through surgical removal. (As noted below, a similar error has been made by the apologists for GMO food when they seek to correct malnutrition by a greater reliance on genetically modified food crops.)

Faith in the truth of the evolutionary hypothesis has repeatedly led scientists and medical researchers to believe that organs of the human body that have no apparent function are “vestigial” and expendable. The full extent of the danger inherent in this unproven and unsubstantiated assumption emerged soon after the publication of *Origin of Species* with the popularization of the concept of “embryonic recapitulation” by Darwin’s disciple the German medical doctor and professor of anatomy Ernst Haeckel (1834-1919). Darwin had argued that similarities in structure among diverse life forms indicated that they had all evolved from a common ancestor. According to Haeckel, the existence of similarities in embryos of various kinds of organisms *proved* that the higher life forms “recapitulated”

¹⁹ PRICE, W. A., *Nutrition and Physical Degeneration*, Price-Pottenger Nutrition Foundation, page 91.

²⁰ BURKITT, D. P., “The Aetiology of Appendicitis,” *British Journal of Surgery*, December 2005.

their evolutionary history before birth and that they had all descended from a common ancestor. To make this “proof” more compelling for his contemporaries, Haeckel doctored drawings of the embryos of fish, salamanders, chickens, turtles, rabbits, pigs, and human beings to exaggerate their similarities and minimize their differences. Although Haeckel’s fraud was discovered and exposed during his lifetime, the evolutionary hypothesis demanded common descent, and the concept of embryonic recapitulation continued to exert a profound influence on the study of embryology for many decades.²¹

One of the leading lights in the study of embryology in the twentieth century, Gavin R. de Beer wrote that:

Haeckel’s theory of recapitulation . . . thwarted and delayed the introduction of causal analytic methods into embryology,” since “if phylogeny was the mechanical cause of ontogeny as Haeckel proclaimed, there was little inducement to search for other causes.²²

De Beer’s observation implied that Haeckel’s influence had come to an end by the 1950’s—but this was far from being the case. To this day, biology textbooks all over the world argue that similarities between embryos of fish, amphibians, reptiles, humans and lower mammals constitute evidence for the evolutionary hypothesis.

Typical of examples too many to cite is the caption that accompanies drawings of embryos of various life-forms from a widely used American biology textbook published in 2002. Entitled “Embryonic development of vertebrates,” it states:

Notice that the early embryonic stages of these vertebrates bear a striking resemblance to each other, even though the individuals are from different classes (fish, amphibians, reptiles, birds, and mammals). All vertebrates start out with an enlarged head region, gill slits, and a tail regardless of whether these characteristics are retained in the adult.²³

Although Haeckel’s distorted drawings do not accompany this caption, the statement falsely gives the impression that human embryos—as members of the vertebrate phylum—possess gill slits. But this is patently false. The pharyngeal arches in human embryos have no connection with gill slits whatsoever but develop into the outer and middle ear, and into the neck bones, muscles, nerves, and glands. Moreover, after the discovery of DNA, confidence in the truth of the evolutionary hypothesis led many evolutionary biologists to predict that similar body parts in diverse organisms would be controlled by the same genes. This, however, proved to be false, as embryologists have discovered that the realization of the same body plan—such as five digit extremities—in

²¹ Cf. RICHARDSON, M. K., ET AL *Anatomy and Embryology*, “There is no highly conserved stage in the vertebrates; implications for current theories of evolution and development,” Vol. 196, No. 2, Springer Verlag, Heidelberg, Germany, 1997, pp. 91-106.)

²² DE BEER, G., *Embryos and Ancestors*, Third Edition, Clarendon Press, Oxford, 1958, p. 172.

²³ RAVEN, P. H., and JOHNSON, G. B., *Biology*, 6th ed., McGraw Hill, 2002, p. 1229.

diverse organisms (such as whales and humans) is controlled by different genes and is achieved through totally different embryonic pathways.

The idea of embryonic recapitulation not only led embryonic researchers down the wrong pathways—it also led to a devaluation of the human embryo similar to the devaluation of the appendix documented above. In this case, however, the consequences of the devaluation were far more serious since what was being devalued was no longer an organ of the human body but the human body itself! All over the world, abortion advocates have used the alleged similarity between human and lower animal embryos to trivialize abortion in the early stages of pregnancy. For example in Germany pro-abortion activists:

skillfully exploited the disunity of the German Catholic intellectuals to bring their demands for the legalization of abortion to the legislature. ... Karl Rahner, who was in the forefront of the fight over [the loosening of] paragraph 218, wrote in *Naturwissenschaft und Theologie* (brochure 11, page 86, 1970): “I think that there are biological developments which are pre-human, but these developments are still aimed in the direction of man. Why cannot these developments be transferred from phylogeny to ontogeny?”²⁴ (emphasis added)

“Ontogeny recapitulates phylogeny” is a fancy way of saying that “embryos re-live their evolutionary history in the womb”—a tenet of Darwin that has been refuted by the modern science of embryology. It is painfully apparent that his belief in “embryonic recapitulation” led Germany’s most influential Catholic theologian, Fr. Karl Rahner, to conclude that unborn human beings pass through a “pre-human” stage. This opened wide the door to approval of abortifacient contraception and abortion—since the child in the womb could now be regarded “scientifically” as “pre-human.”

These examples of the severe harm that faith in the evolutionary hypothesis has done to scientific and medical research parallel the harm that faith in the evolutionary hypothesis has done to scientific research in the realm of GMO food. In both cases, evolutionary pre-suppositions have led to serious scientific errors in matters of life and death. Confidence in the truth of the evolutionary hypothesis has obstructed scientific progress in understanding not only the human embryo but virtually all of embryology and all of Darwin’s alleged vestigial organs. It would take a large book to document all of the examples, but it will be important to cite one other example of the disastrous impact on scientific research of the evolutionary presumption of flux and dysfunction in regard to so-called non-coding “junk DNA”—an example that is relevant to the controversy over GMO food.

It is well known that the origin of the term “junk DNA” has been traced to a paper by Dr. Susumu Ohno in 1970 in which Dr. Ohno speculated that just as fossils of extinct species litter the geological record, so DNA that has lost its function litters the human genome.²⁵ Although some scientists argued that DNA would not have been conserved for

²⁴ HAUSSLER, A., *The Betrayal of the Theologians*, Human Life International, 1982, p. 2.

²⁵ Cf. "So Much 'Junk DNA' in our Genome," Brookhaven Symposium on Biology 23: 366-370.

the alleged millions of years of evolutionary time if it had no function, the term “junk DNA” began to be widely used to describe the bulk of the human genetic material that does not code for protein.

In 1976 evolutionary biologist Richard Dawkins published his influential book *The Selfish Gene* in which he argued that pieces of DNA are “selfish replicators.” With respect to the enormous amounts of DNA that seem to have no function in the genome, he wrote:

Biologists are wracking their brains trying to think what useful tasks this apparently surplus DNA in the genome is doing. But for the point of view of the selfish genes themselves there is no paradox. The true "purpose" of DNA is to survive, no more no less. The simplest way to explain the surplus DNA is to suppose that it is a parasite, or at best a harmless but useless passenger hitching a ride in the survival machines created by other DNA . . .²⁶

In 1980 two key papers in *Nature* combined the concept of “junk DNA” with Dawkins’ concept of the “selfish gene.”²⁷ Throughout the 1980s, most biologists held that genomes were bloated and littered with an excess of non-functional (non-coding) sequences that had been generated via "selfish" replication. As a result, some questioned the need to sequence or study the so-called non-coding sections of the human genome—then thought to be around 97% of the total DNA. When Robert Sinsheimer, Rene Dulbecco, and Charles DeLisi proposed a project to sequence the entire human genome (subsequently known as the Human Genome Project) many molecular biologists opposed the idea on the grounds that so much “junk DNA” would be sequenced.²⁸

The Human Genome Project officially began in 1990, and the data it uncovered proved to be quite a surprise. For one thing, far fewer "genes" were found than were expected. For another, the human gene complement was found to be strikingly similar to that of other organisms, like the fly. With the publication of the drafts of the chimpanzee, rat, dog, opossum, and other genomes, it also became evident that the DNA scripts differ mainly in the so-called non-coding regions. Then in 2007, with the results of project ENCODE made available, it finally became clear that the most important factors in genome functioning reside in non-protein-coding DNA. These findings refined what had become known as “the Central Dogma” of genetics, namely that DNA produces RNA, which makes protein, which constitutes the significant stuff of organic life. The ENCODE results showed that most of the non-protein-coding DNA is transcribed, so information flows from the DNA to RNA (but not further to protein), i.e., in the direction specified by the Central Dogma. However, much more is going on in overall genome functioning than was covered by the old Central Dogma.

²⁶ DAWKINS, R., *The Selfish Gene*, Oxford University Press, New York, 1976, p. 47.

²⁷ ORGEL, L.E., CRICK, F. H. 1980. Selfish DNA: the ultimate parasite. *Nature* 284: 604-607.

²⁸ DOOLITTLE, W. F., SAPIENZA, C. Selfish genes, the phenotype paradigm and genome evolution. *Nature* 284: 601-603.

The discovery that fully 98% of the human genome did not code for protein forced scientists to look more closely at the “junk DNA” (or non-protein coding DNA). This class of DNA was found to fall into three main categories: pseudogenes, retrovirus-like elements, and retrotransposons. Pseudogenes are alleged to be the relics of genes which have lost their ability to code for protein and which have acquired mutations since losing their functionality. But recent research has found evidence of functionality in pseudogenes. According to a recent article in *Nature*, a team of scientists at Cold Spring Harbor Laboratory in New York has discovered a function for pseudogenes in regulating gene expression²⁹ The second main category of non-protein coding DNA contains moveable chunks of DNA. These include Class I mobile genetic elements called retrotransposons which move around the genome by being transcribed to RNA and then back to DNA.

Until recently, retrotransposons were widely believed to be useless relics of viral infections. A study published in the journal *Developmental Cell* has shown this belief to be false. According to an article on the Eureka website: *Researchers have discovered that expression of genes in mouse eggs and very early embryos is activated in part by regions of DNA called retrotransposons, which may have originated from retroviruses.* These regions, found in DNA of human, mouse, and other mammals in hundreds of thousands of copies, are called retrotransposons because they have the ability to propagate and insert themselves into different positions within the genome. The research, published in the October [2004] issue of *Developmental Cell*, suggests that retrotransposons may not be just the “junk DNA” once thought, but rather appear to be a large repository of start sites for initiating gene expression. Therefore, more than one third of the mouse and human genomes, previously thought to be non-functional, may play some role in the regulation of gene expression and promotion of genetic diversity.

One of the pioneers in establishing the functionality of “junk DNA,” Prof. John Mattick, recently claimed that, “*the failure to recognize the implications of the non-coding DNA will go down as the biggest mistake in the history of molecular biology.*”³⁰

This prediction will most likely be fulfilled, not only because of the way that the “junk DNA” concept has retarded the scientific investigation of genetic material that does not code for protein, but perhaps more importantly because of the way that the evolutionarily inspired “junk DNA” concept has delayed the medical understanding and treatment of serious genetic disorders.

These examples of the harm that faith in evolution has done to scientific research offer a rebuke to the unquestioning acceptance of evolutionary framework by so many advocates for GMO food. Faith in evolution led the majority of biologists to regard the intricate

²⁹ TAM, O.H., ARAVIN, A.A., STEIN, P., GIRARD, A., MURCHISON, E.P., CHELOUFI, S., HODGES, E., ANGER, M., SACHIDANANDAM, R., SCHULTZ, R.M., HANNON, G.J. Pseudogene-derived small interfering RNAs regulate gene expression in mouse oocytes. *Nature*. 2008 May 22;453(7194):534-8. Epub 2008 Apr 10).

³⁰ “Genius of Junk (DNA),” *Catalyst*, Thursday, 10 July 2003, <http://www.abc.net.au/catalyst/stories/s898887.htm> (accessed 3-10-09).

and fully functional regulatory DNA as “junk” held over from the long ages of evolution. Now, based on the same faith in evolution that shaped the majority view in regard to “junk DNA,” we are told that we need not be concerned about the effects of random insertions of genetic material from one kind of organism to another, using viruses as promoters, in plants that will enter the food supply. It would seem that evolution skeptics are more than justified in calling for caution, since genetic modification of food plants at this stage will undoubtedly interfere with intricate genetic structures that we do not understand, in ways that we cannot foresee, with potentially harmful consequences. Scientists whose evolutionary beliefs led them to embrace the false notion of junk DNA have little credibility now when they wave off concerns about the unpredictable consequences of tinkering with the genetic make-up of food plants.

C) Evolutionary framework of the reports denies God’s creative design in nature

The evolutionary assumptions of most, if not all, of the scientists who have contributed to PAS sponsored reports on GMO food attribute to the mechanisms of gene transfer, mutation, and natural selection, what the Sacred Scriptures, Sacred Tradition, and authoritative Magisterial teaching—supported by current scientific evidence—attribute to divine design. For example, as mentioned earlier, Dr. Richard Flavell writes:

Crops did not evolve to serve man. It is to be expected that many crops are not well designed for agriculture. Man must continue to seek to make the crops he needs. Such advances will enable mankind to avoid relying on natural biodiversity for food.³¹

Absent from this perspective, which is typical of the contributors to the PAS reports on GMO food, is any recognition of the innumerable examples of what Pope Benedict XVI called the “intelligent design which is the universe.” As mentioned above, Arber sounds a theme that runs through most if not all the papers when he writes:

It is generally known that altered nucleotide sequences turn out to be only rarely favourable, useful for the organism that has suffered the mutation. Often, a mutation provides selective disadvantage by inhibiting to some degree the life processes. In extreme cases this can be lethal. Also quite often a new alteration in the nucleotide sequence has no immediate influence on the life processes. These are neutral, silent mutations. Consequently, we cannot identify evidence for a directedness of spontaneous mutations and the rates of spontaneous mutagenesis must be kept quite low under natural conditions not to eradicate life.³²

The PAS reports on GMO food give the impression that little if anything in the biosphere was designed for man’s benefit, but this flies in the face of innumerable examples of coordinated complexity. For example, some of the most valuable crops on earth are

³¹ FLAVELL, p. 514.

³² ARBER, “Genetic Engineering Compared to Natural Genetic Variations,” *New Biotechnology* _ Volume 27, Number 5, November 2010, p. 519.

legumes, like soybeans and cowpeas, which do not need nitrogen fertilizer. Soil microbiologists have documented the amazing coordination between the bacteria that take nitrogen from the atmosphere and make it available to the host plants in a suitable chemical form and the plant machinery that absorbs and makes use of these chemicals. Commenting on this marvelous design, soil microbiologist Dr. H. D. Skipper observes:

Since there are about 50 genes in the root-nodule bacterium and another 50 or so genes in the host plant involved in nodule formation and nitrogen fixation in legumes, the process speaks loud and clear of design and not evolution by random changes called mutations. The probability of multiple genes coming together accidentally to fix nitrogen is beyond comprehension.³³

The dismal view that “crops did not evolve to serve man,” also ignores the fact that the earth is full of plants that *do* serve man, often with little or no intervention from human plant breeders. The history of food plants shows that the essential goodness of plant foods is a *created good*, not a mere random product of mutation and natural selection. Virtually, every food plant can be traced back to a created ancestor-plant, which already possessed ingredients beneficial to man, ingredients which could be increased but not created through selective breeding. Take the coconut, for example. The coconut has been a staple food in many parts of the world for thousands of years and has undergone very little change during that time. Natural scientists are only beginning to fathom the beneficial uses of the coconut, which provides essential fats, strengthens the immune system, and acts as an antiseptic.

The view that the coconut is a random product of mutation and natural selection contradicts the Church’s teaching that God “directed certain things to the sustenance of man’s body” and fosters an attitude of contempt for the many properties of plants and animals that God has created with man in view. Indeed, the belief that genetic transfer, mutation, and natural selection can produce life’s diversity, coupled with a belief in an “absence of directedness” in spontaneous mutations leads to a consensus view that man is not “fearfully and wonderfully made” as Scripture, Tradition, Magisterial teaching, and current scientific evidence demonstrate, but is rather the result of hundreds of millions of years of genetic accidents. By failing to make appropriate distinctions between human life and other life-forms, this evolutionary faith not only denigrates man’s God-given unique place in the universe but, as explained later on, conditions its adherents to minimize the risks associated with using viruses to mix genetic material from unrelated life-forms in plants engineered for human consumption.

³³ “Soil microbiologist: Evolution no help in research,” an interview with H. D. SKIPPER, <http://creation.com/microbiologist-skipper#endRef3> (accessed 12-27-12).

D) Persecution of Scientists Critical of Evolutionary Science

The parallels between evolutionary science and GMO-friendly science do not end with their common rejection of the special creation of man, a stable human nature, and the original harmony between man and nature in the pre-Fall world (of which more is said below). The parallels extend to the treatment accorded scientists who dare to dissent from evolutionary presuppositions and speculations based on those presuppositions, and the treatment meted out to scientists who dare to question the safety of GMO food. In light of the demonstrable link between faith in biological evolution and faith in GMO safety, it is important to recognize that the same kind of persecution unleashed against scientists who dare to question Darwinian dogma also afflicts critics of GMO food safety.

Dr. Jerry Bergman has dedicated an entire book to examples of persecution of scientists who have dared to criticize one or more tenets of cosmological or biological evolution.³⁴ It may be helpful to cite the details of one of the cases Bergman documents in his book, since it involves a scientist with two Ph.Ds in evolutionary biology at one of the most prestigious research centers in the United States. It is also one of the few cases that has been the subject of an official government investigation.

Dr. Richard Von Sternberg was a research associate at the Smithsonian Institution in Washington, D.C. and the editor of a prestigious biological journal. What follows is a brief description in his own words of what happened when he dared to publish a peer-reviewed journal article critical of Neo-Darwinism, the view that mutation and natural selection can explain the origin of the diversity of living things. Von Sternberg reported the following forms of harassment:

- **Efforts to remove me from the Museum.** After Smithsonian officials determined that there was no wrong-doing in the publication process for the Meyer paper and that they therefore had no grounds to remove me from my position directly, they tried to create an intolerable working environment so that I would be forced to resign. As the OSC investigation concluded, “[i]t is... clear that a hostile work environment was created with the ultimate goal of forcing you out of the SI.” In addition, it was made clear to me that my current position at the Smithsonian will not be renewed despite my excellent record of research and publication.
- **Efforts to get NIH to fire me.** Pressure was put on the NIH to fire me.
- **Perceived political and religious beliefs investigated.** Smithsonian officials attempted to investigate my personal religious and political beliefs in gross violation of my privacy and my First Amendment rights.
- **Smeared with false allegations.** My professional reputation, private life, and ethics were repeatedly impugned and publicly smeared with false allegations by government employees working in tandem with a non-governmental political advocacy group, the National Center for Science

³⁴ Cf. BERGMAN, J., *Slaughter of the Dissidents: The Shocking Truth About Killing the Careers of Darwin Doubters*.

Education (NCSE).

- **Pressured to reveal peer reviewers and to engage in improper peer review.** I was repeatedly pressured to reveal the names of the peer-reviewers of the Meyer article, contrary to professional ethics. I was also told repeatedly that I should have found peer reviewers who would reject the article out-of-hand, in direct violation of professional ethics which require editors to find peer reviewers who are not prejudiced or hostile to a particular author or his/her ideas.
- **Supervisor replaced.** I was transferred from the supervision of a friendly sponsor (supervisor) at the Museum to a hostile one.
- **Office space.** I was twice forced to move specimens from my office space on short notice for no good reason, my name plate was removed from my office door, and eventually I was deprived of all official office space and forced to use a shared work area as my work location in the Museum.
- **Unprecedented work requirements.** I was subjected to an array of new reporting requirements not imposed on other Research Associates.
- **Access to specimens limited.** My access to the specimens needed for my research at the Museum was restricted. (My access to the Museum was also restricted. I was forced to give up my master key.)

In sum, it is clear that I was targeted for retaliation and harassment explicitly because I failed in an unstated requirement in my role as editor of a scientific journal: I was supposed to be a gatekeeper turning away unpopular, controversial, or conceptually challenging explanations of puzzling natural phenomena. Instead, I allowed a scientific article to be published critical of neo-Darwinism, and that was considered an unpardonable heresy.

In November, 2004, Dr. von Sternberg filed a complaint with the U.S. Office of Special Counsel (OSC). The OSC found evidence to back up the complaint and stated that it was "*clear that a hostile work environment was created with the ultimate goal of forcing*" Dr. Sternberg out of the Smithsonian. Despite this finding, a lack of jurisdiction prevented the OSC pursuing its investigation to any greater depth. In August, 2005, however, the case was officially taken up by a U.S. House of Representatives subcommittee. Their 29 page report, and a separate appendix, was published on December 11th, 2006, and makes shocking reading. A short summary of its findings follow:

Intolerance and Politicization of Science at the Smithsonian - Staff report prepared for The Hon. Mark Souder, Chairman, Subcommittee on Criminal Justice, Drug Policy and Human Resources, December 11th, 2006.

- The staff investigation has uncovered compelling evidence that Dr. Sternberg's civil and constitutional rights were violated by Smithsonian officials. Moreover, the agency's top officials—Secretary Lawrence Small and Deputy Secretary Sheila Burke—have shown themselves completely unwilling to rectify the wrongs that were done or even to genuinely investigate the wrongdoing. Most recently, Burke and Small have allowed

NMNH officials to demote Dr. Sternberg to the position of Research Collaborator, despite past assurances from Burke that Dr. Sternberg was a “Research Associate in good standing” and would be given “full and fair consideration” for his request to renew his Research Associateship. The failure of Small and Burke to take any action against such discrimination raises serious questions about the Smithsonian’s willingness to protect the free speech and civil rights of scientists who may hold dissenting views on topics such as biological evolution.

- Officials at the Smithsonian’s National Museum of Natural History created a hostile work environment intended to force Dr. Sternberg to resign his position as a Research Associate in violation of his free speech and civil rights.
- In emails exchanged during August and September 2004, NMNH officials revealed their intent to use their government jobs to discriminate against scientists based on their outside activities regarding evolution.
- The hostility toward Dr. Sternberg at the NMNH was reinforced by anti-religious and political motivations.
- NMNH officials conspired with a special interest group on government time and using government emails to publicly smear Dr. Sternberg; the group was also enlisted to monitor Sternberg’s outside activities in order to find a way to dismiss him. In cooperation with the pro-evolution National Center for Science Education (NCSE), Museum officials attempted to publicly smear and discredit Dr. Sternberg with false and defamatory information.
- Secretary Small and Deputy Secretary Burke have exhibited a head-in-the-sand attitude toward wrongdoing at their agency; they have engaged in stonewalling and spin rather than dealing forthrightly with the discrimination that has occurred..... More broadly, NMNH officials have made clear their intent to prevent any scientist publicly skeptical of Darwinian theory from ever being appointed as a Research Associate, no matter how sterling his or her professional credentials or research.³⁵

The persecution of scientists holding views opposed to evolutionary presuppositions which offer apparent justification for GMO agriculture parallels the treatment meted out to scientists who attempt to investigate the safety of GMO food. As a result, objective discussion and evaluation of evolutionary claims and GMO safety claims is rendered difficult if not impossible in many parts of the world.

³⁵ “Intolerance and the Politicization of Science at the Smithsonian”
<http://www.souder.house.gov/sitedirector/~files/IntoleranceandthePoliticizationofScienceattheSmithsonian.pdf>

II. **GMO Food: Boon or Bane?**

Having addressed the evolutionary presuppositions that undergird most if not all of the PAS reports on GMO food, it is important to address the arguments made for the safety of GMO food in those reports.

A) Safety of GMO Food: Pro and Con

The unanimous view of all of the contributors to the PAS reports on GMO food is that it is safe for human consumption. This sanguine view of GMO food safety was well articulated by Dr. Peter H. Raven who asserted confidently that:

not a single one of the hundreds of millions of people who regularly consume foods produced by GE plants has become ill as a result of eating such foods.³⁶

This view was buttressed by the common faith of all of the contributors in biological evolution which in their view has evolved the bodies of human beings through millions of years of genetic transfer, mutation and natural selection. The claim was also made repeatedly that no scientific study had ever demonstrated greater risk to man from GMO food than from “natural”—i.e. non-genetically engineered by man—varieties of plant food.

The 2009 statement on “Transgenic Plants for Food Security” states confidently:

The regulatory process in place is bureaucratic and unwarranted by science: despite rigorous investigation over more than a decade of commercial use of Genetically Modified Organisms (GMOs), no substantiated environmental or health risks have been noted. Opposition to biotechnology in agriculture is usually ideological. The huge potential of plant biotechnology to produce more, and more nutritive, food for the poor will be lost if GMO-regulation is not changed from being driven by ‘extreme precaution’ principles to being driven by ‘science-based’ principles.

No doubt this fairly represents the consensus view of the attendees at the meeting, but the claim that “no substantiated environmental or health risks have been noted” is greatly exaggerated. Space does not permit mention of all of the studies that have been made and all of the expert testimony that has been offered pointing out the need for much more careful long-term studies of the effects of GMO food on laboratory animals. The following is a small sample of studies raising serious questions about the safety of GMO food:

³⁶ Raven, P. H., Does the use of transgenic plants limit or promote biodiversity?” *New Biotechnology* _ Volume 27, Number 5 _ November 2010, p. 529.

Long term toxicity of a Roundup herbicide and a Roundup-tolerant genetically modified maize *Food and Chemical Toxicology* xxx (2012) xxx–xxx
Gilles-Eric Séralini a,†, Emilie Clair a, Robin Mesnage a, Steeve Gress a, Nicolas Defarge a, Manuela Malatesta b, Didier Hennequin c, Joël Spiroux de Vendômois https://docs.google.com/viewer?a=v&q=cache:HEMvVQWY0pkJ:research.sustainablefoodtrust.org/wp-content/uploads/2012/09/Final-Paper.pdf+&hl=en&gl=us&pid=bl&srcid=ADGEEShEEhXtK8q2eaAVRvAXC8HreLrsKbMRIZwAqc62JHeLwdJs1P6-ffve25ivkr6vqwJV5gLuydb2i3s_RwaOZU0GNsuD846qeWU_fVjRHeK3ExmjW3VN2ZpF1pqnbfBAmU6B1TB8&sig=AHIEtbQJ9RBloOgUcrqUZqvddb-77XN2qQ

The following response to criticisms of this study was signed by well over 100 scientists: <http://www.gmwatch.org/latest-listing/51-2012/14217-scientists-response-to-critics-of-seralini-study> Of still greater importance is the recently published reply by Seralini *et. al.* to their critics: <http://www.sciencedirect.com/science/article/pii/S0278691512008149>³⁷

de Vendômois JS, Roullier F, Cellier D, Séralini GE. A Comparison of the Effects of Three GM Corn Varieties on Mammalian Health. *Int J Biol Sci* 2009; 5(7):706-726. doi:10.7150/ijbs.5.706. Available from <http://www.biolsci.org/v05p0706.htm>

Biological effects of transgenic maize NK603xMON810 fed in long term reproduction studies in mice. October 2008 par Dr. A. Velimirov, Dr. C. Binter , Univ. Prof. Dr. J. Zentek <http://www.ages.at/ueber-uns/presse/pressemeldungen/klarstellung-zu-neuen-erkenntnissen-zur-fuetterung-mit-gvo-mais/>

Intestinal and peripheral immune response to MON 810 maize ingestion in weaning and old mice. Finamore A, Roselli M, Britti S, et al.. J Agric. Food Chem. 2008; 56(23):11533-11539. https://docs.google.com/viewer?a=v&q=cache:geqOQrfhZ7IJ:www.somloquesembrem.org/img_editor/file/finamore08_jf802059w.pdf+&hl=en&gl=us&pid=bl&srcid=ADGEESi2UcNN3kldDT8mEWNPFcbqbkzTPnFJffLWt4omI1lwHg9-wtxDH7URYjHWCcNqNnCkkMk7xx3XAdEAZHGS85_QxZRcDdDw8gIV9Ym_EUfAAj3YvYTVd0Okkoex2r3L9p9F881&sig=AHIEtbQafYsd1HtMCT68fOnSaB_M2rCMhg

Norwegian School of Veterinary Science <http://sciencenordic.com/growing-fatter-gm-diet> Original Paper available in Norwegian at <http://www.forskning.no/artikler/2012/juli/327547>

³⁷ SERALINI, G.-E., et al. Answers to critics: Why there is a long term toxicity due to a Roundup- tolerant genetically modified maize and to a Roundup herbicide. *Food Chem. Toxicol.* (2012), <http://dx.doi.org/10.1016/j.fct.2012.11.007>

Confronted with these studies, it is hard to understand how Peter H. Raven can assert so confidently that:

not a single one of the hundreds of millions of people who regularly consume foods produced by GE plants has become ill as a result of eating such foods.³⁸

How could Dr. Raven possibly know this with certainty, especially in the light of the above-cited studies which demonstrate serious harm to laboratory animals from the consumption of GMO feed?

Nor are the above-mentioned safety studies the only cause for concern. It is even more alarming that the short-term safety trials conducted by the producers of GMO food have been shown to be woefully inadequate. According to one report:

Experts with the Public Health Association of Australia (PHAA) thoroughly reviewed many of the data packages the manufacturers submitted to the regulators and have reported they lack key information that is routinely provided in scientific research and is required to enable meaningful review by others. They stated that such research could not have qualified for publication in peer-reviewed journals and should not have been accepted by the regulators. (*PHAA Written Comments to ANZFA, October 2000.*) And a team of Japanese scientists who reviewed Monsanto's tests on its "Roundup Ready" soybean (which has been approved in the EU) found so many irregularities in the safety assessment they concluded it was "inadequate and incomplete." (The team was headed by Dr. Masaharu Kawata, an Assistant Professor in the School of Science at Nagoya University. Their report was published in the Japanese journal *Technology and Human Beings*, vol.11, Nov. 2000, pp. 24-33).³⁹

Contrary to the claims of Dr. Raven and other contributors to the PAS sponsored reports, even the deficient data made public by the biotech industry has often revealed potential problems that regulators have ignored—even in the less GMO-friendly European Union. The report continues:

[T]he PHAA analyzed Monsanto's data from controlled studies on three of its GM plants (herbicide resistant maize and canola, and pesticide-producing corn) and in *all* three cases discovered several statistically significant differences in chemical composition (including amino acid profiles) between the GM organism and its non-GM counterpart. The PHAA report (October 2000) states that the differences in the amino acids cannot be attributed solely to the known products of the inserted genes and cautions that these plants may contain unexpected – and

³⁸ RAVEN, P. H., "Does the use of transgenic plants limit or promote biodiversity?" *New Biotechnology* _ Volume 27, Number 5 _ November 2010, p. 529.

³⁹ http://www.globalcountry.org.uk/newsletters/2003/uk20030708p_gm.htm (1-02-13)

to date unidentified – new proteins that could be harmful to humans. Nonetheless, the EU has approved two of these plants for human consumption.⁴⁰

To make matters worse, it is virtually impossible to obtain funding for long-term safety studies on the effects of GMO food. Moreover, the same companies that promote GMO feed and food crops spend huge sums of money—over 45 million US dollars in California recently—to block efforts to introduce mandatory labeling of GMO food. In these circumstances, it is at best disingenuous and grossly misleading to claim that GMO food has never made any one ill. In reality, there is overwhelming circumstantial evidence that GMO food products *are* producing allergic reactions. For example, a recent article noted that:

The UK is one of the few countries that conducts a yearly evaluation of food allergies. In March 1999, researchers at the York Laboratory were alarmed to discover that reactions to soy had skyrocketed by 50% over the previous year. Genetically modified soy had recently entered the UK from US imports and the soy used in the study was largely GM. John Graham, spokesman for the York laboratory, said, "We believe this raises serious new questions about the safety of GM foods."⁴¹

Apologists for GMO food usually respond to warnings of this kind by arguing that these statements have no scientific value. But this defense appears quite disingenuous on the lips of people who oppose GMO food labeling and funding for long term safety studies. As the author of the article just cited explains:

Critics of GM foods often say that the US population is being used as guinea pigs in an experiment. But experiments have the benefit of controls and measurement. In this case, there is neither. GM food safety experts point out that even if a someone tried to collect data about allergic reactions to GM foods, they would not likely be successful. "The potential allergen is rarely identified. The number of allergy-related medical visits is not tabulated. Even repeated visits due to well-known allergens are not counted as part of any established surveillance system."^[5] Indeed, after the Canadian government announced in 2002 that they would "keep a careful eye on the health of Canadians"^[6] to see if GM foods had any adverse reactions, they abandoned their plans within a year, saying that such a study was too difficult.

The author goes on to explain how genetic engineering may provoke increased allergies to soy:

The classical understanding of why a GM crop might create new allergies is that the imported genes produce a new protein, which has never before been present.

⁴⁰ http://www.globalcountry.org.uk/newsletters/2003/uk20030708p_gm.htm (1-02-13)

⁴¹ <http://www.biointegrity.org/health-risks/health-risks-ge-foods.htm> (accessed 1-03-13)

The novel protein may trigger reactions. This was demonstrated in the mid 1990s when soybeans were outfitted with a gene from the Brazil nut. While the scientists had attempted to produce a healthier soybean, they ended up with a potentially deadly one. Blood tests from people who were allergic to Brazil nuts showed reactions to the beans.[7] It was fortunately never put on the market.

The GM variety that is planted in 89% of US soy acres gets its foreign gene from bacteria (with parts of virus and petunia DNA as well). We don't know in advance if the protein produced by bacteria, which has never been part of the human food supply, will provoke a reaction. As a precaution, scientists compare this new protein with a database of proteins known to cause allergies. The database lists the proteins' amino acid sequences that have been shown to trigger immune responses. If the new GM protein is found to contain sequences that are found in the allergen database, according to criteria recommended by the World Health Organization (WHO) and others, the GM crop should either not be commercialized or additional testing should be done. Sections of the protein produced in GM soy are identical to known allergens, but the soybean was introduced before the WHO criteria were established and the recommended additional tests were not conducted.

If this protein in GM soybeans is causing allergies, then the situation may be made much worse by something called horizontal gene transfer (HGT). That's when genes spontaneously transfer from one species' DNA to another. While this happens often among bacteria, it is rare in plants and mammals. But the method used to construct and insert foreign genes into GM crops eliminates many of the natural barriers that stop HGT from occurring. Indeed, the only published human feeding study on GM foods ever conducted verified that portions of the gene inserted into GM soy ended up transferring into the DNA of human gut bacteria. Furthermore, the gene was stably integrated and it appeared to be producing its potentially allergenic protein. This means that years after people stop eating GM soy, they may still be exposed to its risky protein, which is being continuously produced within their intestines.⁴²

The claim is often made in the reports that bioengineering of GMO food is no different than the kind of genetic modification of plants that takes place in nature. The PAS “Multilanguage Statement” notes that:

often ignored in the public debate is that all forms of plant breeding involve genetic modification and that some examples of what is called ‘conventional’ breeding – for example mutagenesis induced by radiation – have outcomes that are intrinsically much less predictable than the application of GE technologies.⁴³

⁴² Ibid.

⁴³ “Transgenic Plants for Food Security in the Context of Development,” p. 7.

<http://www.pas.va/content/accademia/en/publications/scriptavaria/transgenic.html>

This sounds reassuring, but in reality there are significant differences between traditional plant breeding such as hybridization or even “knocking out” a gene through mutagenesis and the bioengineering of traits from an unrelated plant (or animal) into a target food plant. As a geneticist from the University of Bristol, Dr. Richard Lacey, testified in a recent court case:

Recombinant DNA technology is an inherently risky method for producing new foods. Its risks are in large part due to the complexity and interdependency of the parts of a living system, including its DNA. Wedging foreign genetic material *in an essentially random manner* into an organism's genome necessarily causes some degree of disruption, and the disruption could be multi-faceted. Further, whether singular or multi-faceted, the disruptive influence could well result in the presence of unexpected toxins or allergens or in the degradation of nutritional value. Further, because of the complexity and interactivity of living systems — and because of the extent to which our understanding of them is still quite deficient—it is impossible to predict what specific problems could result in the case of any particular genetically engineered organism.”⁴⁴

Dr. Lacey rightly points out the danger inherent in randomly reorganizing an organism’s genetic makeup and contrasts the genetic modification of food plants in the laboratory with natural methods of breeding.

The mechanics and risks of recombinant DNA technology are substantially different from those of natural methods of breeding. The latter are typically based on sexual reproduction between organisms of the same or closely related species. Normally, entire sets of genes are paired in an orderly manner that maintains a fixed sequence of genetic information. Every gene remains under the control of the organism's intricately balanced regulatory system. The substances produced by the genes are those that have been within the species for a long stretch of biological time. (In cases where mating is between closely related species, there is generally close correspondence between the substances produced by each.) In contrast, biotechnicians take cells that are the result of normal reproduction and randomly splice a chunk of foreign genetic material into their genome. This always disturbs the function of the region of native DNA into which the material wedges. Further, the foreign genes will usually not express within their new environment without a big artificial boost, which is supplied by fusing them to promoters from viruses or pathogenic bacteria. As a result, these genes operate essentially as independent agents outside the host organism's regulatory system, which can lead to many deleterious imbalances.⁴⁵

⁴⁴ Declaration of Dr. R. Lacey, M.D., Ph.D. United States District Court for the District of Columbia, Alliance for Bio-Integrity, et al. Plaintiffs, v. Donna Shalala, et al. Defendants. Civil Action No. 98-1300 (CKK). Emphasis added.

⁴⁵ Ibid.

Scientists like Dr. Lacey are not a lunatic fringe in the scientific community. The “Open Letter from World Scientists to All Governments Concerning Genetically Modified Organisms (GMOs)” <http://www.i-sis.org.uk/list.php> has been signed by 828 scientists from more than 70 nations. Why is it that their concerns are acknowledged but not addressed in detail by the documents prepared by the PAS? How can the Pontifical Academy of Sciences provide an exclusive platform for the one-sided view of Dr. Peter Raven in the face of laboratory studies and common sense arguments by so many qualified experts that contradict his claims? The studies and expert testimony cited here suggest that the confidence of the contributors to the PAS reports has far more to do with their faith in biological evolution than it does with a rigorous examination of the effects of GMO food on laboratory animals.

B) Environmental Impact of GMO food crops: Pros and Con

Besides arguing that GMO food is safe for human consumption, many of the contributors to the PAS reports claimed that GMO crops benefit the environment by reducing farmers’ dependency on pesticides and environmentally harmful practices like excessive tilling and water usage. A number of contributors argued that GMO crops are the only answer to sustainable agriculture in the face of growing populations, changing climate, and shrinking areas of land available for farming. Only through bioengineering, they argued, can food crops be designed to thrive in the greatest possible range of environments, with the least harmful ecological impact, and with the maximum nutritional benefit. A number of contributors argued that to oppose the use of GMO food crops like “Golden Rice,” which could combat Vitamin A deficiency in developing nations, constitutes a “crime against humanity.” With regard to the ecological benefits of GMO food crops, one study document noted that:

An estimated 85 million birds and billions of insects are killed annually in the United States alone, as a result of the application of pesticides on crops. Some 130,000 people become ill in this connection each year. Genetically modified plants currently in use have already greatly reduced the use of such chemicals, with great ecological benefits. It is expected that such benefits will be significantly enhanced as research and development efforts continue.⁴⁶

Again and again, in reading the reports, one is reminded of the proverb:

The first to plead his case seems right, until another comes and examines him.
Proverbs 18:17

With regard to the beneficial effects of GMO crops on the environment, the PAS reports fail to recognize or engage with the scientific evidence that GMO crops pose a serious threat to the environment. In a paper on the potential environmental impact of

⁴⁶ *Study Document on the Use of Genetically Modified Food Plants to Combat Hunger in the World*, page 16, <http://www.pas.va/content/accademia/en/publications/extraseries/gmo.html>

genetically modified plants, Dr. Miguel Altieri, with the Division of Insect Biology at the University of California, Berkeley, summarized the potential threats to the environment posed by transgenic crops:

The trend set forth by [agribusiness] corporations is to create broad international markets for a single product, thus creating the conditions for genetic uniformity in rural landscapes. History has repeatedly shown that a huge area planted to a single cultivar is very vulnerable to a new matching strain of a pathogen or pest;

The spread of transgenic crops threatens crop genetic diversity by simplifying cropping systems and promoting genetic erosion;

There is potential for the unintended transfer to plant relatives of the "transgenes" and the unpredictable ecological effects. The transfer of genes from herbicide resistant crops (HRCs) to wild or semidomesticated relatives can lead to the creation of super weeds;

Most probably insect pests will quickly develop resistance to crops with Bt [*Bacillus Thuringiensis*] toxin. Several Lepidoptera species have been reported to develop resistance to Bt toxin in both field and laboratory tests, suggesting that major resistance problems are likely to develop in Bt crops which through the continuous expression of the toxin create a strong selection pressure;

Massive use of Bt toxin in crops can unleash potential negative interactions affecting ecological processes and non-target organisms. Evidence from studies conducted in Scotland suggest that aphids were capable of sequestering the toxin from Bt crops and transferring it to its coccinellid predators, in turn affecting reproduction and longevity of the beneficial beetles;

Bt toxins can also be incorporated into the soil through leaf materials and litter, where they may persist for 2-3 months, resisting degradation by binding to soil clay particles while maintaining toxic activity, in turn negatively affecting invertebrates and nutrient cycling;

A potential risk of transgenic plants expressing viral sequences derives from the possibility of new viral genotypes being generated by recombination between the genomic RNA of infecting viruses and RNA transcribed from the transgene;

Another important environmental concern associated with the large scale cultivation of virus-resistant transgenic crops relates to the possible transfer of virus-derived transgenes into wild relatives through pollen flow.⁴⁷

⁴⁷ ALTIERI, M. A., "Modern Agriculture: Ecological impacts and the possibilities for truly sustainable farming," http://www.agroeco.org/doc/modern_agriculture.html (accessed 1-03-13)

Altieri's concerns have been substantiated by scientific research. In 2008, Dr. E. Ann Clark, associate professor of plant agriculture at the University of Guelph, challenged the claim that GM crops reduce biocide use:

Do GM crops reduce biocide use? With just HT [herbicide resistance] and IR [insect resistance] to work with, it is difficult to imagine how switching to GM crops could reduce herbicide or pesticide use. Beckie *et al.* (2006) cited primarily web-mounted reports and unpublished data as evidence of biocide use reductions for HT canola and soybeans. However, most such reports pertained to the first 5 years of GM field crop production and were not in the refereed literature. Beckie *et al.* (2006) acknowledged that the tank mixes including other herbicides, as has been necessitated by the evolution of resistant weed biotypes in more recent years, negate this claimed benefit of GM crops. Weed resistance to GLU, which accounts for roughly a third of western canola, has not been reported. However, repeated reliance on GLY crops and widespread use of glyphosate for a variety of other applications has generated glyphosate-tolerant weed biotypes, which can now be controlled only with additional herbicides, more frequent applications, and higher herbicide application rates.

A total of 75 weed biotypes spread over 15 species are now tolerant to glyphosate, of which most were detected in soy or cotton fields starting in 2000 (www.weedscience.org). Of these, most were reported from the US, with the rest predominantly from Brazil and Argentina, paralleling global use patterns of GLY technology. In response to growing weed tolerance for glyphosate, rate of herbicide (glyphosate plus other herbicides) application to GM soy in the US increased between 1996 and 2004 at a rate of 0.07 lb a.i./ac/year ($r_2 = 0.87$), while rate of herbicide application to non-GM soy decreased at a rate of -0.05 lb a.i./ac/year ($r_2 = 0.73$) (calculated from Benbrook, 2004).

Almost all insecticides used on corn in Canada are for corn rootworm, but the target of the types of Bt corn commercialized to date in Canada is predominantly the European cornborer. If the intent was to reduce biocide use through GM, this type of Bt corn was a poor choice because European cornborer is sufficiently difficult to control with insecticidal sprays that very little insecticide is actually used on it. Thus, replacing non-Bt corn with Bt-corn necessarily had a negligible effect on reducing use of insecticides which are not used in the first place.

Thus, claims that GM technology reduces biocide use in Canada are increasingly difficult to justify, given the compounding effects of GLY-tolerant weed biotypes and the choice of Bt corn active against European corn borer.⁴⁸

⁴⁸ CLARK, E. A., "The curious legacy of GMO agriculture," Associate Professor, Plant Agriculture, University of Guelph, p. 5.

In a recent study published in the journal *Environmental Sciences Europe* Benbrook studied the impact of genetically modified crops on herbicide use in the United States and concluded that:

Herbicide-resistant crop technology has led to a 239 million kilogram (527 million pound) increase in herbicide use in the United States between 1996 and 2011, while *Bt* crops have reduced insecticide applications by 56 million kilograms (123 million pounds). Overall, pesticide use increased by an estimated 183 million kgs (404 million pounds), or about 7%.

Contrary to often-repeated claims that today's genetically-engineered crops have, and are reducing pesticide use, the spread of glyphosate-resistant weeds in herbicide-resistant weed management systems has brought about substantial increases in the number and volume of herbicides applied. If new genetically engineered forms of corn and soybeans tolerant of 2,4-D are approved, the volume of 2,4-D sprayed could drive herbicide usage upward by another approximate 50%. The magnitude of increases in herbicide use on herbicide-resistant hectares has dwarfed the reduction in insecticide use on *Bt* crops over the past 16 years, and will continue to do so for the foreseeable future.⁴⁹

A number of peer reviewed studies of biocide-resistant GMO crops also testify to their potentially dangerous effects on animals. For example, a team of researchers in Argentina explored the effects of low doses of glyphosate on the embryological development of frogs and chickens and found that they developed various kinds of abnormalities:

Embryos injected with pure glyphosate showed very similar phenotypes. Moreover, GBH [Glyphosate-based herbicides] produced similar effects in chicken embryos, showing a gradual loss of rhombomere domains, reduction of the optic vesicles, and microcephaly. This suggests that glyphosate itself was responsible for the phenotypes observed, rather than a surfactant or other component of the commercial formulation . . . The direct effect of glyphosate on early mechanisms of morphogenesis in vertebrate embryos opens concerns about the clinical findings from human offspring in populations exposed to GBH in agricultural fields.⁵⁰

If this were not serious enough, recent studies have confirmed that Bt-toxin has been found in the blood of pregnant women and their babies in countries that raise Bt corn. At Sherbrooke University Hospital in Quebec doctors found Bt-toxin in the blood of 93% of

⁴⁹ BENBROOK, C. M., "Impacts of genetically engineered crops on pesticide use in the U.S. -- the first sixteen years" *Environmental Sciences Europe* 2012, 24:24 doi:10.1186/2190-4715-24-24.

⁵⁰ PAGANELLI, A., GNAZZO, A., ACOSTA, H., LOPEZ, S.E., and CARRASCO, A.E., Glyphosate-Based Herbicides Produce Teratogenic Effects on Vertebrates by Impairing Retinoic Acid Signaling,* Laboratorio de Embriología Molecular, CONICET-UBA, Facultad de Medicina, Universidad de Buenos Aires, Paraguay 2155, 3° piso (1121), Ciudad Autónoma de Buenos Aires, Argentina *Chem. Res. Toxicol.*, 2010, 23 (10), pp 1586–1595 DOI: 10.1021/tx1001749 Publication Date (Web): August 9, 2010 <http://pubs.acs.org/doi/abs/10.1021/tx1001749>

30 pregnant women, 80% of the umbilical blood in their babies, and in the blood of 67% of the 39 non-pregnant women. According to the study published in the journal *Reproductive Technology*, doctors discovered:

the presence of circulating PAGMF [Pesticides Associated to Genetically Modified Food] in women with and without pregnancy, paving the way for a new field in reproductive toxicology including nutrition and utero-placental toxicities.⁵¹

In a government-funded Italian study, the same Bt toxin that was found in the blood of the Canadian women was fed to mice in the form of Monsanto's Bt corn MON 810. The mice showed an increase in antibodies that are associated with allergic and inflammatory responses in humans and had higher levels of cytokines which are associated with various disorders in humans, including arthritis, osteoporosis, inflammatory bowel disease, and cancer. The younger mice also had a greater number of T-cells, a condition associated in children with food allergies and juvenile arthritis.

If GMO crops were the only way, or even the best way, to combat weeds and to feed mankind, it would be one thing. But they are not. Many experts argue that integrated weed management (IWM) offers a much better solution to the problem of weeds than the use of biocide-resistant GMO plants. In a recent study, entitled "Navigating a Critical Juncture for Sustainable Weed Management" the authors concluded that:

Integrated weed management is characterized by reliance on multiple weed management approaches that are firmly underpinned by ecological principles (Liebman *et al.* 2001). As its name implies, IWM integrates tactics, such as crop rotation, cover crops, competitive crop cultivars, the judicious use of tillage, and targeted herbicide application, to reduce weed populations and selection pressures that drive the evolution of resistant weeds. Under an IWM approach, a grain farmer, instead of relying exclusively on glyphosate year after year, might use mechanical practices such as rotary hoeing and inter-row cultivation, along with banded pre- and post-emergence herbicide applications in a soybean crop one year, which would then be rotated to a different crop, integrating different weed management approaches. In fact, long-term cropping-system experiments in the United States have demonstrated that cropping systems that employ an IWM approach can produce competitive yields and realize profit margins that are comparable to, if not greater than, those of systems that rely chiefly on herbicides (Pimentel *et al.* 2005, Liebman *et a.* 2008, Anderson 2009) quoted in Mortenson *et al.*, p. 81. Author(s): David A. Mortensen, J. Franklin Egan, Bruce D. Maxwell, Matthew R. Ryan, Richard G. Smith Reviewed work(s):Source: BioScience, Vol. 62, No. 1 (January 2012), pp. 75-84Published by: University of California Press

⁵¹ ARIS, A., LEBLANC, S., *Reprod Toxicol.* 2011 May;31(4):528-33. doi: 10.1016/j.reprotox.2011.02.004. Epub 2011 Feb 18. Maternal and fetal exposure to pesticides associated to genetically modified foods in Eastern Townships of Quebec, Canada. <http://www.ncbi.nlm.nih.gov/pubmed/21338670> (accessed 1-05-13)

on behalf of the American Institute of Biological Sciences Stable URL:
<http://www.jstor.org/stable/10.1525/bio.2012.62.1.12> .

The superiority of ecologically-based solutions to food production and pest and weed management underscores the wisdom of the precautionary principle that bioengineered organisms must be tested for long-term effects on the environment for which they are engineered. Dr. Elaine Ingham's experience with genetically engineered *Klebsiella-planticola* at Oregon State University demonstrates that the unintended consequences of releasing genetically engineered organisms into the environment could jeopardize the entire biosphere. She writes:

A genetically engineered *Klebsiella-planticola* had devastating effects on wheat plants while in the same kind of units . . . the parent bacteria did not result in the death of the wheat plants.

Consider that the parent species of bacteria grows in the root systems of every plant that has been assessed for *Klebsiella's* presence. The bacterium also grows on and decomposes plant litter material. It is a very common soil organism. It is a fairly aggressive soil organism that lives on exudates produced by the roots of every plant that grows in soil. This bacterium was chosen for those very reasons to be engineered: aggressive growth on plant residues.

Field burning of plant residues to prevent disease is a serious cause of air pollution throughout the US. In Oregon, people have been killed because the cloud from burning fields drifted across the highways and caused massive multi-car crashes. A different way was needed to get rid of crop residues. If we had an organism that could decompose the plant material and produce alcohol from it; then we'd have a win-win situation. A sellable product and get rid of plant residues without burning. We could add it to gasoline. We could cook with it. We could drink grass wine-although whether that would taste very good is anyone's guess. Regardless, there are many uses for alcohol.

So, genes were taken out of another bacterium, and put into *Klebsiella-planticola* in the right place to result in alcohol production. Once that was done, the plan was to rake the plant residue from the fields, gather it into containers, and allow it to be decomposed by *Klebsiella-planticola* . But, *Klebsiella* would produce alcohol, which it normally does not do. The alcohol production would be performed in a bucket in the barn. But what would you do with the sludge left at the bottom of the bucket once the plant material was decomposed? Think about a wine barrel or beer barrel after the wine or beer has been produced? There is a good thick layer of sludge left at the bottom. After *Klebsiella-planticola* has decomposed plant material, the sludge left at the bottom would be high in nitrogen and phosphorus and sulfur and magnesium and calcium-all of those materials that make a perfectly wonderful fertilizer. This material could be spread as a fertilizer then, and there wouldn't be a waste product in this system at all. A win-win-win situation.

But my colleagues and I asked the question: What is the effect of the sludge when put on fields? Would it contain live *Klebsiella-planticola* engineered to produce alcohol? Yes, it would. Once the sludge was spread onto fields in the form of fertilizer, would the *Klebsiella-planticola* get into root systems? Would it have an effect on ecological balance; on the biological integrity of the ecosystem; or on the agricultural soil that the fertilizer would be spread on?

One of the experiments that Michael Holmes did for his Ph.D. work was to bring typical agricultural soil into the lab, sieve it so it was nice and uniform, and place it in small containers. We tested it to make sure it had not lost any of the typical soil organisms, and indeed, we found a very typical soil food web present in the soil. We divided up the soil into pint-size Mason jars, added a sterile wheat seedling in every jar, and made certain that each jar was the same as all the jars.

Into a third of the jars we just added water. Into another third of the jars, the not-engineered *Klebsiella-planticola*, the parent organism, was added. Into a final third of the jars, the genetically engineered microorganism was added.

The wheat plants grew quite well in the Mason jars in the laboratory incubator, until about a week after we started the experiment. We came into the laboratory one morning, opened up the incubator and went, "Oh my . . . some of the plants are dead. What's gone wrong? What did we do wrong?" We started removing the Mason jars from the incubator.

When we were done splitting up the Mason jars, we found that every one of the genetically engineered plants in the Mason jars was dead. Wheat with the parent bacterium, the normal bacterium, was alive and growing well. Wheat plants in the water-only treatment were alive and growing well.

From that experiment, we might suspect that there's a problem with this genetically engineered microorganism. The logical extrapolation from this experiment is to suggest that it is possible to make a genetically engineered microorganism that would kill all terrestrial plants. Since *Klebsiella-planticola* is in the root system of all terrestrial plants, presumably all terrestrial plants would be at risk.

So what does *Klebsiella-planticola* do in root systems? The parent bacterium makes a slime layer that helps it stick to the plant's roots. The engineered bacterium makes about 17 parts per million alcohol. What is the level of alcohol that is toxic to roots? About one part per million. The engineered bacterium makes the plants drunk, and kills them.

But I am not trying to say that all genetically engineered organisms are technological terrors. What I am saying is that we have to test each and every

genetically engineered organism and make sure that it really does not have unexpected, unpredicted effects.⁵²

Is it unreasonable to suppose that genetically modified food could also have unintended effects on human beings that would not be detected by the standard ninety-day trials performed by industry? It would seem that, once again, the contributors to the PAS reports failed to invite the participation of competent experts who had reached different conclusions in regard to the safety and benefit of GMO crops and then failed to fairly represent their views in the final reports.

C) Persecution of GMO Critics in the Scientific Community

The failure of the contributors to the four reports to adequately represent or address the evidence and arguments of GMO critics is deeply disturbing. But the failure becomes much more distressing against a consistent pattern of persecution of GMO critics within many segments of the scientific community.

Since the recently published study by Seralini *et al.* on the effects of GMO food on laboratory animals ignited a firestorm of criticism in the media, it is incumbent upon all of the participants in the debate over GMO agriculture to examine the way in which Dr. Seralini was attacked in the media and to evaluate the claims that have been leveled against him and his team. To that end, the article at the following link is extremely helpful: <http://independentsciencenews.org/health/seralini-and-science-nk603-rat-study-roundup/> It has been signed-on-to by well over 100 scientists from around the world and acknowledges that:

US scientists who publish studies finding adverse environmental effects are frequently vehemently attacked by other pro-GM scientists. As a report in *Nature*, which discusses numerous examples, points out, "Papers suggesting that biotech crops might harm the environment attract a hail of abuse from other scientists. Behind the attacks are scientists who are determined to prevent papers they deem to have scientific flaws from influencing policy-makers. When a paper comes out in which they see problems, they react quickly, criticize the work in public forums, write rebuttal letters, and send them to policy-makers, funding agencies and journal editors" (pg. 27 in Waltz, E. 2009a. Battlefield. *Nature* 461: 27-32). Indeed, when one of us wrote a Commentary in *Nature Biotechnology* ten years ago suggesting that more attention needs to be paid to the potential unintended effects associated with insertional mutagenesis, we received a flood of responses, and an administrator at the Salk Institute even said that the publication "was jeopardizing funding for his institution" (see Waltz, 2009a). Similar attacks have greeted studies on adverse effects of Bt toxins on ladybird beetles and green lacewing larvae, which were used by German authorities to ban cultivation of Mon810, a Bt corn variety (see: Hilbeck *et al.*).

⁵² INGHAM, E., "Good Intentions and Engineering Organisms that Kill Wheat," <http://www.greens.org/s-r/18/18-14.html> (accessed 1-13-13).

2012a,b , respectively). In 2009, a group of 26 public sector corn entomologists sent a letter to the US Environmental Protection Agency which stated "No truly independent research can be legally conducted on many critical questions involving these crops [because of company-imposed restrictions]" (pg. 880 in Waltz, 2009b; it was no surprise that the letter was sent anonymously as the scientists feared retribution from the companies that funded their work (Pollack, 2009). Furthermore, industry control over what research can be conducted in the US means that adverse findings can effectively be suppressed.

In one example cited in the article, Pioneer was developing a binary Bt toxin, Cry34Ab1/Cry35Ab1, against the corn rootworm. In 2001, Pioneer contracted with some university laboratories to test for unintended effects on a lady beetle. The laboratories found that 100% of the lady beetles died after eight days of feeding. Pioneer forbade the researchers from publicizing the data. Two years later Pioneer received approval for a Bt corn variety with Cry34Ab1/Cry35Ab1 and submitted studies showing that lady beetles fed the toxin for only 7 days were not harmed. The scientists were not allowed to redo the study after the crop was commercialized (Waltz, 2009b). In another example, Dow AgroSciences threatened a researcher with legal action if he published information he had received from US EPA. As the article notes, "The information concerned an insect-resistant variety of maize known as TC1507, made by Dow and Pioneer. The companies suspended sales of TC1507 in Puerto Rico after discovering in 2006 that an armyworm had developed resistance to it. Tabashnik was able to review the report the companies filed with the EPA by submitting a Freedom of Information Act request. "I encouraged an employee of the company [Dow] to publish the data and mentioned that, alternatively, I could cite the data," says Tabashnik. "He told me that if I cited the information...I would be subject to legal action by the company," he says. "These kinds of statements are chilling" (pg. 882 in - Waltz, E. Under Wraps. *Nature Biotechnology* 27(10): 880-882. Waltz, E. 2009b. Under Wraps. *Nature Biotechnology* 27(10): 880-882.).⁵³

A second article by Dr. E.A. Clark evaluates the claims leveled against Seralini *et al.* and finds them wanting. In particular, she observes that one of the criticisms of Dr. Seralini's research concerned the use of Sprague Dawley rats which are prone to tumors. This criticism ignores the fact that humans are also prone to tumors and that Sprague Dawley rats are used for safety studies precisely because of their similarity to humans. The criticism also seems rather disingenuous coming from pro-GMO scientists, since the short-term safety trials conducted by Monsanto use the same kind of rat! Finally, a subsequent piece by Matthews <http://www.scribd.com/doc/116473155/Smelling-a-corporate-rat> explains in greater depth the uneven manner in which the Seralini story was covered by the biotech sector.

It is noteworthy that a number of the contributors to the PAS reports decried EU-funded public relations campaigns against GMO food research and even acts of vandalism by

⁵³ Quoted in "Seralini and Science: An Open Letter," <http://independentsciencenews.org/health/seralini-and-science-nk603-rat-study-roundup/> (accessed 12-22-12)

protestors against GMO research projects, but none of them testified to having had their professional reputations or careers destroyed because of their support for GMO agriculture. This stands in marked contrast to the experience of scientists critical of GMO food safety, many of whom have had their reputations, careers, and livelihood threatened after daring to publicly discuss the evidence of GMO food risks to man, to animals, and to the environment.

As a body of expert advisors to the Catholic Church, the pillar and foundation of the truth, the Pontifical Academy of Sciences would seem to have a special responsibility to insure that qualified spokesmen on both sides of important scientific controversies are given a forum where their arguments can be fairly evaluated on their merits and where advocates for opposing points of view can be protected from political or economic pressure. It is deeply distressing to see that the PAS has not done this for scientists critical of evolutionary speculation or for scientists critical of GMO agriculture, but has instead helped to silence opposing points of view on both of these fundamental issues.

D) Africa and GMO Food Policy

In his paper “GMO Foods and Crops: Africa’s Choice,” Dr. Robert Paarlberg affirms the consensus view of the four reports by stating that

There has not yet been any documented evidence that approved GMOs have posed new risks either to human health or the environment.

Paarlberg argues that in the absence of any documented evidence of GMO risks to human health or the environment, Africa’s rejection of GMO food crops results from pressure from European markets and lobbyists. Paarlberg’s argument lacks plausibility on the face of it, since it is virtually impossible to obtain funding for long-term safety studies like the one conducted by Seralini and his team. As explained above, the effective lobbying of agribusiness *against* labeling of GMO products also makes it almost impossible to do any kind of scientific study of the short or long-term effects of eating GMO food—since it is impossible know with any degree of certainty the GMO content of non-organic food. Indeed, we find Dr. Paarlberg’s analysis quite condescending and insulting to African scientists and civic leaders who have explained their reasons for rejecting GMOs but whose public statements are apparently deemed unworthy of serious consideration by Paarlberg. Had he consulted Africans about their reasons for rejecting GMO food, he would have found that they have studied the “documented evidence” but have come to a different conclusion. A statement signed by African civil society leaders reflects their familiarity with current research and the uneven coverage of that research in the biotechnology sector:

During September 2012, Professor Gilles-Eric Seralini, and his research team at the University of Caen in France, published the results of a two-year animal feeding study, in which rats fed with Monsanto's herbicide tolerant GM maize, event NK603, and glyphosate residues, developed tumours and showed signs of liver and kidney damage. The peer reviewed study, published in a highly respected scientific journal has come under vicious and sustained attack from the

biotechnology machinery.

Nevertheless, scientific consensus has emerged from the discourse, that the current methods used by Monsanto *et al.*, for testing the safety of GM food are dangerously inadequate and that long term, independent and publicly conducted food safety studies are urgently needed. We also note with concern that there are no internationally agreed protocols for long term testing of GMOs.

The civil society leaders' mention of Monsanto had a particular sting to it in light of a South African court's finding in 2006 that Monsanto had engaged in false advertising of its GMO corn. In language reminiscent of the PAS reports, Monsanto had claimed that

All commercially approved grain products that have been genetically modified adhere to strict food, feed and environmental safety guidelines of regulatory authorities worldwide. This is one of the most extensively tested and controlled types of food, and no negative reactions have ever been reported.⁵⁴

When brought before the South African Advertising Authority (ASA) to defend this claim in regard to one of their products, MON 863, Monsanto representatives claimed that MON 863 was not their product. However, the ASA found that MON 863 *was* a Monsanto product, that it had been found to harm laboratory rats in independent trials, and that Monsanto had applied for the product to be released in South Africa. The ASA then ordered Monsanto to withdraw its advertisement. In spite of the ASA's decision, Monsanto proceeded to publish the same advertisement with the same wording except for the added words "No substantiated medical or scientific negative reactions have ever been reported." Mark Wells, a founder member of Farmers Legal Action Group, South Africa, who was the successful applicant in the previous incident, challenged the new advertisement. In December 2007 Judge King of the ASA ruled that despite the amended wording, the overall meaning of the advertisement remained the same. A reasonable person would interpret the claim to mean that Monsanto products had been tested and that no negative reactions had been found. Thus, the judge found Monsanto guilty of breaching the previous ruling.

In light of Monsanto's record of questionable practices in South Africa, the participation of Monsanto agents in a recent Academy-supported conference on GMO food seems particularly troubling. According to a Catholic News Service story, the conference on GMO food featured:

at least four speakers who have ties to the U.S. agribusiness giant Monsanto, which created a synthetic bovine growth hormone to boost cow milk production as well as insect- and herbicide-resistant seeds.

⁵⁴ "Falsified Food Safety Claims Rejected by Court," http://www.gmfrecymru.org/documents/monsanto_slammed.htm (accessed 12-26-12).

The CNS story added that an African bishop attended the Academy meeting to speak about opposition to GMO food on the part of his fellow African bishops.

Bishop George Nkuo of Kumbo, Cameroon, attended the closed-door study week with the idea that he would talk about a warning by African bishops against claims that genetically modified crops would solve Africa's food crises.

A working document for the Synod of Bishops for Africa released two months before the meeting in 2009 said that using modified crops risks "ruining small landholders, abolishing traditional methods of seeding and making farmers dependent on the production companies selling their genetically modified seeds."⁵⁵

Reading Paarlberg's dismissal of African opposition to GMO food as an ill-informed reaction to pressure from European markets and NGOs, one wonders why he made no mention of the African bishops' synod document, or of the serious concerns mentioned by other African leaders. These concerns echo those of many civil society leaders in other parts of the so-called developing world who oppose the introduction of GMO crops for similar reasons. The success of Asian farmers in finding alternatives to "Golden Rice" as a solution to Vitamin A deficiency fully justifies the determination of African farmers and civil society leaders to find such solutions in Africa. As one reporter observed:

The sobering fact is that "nearly eighty percent of all malnourished children in the developing world in the early 1990s lived in countries that boasted food surpluses." The Green Revolution in Asia brought about a shift toward intensive cultivation of fewer crops like wheat and rice, which are often grown for export. Traditional diverse polycultures have yielded to large monocultures.

At the same time—and at least in part due to the Green Revolution and other technology-driven change—hundreds of millions of people have migrated from rural to urban areas in Asia during the past few decades. Mostly poverty-stricken, these transplants take up residence in the ever-expanding slums around cities. Their problem is that they can't buy the food they need. Golden rice will do them no good if they can't afford it—and if they can afford it, then it is not clear what the new rice offers that would not be offered better by a more traditional and diverse diet.

Every green part of a plant contains beta-carotene. When Indian scientist and activist Vandana Shiva was asked what alternative she saw to golden rice, she cited "the 200 kinds of greens we grow on our farms."⁵ Traditional cultures never subsist on rice alone. In addition to the many different types of greens grown in India, wheat, millet, and various legumes are cultivated, not to mention the wild greens gathered from the countryside. Such polycultures develop differently in

⁵⁵ GLATZ, C., "Vatican has not endorsed genetically modified food, official says," Catholic News Service, December 1, 2012 <http://www.catholicnews.com/data/stories/cns/1004910.htm> (accessed 1-13-13)

each region, but all allow, as long as there is enough food, for a balanced, life-sustaining diet.

It needs recognizing that what we in the western world embrace as export-driven economic growth has contributed to the problem of hunger in developing nations.⁶ Golden rice can be seen in part as a one-dimensional attempt to "fix" a problem created by the Green Revolution—namely the problem of diminished crop and dietary diversity. But the fix offers no direct help to those who have been displaced by the revolution and who cannot buy the food they need.

There are alternative approaches that do more justice to the complex geographical, historical, social, political, and economic issues. In 1993, the United Nations Food and Agriculture Organization, collaborating with nongovernmental organizations such as Helen Keller International, began a program to help poor people in Bangladesh grow a diverse array of plants to combat vitamin A deficiency.⁷ In areas where people have at least small plots of land, families—usually mothers become the driving force of such projects—were introduced to different carotene-rich varieties of fruits and vegetables and they learned cultivation methods. Landless families were shown how they could plant vines in pots on outside walls. They then planted beans and squashes that can grow up the vines.

When women noticed the positive health effects of their new diet, news spread by word of mouth, and now approximately 600,000 households (about three million people) participate in this project. This is, relatively speaking, a small number, but the project is promising because it can become part of cultural tradition. It empowers people instead of making them dependent on western aid.

Scientists evaluating the project found that the general health of the participants improved and that even small plots can provide sufficient vitamin A in the diet. Moreover, the more different kinds of fruits and vegetables people ate, the better the uptake of carotene—an illustration of the inherent value of natural variety in the diet.

After assessing a number of such projects, John Lupien of the Food and Agriculture Organization concludes: "A single-nutrient approach toward a nutrition-related public health problem is usually, with the exception of perhaps iodine or selenium deficiencies, neither feasible nor desirable."⁵⁶

The imprudence of forging ahead with GMO crops in developing countries, in the current environment, was highlighted by the recent report by a court-appointed scientific panel in India which called for a ten-year moratorium on field trials of *any* GMO crops. According to *Science Insider*:

⁵⁶ KOECHLIN, F. (2000). "Golden Rice" -- A Big Illusion? www.blauen-institut.ch.html; click "Hintergruende", then click "Vitamin A Documents".

A court-appointed scientific panel on 17 October [2012] has come down heavy on genetically modified (GM) foods. It is calling for a ten-year moratorium on field trials of any GM food crop as well as nonfood crops such as cotton equipped to produce an insect-killing toxin from *Bacillus thuringiensis* (Bt). A decade, the panel said, "is a reasonable length of time" to strengthen India's regulatory regime and develop "a cadre of experts in areas of relevance to food safety evaluation, environmental impact assessment etc . . . Among the panel's recommendations are calls for more rigorous "intergeneration" animal feeding studies, a halt on trials conducted outside public institutes, and the removal of advisers with conflicts of interest from regulatory bodies.⁵⁷

In light of the evidence that has been presented here, it would seem that the conclusions reached by African civil society leaders are well founded and not simply a reaction to pressures from European markets and lobbyists. This is reflected in the civil society leaders' statement:

Recognising that millions of Africans have been consuming GM maize and other GM products without their knowledge or consent; and

Taking into account the new consensus that long term, independent food safety studies are urgently needed;

We strongly urge the government of South Africa, (as the only GM food producer on the continent) and all other African governments that import GMOs and GM products, to urgently respond to our calls for a ban.

We urge our policy makers to follow the guidance provided by the International Assessment of Agricultural Knowledge Science and Technology for Development (IAASTD). The IAASTD recommends that policy makers move away from industrial agriculture and GMOs, to food production systems that are appropriate for the millions of small-scale farmers around the world, who are primarily responsible for the global population's sustenance.⁵⁸

It is embarrassing to note that one of the few papers in recent PAS reports devoted to the future of GMO agriculture in Africa dismisses the well-founded concerns of African scientists and civil leaders as uninformed responses to political and economic pressures, without addressing them. The Catholic Church should play a leading role in insuring that the legitimate concerns of African scientists and civil leaders are addressed before advocating the introduction of GMO food crops into Africa's economy. Indeed, far from being mere pawns of European markets and lobbyists, the scientists and civic leaders of Africa should be hailed as independent thinkers and prophetic voices, warning their

⁵⁷ <http://news.sciencemag.org/scienceinsider/2012/10/india-eyes-10-year-ban-on-gm-fie.html> (accessed 1-02-13)

⁵⁸ "African Civil Society Calls on the African Union to Ban Genetically Modified Crops," Biosafety Information Centre, December 27, 2012 <http://www.biosafety-info.net/article.php?aid=934> (accessed 12-27-12).

wealthier cousins in the Northern Hemisphere to exercise greater prudence, lest they fill the whole world with products whose unpredictable and potentially destructive effects could do irreversible harm to man and the environment.

III. Church Teaching on Creation and Man's Relationship to Nature

It is axiomatic that no business plan or hypothesis in natural science can be viable that contradicts the authoritative teaching of the Catholic Church in faith or morals. No responsible evaluation of the arguments for GMO agriculture can ignore the fact that the dogmatic teaching of the Church on creation, especially as summed up in the *firmiter* of Lateran IV and Vatican I, contradicts the evolutionary assumptions that undergird the Pontifical Academy of Science's support for biotechnology.

A) Preliminary Philosophical Considerations

In the last papal encyclical devoted to the topic of origins, *Humani generis*, Pope Pius XII reminded the bishops that the Church's philosophical tradition must be maintained in any discussion of origins. In the Church's metaphysical tradition, created reality can be understood in terms of the four causes of Aristotle: the formal, final, material and efficient. In this tradition, it was understood that the formal cause is that which meaningfully arranges the material elements of an entity. So thoroughly were the four causes integrated into the theological activity of the Church that in 1312, an ecumenical Council in Vienne defined that "the soul is the form of the human body." With this definition, the Church defined once and for all that it is the soul that meaningfully arranges all of the material elements, including the organs and physiological systems of the human body, and makes them, specifically, a human body. In the light of this dogmatic definition, it is obvious that man's humanity cannot be reduced to one or the other part of his body. His soul gives form to the whole body and to all of its physical components. It is not "a ghost in a machine" made up of material units that act according to their physical characteristics without a unifying principle of coordination.

Pope Pius XII wisely linked the acceptance of evolutionism to a denial of the Church's traditional philosophy. Indeed, historians of philosophy have noted that from the time of Descartes and Bacon, natural scientists in Europe began to dispense with formal and final causes, and to focus exclusively on material and efficient causes. This philosophical revolution led eventually to the acceptance of the Darwinian notion that the different kinds of living things evolved part by part, through natural selection, over millions of years. In the traditional philosophy of St. Thomas, it was understood that plants, animals and men each had a formal cause that meaningfully arranged and coordinated the physical elements of their bodies as an integrated whole. In the new Darwinian evolutionary framework, it was assumed that the only things worthy of a scientist's attention were the quantifiable ones, things that could be measured by some kind of physical measurement. In this view, man, in particular, was assumed to have evolved from a lower life-form through a long series of small changes, part by part, organ by organ. Within this framework it was understood that the "part" that set man apart from

the apes was his brain and it was assumed that the brain had evolved last in man to differentiate him from his subhuman primate cousins.

The folly of this line of reasoning flows from the assumption that the whole body of man could have been cobbled together piecemeal. In reality, the more natural scientists have learned about the marvelous design of the human body, the more obvious it has become that the traditional philosophy of the Church was correct and that the human body could not have come into existence part by part. The *definition* of the council of Vienne was a tremendous gift from God to the Church on the eve of a philosophical revolution that attempted to reduce man to a collection of material parts subject to chemical and physical laws, but not organized into a harmonious whole by a divinely created organizing principle, the human soul. The acceptance of this evolutionist, reductionist, materialist philosophy by men of science and medicine has led directly to the idea that a man whose brain no longer functions above a certain level of activity ceases to be human and should be pronounced “dead.” This, in turn, has led to the large-scale extraction of organs from living human subjects with pulse, heartbeat, normal temperature, and exchange of gas through the lungs, often requiring the sedation of the “dead” patients so that their valuable organs can be harvested without undue protest!⁵⁹

The same error that led to reducing man to a collection of physical parts subject only to the laws of physics and chemistry led to a similar tendency to reduce plants, animals, and whole ecosystems to more or less random collections of material elements. Thus, brilliant scientists operating within this impoverished philosophical framework have unintentionally committed serious errors by reducing complex wholes to collections of parts. Indeed, this reductionist tendency pervades the biotechnology reports on GMO food. Both in regard to the nature of food and plant eco-systems, the authors isolate parts of the whole and treat them as if they can be manipulated harmlessly without rigorous and careful testing of impacts on whole organisms and eco-systems. For example, the many champions of Golden rice isolate one vitamin as a key to good health without considering the impact on the whole plant of artificially increasing its production of beta-carotene.

Besides failing to count the cost of genetic engineering for greater beta carotene production on the whole plant, the bio-engineers also failed to consider the way the body assimilates nutritional elements as complexes rather than as discrete individual elements. Many studies have shown that synthetic vitamins may produce very different (and even harmful) effects from those produced by naturally occurring vitamins. This flies in the face of the view asserted by a number of experts in the four reports, that there is no “natural” food, that all food plants are the result of random mutation and natural selection,

⁵⁹ Please see below for a further discussion of the Pontifical Academy of Sciences’ handling of the “brain death” controversy. For an in-depth explanation of the inadequacy of the brain-death criteria for human death, see BYRNE, P. A., *et al.*, “Brain Death: The Patient – The Physician – and Society” https://docs.google.com/viewer?a=v&q=cache:wxJA3FzFtzAJ:www.lifeguardianfoundation.org/pdfs/beyond_brain_death.pdf+&hl=en&gl=us&pid=bl&scid=ADGEESgBrvIKXFJJnuoVwHPAkHVcg1CIgS6BCKjEn1rJf7jR-ZhcHVLF4mgjDp_hOEqN5RHx_M7CwNu1U7LAj2Ca5ZdnFdSVLRImctDkqRPIzrz4H0FJMX1rDHOV8itd_2cO8Iy3u3nl&sig=AHIEtbTZSs_x3wPrmZ9jChrMLSORXRuRLQ

and that, therefore, biotechnology is needed to fix the defects in “natural” food plants. It is well known, for example, that synthetic vitamin D2 added to milk actually has the opposite effect of naturally occurring vitamin D complex, causing decalcification of the hard tissues and calcification of the soft tissues, including the soft tissues of the arteries.⁶⁰ For this reason, D2 has been phased out as an additive and replaced by D3, but there is evidence that synthetic D3 is poorly absorbed.⁶¹

In “Golden Genes and World Hunger” researchers Holdredge and Talbott noted:

The fundamental problem with genetic engineering from the very beginning has been the absence of anything like an ecological approach. Genes are not the unilateral "controllers" of the cell's "mechanisms." Rather, genes enter into a vast and as yet scarcely monitored conversation with each other and with all the other parts of the cell. Who it is that speaks through the whole of this conversation—what unity expresses itself through the entire organism—is a question the genetic engineers have not yet even raised, let alone begun to answer.

But without an awareness of the organism as a whole, we can hardly guess the consequences of the most "innocent" genetic modification. The analogy with ecological studies is a close one. Change one element of the complex balance—in an ecological setting or within an organism—and you change *everything*. It is a notorious truth that our initial expectations of an altered ecological setting often prove horribly off-target. And the possibility of improving our discernment depends directly upon our intimate familiarity with the setting as a whole in all its minutia and unity.

Certain herbicides kill plants by bleaching them—that is, by disrupting carotene metabolism and blocking photosynthesis. When scientists genetically altered tobacco plants to give them herbicide resistance, some of the plants indeed proved resistant to an array of herbicides.¹⁵ [Misawa, N. (1994). Expression of an *Erwinia* Phytoene Desaturase Gene *The Plant Journal* 6:481-489.] Unexpectedly, however, leaves of the transgenic plants produced greater amounts of one group of carotenes and smaller amounts of another group, while the overall carotene production remained about normal. In some unknown way the genetic manipulation affected the balance of carotene metabolism, but the plant as a whole asserted its integrity by keeping the overall production of carotene constant.

Such unexpected effects are typical, expressing the active, adaptive nature of organisms. An organism is not a passive container we can fill up with biotech contrivances. Even when scientists try to change the narrowest trait of an organism, the organism itself responds and adapts as a whole.

⁶⁰ BUIST, R. A. Vitamin Toxicities, *Side Effects and Contraindications*. International Clinical Nutrition Review 4(4), 159-171, 1984.

⁶¹ BARNES, D.J. Comparative Value on Irradiated Ergosterol and Cod Liver Oil as a Prophylactic Antirachitic Agent When Given in Equivalent Dosage According to the Rat Unit of Vitamin D. *American Journal of Diseases in Children* 39, 45, 1930.

When tomatoes were engineered for increased carotene production, some plants did make more carotene, but often in places where they wouldn't normally produce much of the substance—for instance, in the seeds, the seed leaves, and the area where the tomato breaks off the stem.¹⁶ [Fray, R. *et al.*. (1995). Constitutive Expression of a Fruit Phytoene Synthase Gene *The Plant Journal* 8:693-701.] In addition, the plants produced more and different kinds of carotene than expected. More surprisingly still, the plants were dwarfed. The more carotene a plant produced, the smaller it was. Because a substance that normally stimulates growth in plants (giberillin A) was reduced thirty-fold, the scientists assume that the carotene increase interfered with giberillin production.

This is not an isolated example of how genetic manipulations can affect the vitality of a plant. In the first successful alterations of rice to produce precursors of vitamin A, half the transgenic plants were infertile.¹⁷ Of course, infertile or markedly dwarfed plants are left by the wayside, while the researchers select the most desirable specimens for their breeding stock. But unexpected effects are not always as apparent as dwarfed tomato plants.

The transgenic golden rice plants were reported to be "phenotypically normal." This statement needs to be read: "no visible modifications were noted." The researchers evidently didn't undertake a biochemical analysis of the kernels to see how their overall content might have changed. What *doesn't* a golden rice kernel produce as a result of the plant's breaking down excessive amounts of carotene? What new substances does it produce? And what are the changed balances among substances normally present? The more one learns about the flexible and dynamic nature of organisms--demonstrated so clearly by genetic engineering experiments themselves--the more one comes to expect the unexpected and to realize that we cannot know what subtle effects a manipulation may have.

How many genetic engineers have pondered the remarkable fact that rice, despite the myriad varieties that have arisen over thousands of years, never produces carotene in the endosperm of the kernel? The rest of the above-ground plant makes carotene, and the endosperm should (according to prevailing conceptions) have the genes that would allow it to produce carotene. But it never does so. Certainly that should give us pause to consider what we're doing. Might the excess carotene in the seed affect in some way the nourishment and growth of a germinating rice plant? What does it mean to force upon the plant a characteristic it consistently avoids? Can we claim to be acting responsibly when we overpower the plant, coercing a performance from it before we understand the reasons for its natural reticence?

Organisms are not mechanisms that can be altered in a clear-cut, determinate manner. The fact is that we simply don't know what we're doing when we

manipulate them as if they were such mechanisms. The golden kernels of rice almost certainly herald much more than a novel supply of beta-carotene.⁶²

An even more serious consequence of reductionist thinking flows from the attempt to test and treat plants in isolation from the soil. In the context of the Church's traditional creation theology, it would be impossible to treat plants or plant pests without taking into consideration the effect of those treatments upon the whole eco-system, most especially the soil. Reductionist thinking in agriculture in the twentieth century focused on nitrogen as a key ingredient of soil for productive plants, but Elaine Ingham at Oregon State University has voiced the concerns of many agricultural experts who decry the folly of reducing soil health to one or a few chemicals, which, in turn, leads to inadequate testing of GMOs. She writes:

I've worked with folks in the Environmental Protection Agency (EPA) and I know the tests the EPA performs on organisms. They often begin their tests with "sterile soil." But if it's sterile, then it's not really soil. Soil implies living organisms present. If you use "sterile soil" and add a genetically engineered organism to that sterile material, are you likely to see the effects of that organism on the way nutrients are cycled, or on the other organisms in that system? No, you're not likely to. So it's probably no surprise that no ecological effects are found when they test genetically engineered organisms in sterile soil. They really need to put together testing systems, which assess the effects of the test organism on all of the organisms present in soil.

What do we mean, organism-wise, when we talk about soil? Agricultural soil should have 600 million bacteria in a teaspoon. There should be approximately three miles of fungal hyphae in a teaspoon of soil. There should be 10,000 protozoa and 20 to 30 beneficial nematodes in a teaspoon of soil. No root-feeding nematodes. If there are root feeding nematodes, that's an indicator of a sick soil.

There should be roughly 200,000 microarthropods in a square meter of soil to a 10-inch depth. All these organisms should be there in a healthy soil. If those conditions are present in an agricultural soil, there will be adequate disease suppression so that it is not necessary to apply fungicides, bactericides, or nematicides. There should be 40 to 80% of the root system of the plants colonized by mycorrhizal fungi, which will protect those roots against disease.

What happens when you apply the most fungicides and pesticides to soil? In every single case where we have looked at foodweb effects of pesticides, there are non-target organism effects, and usually very detrimental effects. The sets of beneficial organisms that suppress disease are reduced. Organisms that cycle nitrogen from plant-not-available forms into plant-available forms are killed.

⁶² HOLDREGE, C. and TALBOTT, S., "Golden Genes and World Hunger: Let Them Eat Transgenic Rice?" <http://www.westonaprice.org/modern-foods/transgenic-rice> accessed 12-22-12.

Organisms that retain nitrogen, phosphorus, sulfur, magnesium, calcium, etc. are killed. Organisms that retain nutrients in the soil are killed. Once retention is destroyed, where do those nutrients go?

They end up in our drinking water; or end up in our ground water. You and I as taxpayers have to pay in order to clean up that water so we can drink it.⁶³

Reductionist thinking leads to similar disasters even when non-food plants are in view. Researcher Rajan Alexander has demonstrated that Bt cotton was introduced into India to combat a few specific pests but without regard for its impact on the whole Indian cotton-farm ecosystem. Alexander writes:

Bt's weakness as a technology stems from not incorporating the lessons of our hybrid experience. To prevent resistance build up in insects, pesticide management should reflect its judicious use - finding the right toxin-pest fit; right dosage-degree of infestation fit combined with timely and required frequency of applications. This principle was observed to be violated in common practices of hybrid cultivation resulting in contributing to resistant build up in insects, necessitating application of new toxins and/or higher dosages to control the same degree of pest infestation.

The endotoxins secreted from Bt besides does not permit effective control over of either their timing or dosage. The very fact that it targets only one set of insects, necessitates manual spraying of other categories of broad spectrum acting pesticides, including 'cocktails' that violates judicious norms of sustainable pest management principles. Since Bt does not offer protection for bollworms during the entire life cycle of the plant, it also entails limited manual spraying to complement its endotoxins. Multiple stacking of genes, the new generation of Bt's are in fact no different from a 'cocktail' in effect except that it is much worse in impact.

The refuge system was neither complied with by farmers or if complied with, was ineffective to prevent the build up resistance. In fact, the goal of refuge was defensive to begin with. Prevention was never its aim but only to delay resistance from developing long enough so that it becomes manageable, so that, perhaps, by the time super-bollworms evolve, there are new versions of super-Bollgard available to farmers to contain the threat so that the cycle begins again, escalating seed costs for farmers and boosting revenue earnings for seed companies.

The refuge system was a poor alternate to the system of crop rotation, one of the oldest and most effective cultural control strategies. It meant that the succeeding crop must be a different family than the previous one, based on the appreciation that most significant pests are crop specific and their populations can naturally

⁶³ INGHAM, E., Oregon State University, "Good Intentions and Engineering Organisms that Kill Wheat" July 18, 1998 at the First Grassroots Gathering on Biodevastation: Genetic Engineering www.soilfoodweb.com

decline if deprived of food by rotating crops, dying due to absence of food. Bt however created the illusion that it was a superior alternative by offering the refuge system.

It is no surprise that the attempt to stall the evolution of insect resistance through transgenic crops producing *Bacillus Thuringiensis* (Bt) toxins ended up a failure as instead of pests getting killed, they instead began thriving on it. (MT Ranjith *et al.*). But Glenn Gladstone of Washington University in St. Louis in his study warns the failure goes much beyond this level:

beyond the field level to the farm level you see the real problem was a set of factors that eroded the normal process of farmer evaluation of technologies—there were too many rapid, undecipherable changes.

Each new technology—hybrids, then pesticide after pesticide—brought short-term gains but further eroded farm management. Bt cotton has raised yields on average, but already we are seeing erosion of benefits as non-target pest populations are booming. It has also brought a quickening of technological change and undecipherability, which is the real underlying problem."⁶⁴

This section's discussion of the Church's authoritative teaching on creation begins with a preliminary consideration of her traditional philosophy and metaphysics, because the dogmatic teaching of the Popes and Councils on creation presupposes and uses the categories and terminology of this traditional philosophy, the rejection of which has been disastrous for the natural sciences, as the examples just cited demonstrate.

B) Lateran IV

The *firmiter* of Lateran IV teaches that God by his own omnipotent power from the beginning of time created all things, corporeal and spiritual, and then man. However, as a recent study with a foreword by Bishop Desmond Moore has shown, this decree is not compatible with the idea that God created nothing more than a few material elements in the beginning, which He then allowed to evolve, through the same kinds of material processes that are going on now, into all of the different kinds of plants and animals, and then man.⁶⁵ On the contrary, all of the leading commentators on the *firmiter* for century after century, held that it taught that all of the different kinds of corporeal and spiritual creatures were the product of a divine creative act, and not the result of a natural process. As Fr. Boyer, professor of Dogmatic Theology for many years during the pontificates of Pius XI and Pius XII at the Pontifical Gregorian University in Rome, noted:

⁶⁴ ALEXANDER, R., "As Bt turns ten, super flop" <http://devconsultancygroup.blogspot.com/2011/07/as-bt-cotton-turns-10-observational-2920.html> (accessed 12-26-12).

⁶⁵ TASSOT *et al.*, "Creation and Time" in *Evolution Theory and the Sciences: A Critical Examination*, edited by Albrecht Graf von Brandenstein-Zeppelin and Alma Von Stockhausen. 2012. Gustav-Siewerth-Akademie.

The Councils ascribe to God not only the creation of the substance of the world, but also some form of distinction between created beings. *Lateran IV* speaks of “The Creator of all things visible and invisible, spiritual and corporal, who, by His omnipotent power, from the beginning of time made at once (*simul*) out of nothing both orders of creatures . . . and then (*deinde*) the human creature” (Denz. 428). The Decree for *the Jacobites* states: “God, when He willed to do so, created by His goodness the totality of creatures, both spiritual and corporal” (*DS* 706). Clearly, those words “all things visible” and “the totality” would not be used correctly if the commencement of the different species had occurred independently of God’s intention, and without any special divine action.”⁶⁶

When the Pontifical Biblical Commission (PBC) was an arm of the Magisterium and its rulings were binding under pain of grave sin, it upheld the necessity for all Catholics to believe that ALL things were created by God in the beginning of time, and not just a few primordial organisms. If it is objected that this decree pre-dated the discovery of DNA and other discoveries which are said (without sufficient reason, however) to provide a viable mechanism for biological evolution, it must be said in reply that the constant teaching of all of the Fathers, Doctors, Popes and Councils in their authoritative teaching has been that the work of creation ended with the creation of Adam and Eve after which began the order of providence. Indeed, as St. Thomas teaches, in the *Summa*, “In the works of nature, creation does not enter, but is presupposed to the works of nature.”⁶⁷ Thus, the origins of man and the different kinds of corporeal and spiritual creatures cannot be determined by extrapolation from the present order of providence in which we live, and no amount of scientific discovery can remove the barrier to extrapolation that God has established and revealed through Divine Revelation. Indeed, this is surely one of the reasons why St. Pius X in *Lamentabili* condemned with the full weight of his office the proposition that the progress of the sciences demands that the concept of Christian doctrine regarding creation be altered, or recast.

Moreover, the overwhelming preponderance of scientific evidence, especially from the field of genetics, testifies to the truth of the traditional Catholic doctrine of creation and contradicts the claims of the evolutionary hypothesis. As mentioned above, the work of Dr. Sanford, Dr. Spetner, and Dr. Giertych, among others, demonstrates that the real world is characterized by devolution, not evolution. A corollary of this conclusion is that all of the genomes of the different kinds of organisms, including man, must have been created in a state of perfection or near-perfection, free from genetic load. Were this not the case, the accumulation of genetic mutations over the alleged millions of years of evolutionary history would have resulted in man’s extinction from an unsustainable accumulation of “genetic mistakes.” As Dr. Sanford argues in *Genetic Entropy*, the long ages of the patriarchs in Genesis 1-11 are fully harmonious with the scientific evidence. The special creation of the various kinds of plants, animals, and man, followed by adaptation and variation, fits the evidence from paleontology and genetics much better

⁶⁶ BOYER, L., S.J., *De Deo Creante et Elevante*, Rome, Gregorian, 1940, p. 95, (translation by Fr. Brian Harrison, O.S., who provided this quotation).

⁶⁷ AQUINAS, T., *ST*, I q. 45, a. 8.

than the evolutionary framework accepted (seemingly) without question by most if not all of the contributors to recent PAS reports on genetically modified food.

C) Genesis 1-11 in Tradition and Magisterial Teaching

It would seem that the consensus view among the contributors to the PAS reports is that Genesis is a “story” which is not intended to give accurate information about the origins of man and the universe. However, this is not the authoritative teaching of the Church, which has consistently upheld the historical truth of Genesis. That Genesis is a “sacred history” is not only the teaching of all of the Fathers and Doctors of the Church, but of all the Popes and Councils in their authoritative teaching. The Pontifical Biblical Commission, when it was still an arm of the Magisterium, upheld the historical truth of Genesis, and St. Pius X taught that the rulings of the PBC at that time were binding under pain of grave sin. Thus, when the 1994 *Catechism* teaches that the first three chapters of Genesis are “the principal source for catechesis on the mysteries of the ‘beginning’: creation, fall, and promise of salvation” (CCC, 289), it is merely upholding the constant Tradition of the Church which tells us that this source is trustworthy and true.

Indeed, two fundamental elements of the constant authoritative teaching of the Church on creation and the Fall seem to have been forgotten by the contributors to recent PAS reports on biotechnology: the original completeness, perfection and harmony of the first-created world; and the cosmic catastrophe of the Fall. A recurring theme in the reports is the idea that God did not create food plants with man in mind and that plants in their “natural” state are not well suited for human nutrition, standing in need of biotechnology to be rendered more suitable for human consumption. The reports view man as the product of millions of years of random mutation and natural selection, rather than as the crown of creation, specially created in perfection but marred by the effects of Original Sin. Nevertheless, the *Catechism* affirms that “God willed creation as a gift addressed to man, an inheritance destined for and entrusted to him” (CCC, 299). Moreover, the “first man was established in friendship with his Creator and in harmony with himself and with the creation around him” (CCC, 374). The “inner harmony of the human person, the harmony between man and woman, and finally the harmony between the original couple and all creation, comprised the state called ‘original justice’” (CCC, 376). It was the Original Sin of Adam which shattered the original harmony of creation and brought death, deformity and disease into the world.

While acknowledging the corrupting effects of Original Sin on man and nature, the *Catechism* also upholds the traditional teaching of the Church on the interdependence of all creatures and God’s special providence for man. The document on “Transgenic Plants for Food Security” quotes St. Thomas to the effect that

God has sovereign dominion over all things: and he according to his providence **directed certain things to the sustenance of man’s body.** For this reason man

has a natural dominion over things, as regards the power to make use of them (emphasis added).⁶⁸

In practice, however, a recurring theme of the PAS reports seems to be that nothing in nature was created with man in view, that non-GMO food plants are the product of random evolutionary processes and breeding and that man must “create” the foods that he needs through bioengineering. The disastrous effects of this way of thinking have already been displayed in the decades-long controversy over breast feeding, which pitted the consensus view in medicine, science, and industry that “bottle feeding” had the same or better “nutritional value” as breast feeding against the common sense of “ordinary” mothers who insisted that a natural practice so clearly written in to the very nature of woman was bound to be superior to the artificial practice of bottle feeding.

In 1956, only about 25 per cent of American mothers nursed their babies, but, by 1980, 54 per cent of American mothers were breastfeeding, a huge increase in less than 25 years. By 2008, the American Pediatric Association recommended that all mothers nurse their babies for a year—and the percentage of American mothers who nursed at least partially had climbed to 70 per cent. A 2007 study of the outcomes of breastfeeding versus formula feedings (updated in 2010) summarized numerous studies comparing breast-fed and bottle-fed children, and underscored the enormous physical, emotional, and financial benefits of breast-feeding.⁶⁹

As this example demonstrates, a chemical analysis of formula versus breast milk tells only part of the story. For one thing, the scientific consensus in favor of bottle feeding was based on a very incomplete understanding of the biochemistry of mother’s milk, which is still not completely understood. But even if a complete biochemical analysis of breast milk were possible, would it necessarily follow that scientists could create an artificial milk, superior in every respect to God’s design?

It is hubris at this stage of man’s knowledge to suppose that he knows better than God how to provide better nutrition than breast milk for normal newborn babies. It is equally arrogant to think that we understand the interrelationships among all of the elements of genetically modified food and the human body well enough to introduce GMOs into the food supply, without grave risk of unintended harm.

How much the natural sciences would benefit from a renewal of the Church’s pre-Darwinian faith in the traditional doctrine of creation! Scientists blessed with that faith would have a deep confidence in the original goodness of creation, the preeminence of man’s place in creation, and the goodness of God’s plan for them. Indeed, the renewal of this attitude is even more important than safety studies and open forums. It was this attitude, for example, that enabled George Washington Carver to receive from his Creator the inspiration to discover 300 uses for the despised peanut plant, thus establishing a

⁶⁸ AQUINAS, T., *ST*, II, II, q. 66. A. 1, a. 1, quoted in “Transgenic Plants for Food Security in the Context of Development,” p. 658 <http://www.pas.va/content/accademia/en/publications/scriptavaria/transgenic.html>

⁶⁹ http://www.lalecheleague.org/docs/Outcomes_of_breastfeeding_June_2007.pdf

\$300 million industry in a depressed economy. Far from regarding plants and animals as products of undirected gene transfer, mutation and natural selection, Carver wrote:

I love to think of Nature as wireless telegraph stations through which God speaks to us every day, every hour, and every moment of our lives. I ask the Great Creator....to allow me to speak to Him through the three great Kingdoms of the World, which he created , viz- the animal, mineral, and vegetable kingdoms."⁷⁰

The loss of this attitude of trust in the Creator and reverence for His creation has gone hand in hand with the acceptance of evolution. By regarding man, plants and animals as the products of undirected gene transfer, mutation and natural selection rather than the products of special creation in an originally harmonious universe followed by adaptation and variation in a fallen world, the contributors to the reports misinterpret the evidence before them. Rather than seeing similar genes in humans, plants and animals as evidence of a common Creator who used common functional elements in his handiwork, the contributors to PAS reports on biotechnology see this as “proof” that all of these different life-forms evolved through mutation and natural selection from a common ancestor. This same view led, in turn, to the consensus view that organs, like the appendix whose function was not understood were “vestigial”; that human embryonic development “recapitulated” our evolutionary history; and that “non-coding DNA” was “junk” left over from our evolutionary history. The same logical reasoning from the same false evolutionary premises now leads the contributors to the potentially disastrous conclusion that the insertion of genetic material from a plant or animal into a food plant using a virus as a promoter is “natural” because the plants, animals, and even man have acquired their present genetic structure through a similar process of random gene transfer, mutation and natural selection.

The dire consequences of faith in evolutionary presuppositions for the study of the human body, embryology and non-coding DNA in recent decades highlight the folly of a nonchalant attitude to random tinkering with the genetic structure of food plants, without far more rigorous testing for safety than has been conducted to date. If the scientific community had adhered to the framework provided by the traditional Catholic doctrine of creation, it would never have followed the disastrous course dictated by the consensus view in regard to vestigial organs, embryology, and junk DNA. In light of the traditional doctrine of the Church on creation, prudence dictates that the Church insist upon a complete moratorium on the production and use of GMO food crops, until such time as rigorous, impartial, and long-term safety studies can be conducted and their results discussed openly by competent experts on both sides of the controversy in the public forum.

⁷⁰ BAKER, J., “Alabama’s Man of God and Science,” February 6, 2012.

<http://www.examiner.com/article/george-washington-carver-alabama-s-man-of-god-and-science> (accessed 12-26-12).

D) Statements of Blessed Pope John Paul II and Pope Benedict XVI

The Magisterium, or teaching authority of the Catholic Church, is exercised by the successor of St. Peter, the Pope, and the Successors of the Apostles, the bishops in union with him—but only within strict parameters laid down by the Magisterium itself, notably in Vatican Councils I and II. According to the authoritative teachings of these Councils, the teaching of the successor of St. Peter is infallible when he teaches authoritatively on a matter of faith or morals. Vatican II explained:

[The Pope] enjoys in virtue of his office, when, as the supreme shepherd and teacher of all the faithful, who confirms his brethren in their faith (Luke 22:32), he proclaims by a definitive act some doctrine of faith or morals. Therefore his definitions, of themselves, and not from the consent of the Church, are justly held irreformable, for they are pronounced with the assistance of the Holy Spirit, an assistance promised to him in blessed Peter.

The Pope can define doctrine with varying degrees of authority. As Brother Charles Madden explains in his *Compendium of the Doctrines of Genesis 1-11*:

there are three degrees of doctrine. First, those doctrines to be believed as divinely revealed. These doctrines are contained in the Word of God written, or orally transmitted, and defined with a solemn judgment as divinely revealed truth either by the Pope speaking *ex cathedra*, or by the College of Bishops gathered in council, or infallibly proposed for belief by the ordinary and universal Magisterium of the Bishops in union with the Pope.

Second, to be held definitively; assent to this kind of doctrine is based on faith on the Holy Spirit's assistance to the Magisterium and on the Catholic doctrine of the infallibility of the Magisterium. Third, authoritative non-definitive teaching, a teaching on faith and morals that is presented as true, or at least as sure, even though it has not been defined with a solemn judgment or proposed as definitive by the ordinary and universal Magisterium.⁷¹

Any statement by a Pope that does not articulate a doctrine of faith or morals in one of these three degrees is NOT authoritative and does not demand the assent of the faithful.

Today, there is much confusion both within and outside the Catholic community concerning the teaching of the modern Popes on creation, evolution and the Flood. Because of a few non-authoritative statements favorable to the evolutionary hypothesis by recent Popes, many Catholics have the impression that theistic, or God-guided, evolution is now an approved doctrine of the Church. In reality, the authoritative teaching of the Popes, from St. Peter to the Pope Benedict XVI, has upheld the literal historical truth of Genesis 1-11, the special creation of man and the various kinds of creatures in the beginning, and a global Flood in the time of Noah. The following survey of the teaching of the Popes on Creation and the Flood will demonstrate that the authoritative teaching of the Church cannot be reconciled with long ages of evolution and

⁷¹ MADDEN, C., *Compendium of the Doctrines of Genesis 1-11* (Bloomington, IN: Iuniverse, 2012), p. vii.

that the non-authoritative statements of recent Popes with respect to evolution do not—and indeed cannot—abrogate the constant, authoritative teaching of their predecessors.

St. Peter

One of the most remarkable prophecies in the entire Bible can be found in the second letter of St. Peter, the first Pope. In this remarkable prophecy, St. Peter predicted that “in the latter days”—a future time—“scoffers” would arise who would deny God’s supernatural creative action “in the beginning of creation” and at the time of the Noachic Flood, thus casting doubt on His sovereign intervention in the future at the Second Coming of Christ. Writing in the first century, St. Peter predicted:

Scoffers will come in the last days with scoffing, following their own passions and saying, “Where is the promise of his coming? For ever since the fathers fell asleep, *all things have continued as they were from the beginning of creation.*” They deliberately ignore this fact, that by the word of God heavens existed long ago, and an earth formed out of water and by means of water, through which the world that then existed was deluged with water and perished. But by the same word the heavens and the earth that now exist have been stored up for fire, being kept until the day of judgment and destruction of ungodly men (*2 Peter 3:3-7*) (emphasis added).

Enlightened by the Holy Spirit, St. Peter foresaw that the scoffers would predicate their denials on the stability of the natural order “from the beginning of creation,” thus denying the creation of all things by the Word of God and the destruction of the first created world by Noah’s Flood. Indeed, just as St. Peter had foretold, “uniformitarianism” became the guiding principle of Charles Lyell, Charles Darwin, and other naturalistic evolutionists who argued that natural scientists could extrapolate from present-day material processes in the order of providence all the way back to the beginning of creation. St. Peter foresaw that to champion their evolutionary theory they would have to “deliberately ignore” the fact of the Flood, and, indeed, Darwin wrote in an unpublished manuscript of 1873: “Lyell is most firmly convinced that he has shaken the faith in the Deluge far more efficiently [in his writings on geology] by never having said a word against the Bible than if he had acted otherwise.”⁷²

These thinkers flatly contradicted the unanimous teaching of the Church Fathers who held, with St. Paul, that “all God’s works were finished from the foundation of the world” (*Hebrews 4:3*)—*after* the creation of Adam and Eve—and that God created all of the different kinds of creatures, including man, by a supernatural divine action. Indeed, all of the Fathers would have concurred with the fourth century “Apostolic Constitutions” that the Sabbath was observed “on account of Him who ceased from His work of creation, but ceased not from His work of providence.”⁷³ Thus, the farthest thing from St. Peter’s mind was to expand the length of the days of creation to allow for a natural development of new kinds of creatures. Indeed, St. Peter’s primary point in the third chapter of his

⁷² HIMMELFARB, G., *Darwin and the Darwinian Revolution* (London: Chatto Windus, 1959), p.320.

⁷³ The Ante-Nicene Fathers," Vol 7,p. 413. From "Constitutions of the Holy Apostles,"

second epistle is that creation—like the Second Coming—is a supernatural divine action which “scoffers” will try to reduce to a natural process.

Pope St. Clement I

One of St. Peter’s successors as Bishop of Rome at the end of the first century, the martyr St. Clement I, affirmed the teaching of Genesis that God had created all of the different kinds of creatures by divine fiat through His Word. He wrote that God:

By his command . . . brought to life the beasts that roam the earth. He created the sea and all its living creatures, and then by his power set bounds to it. Finally, with his own holy and undefiled hands, he formed man, the highest and most intelligent of his creatures, the copy of his own image . . . Then, **when he had finished making all his creatures, God gave them his approval and blessing:** *Increase and multiply*, he charged them (bold added).⁷⁴

With these words Pope St. Clement underscored the teaching of St. Paul in his letter to the Hebrews that “all God’s works were finished from the foundation of the world” (*Hebrews* 4:3) and that therefore one could not explain the origins of man and the universe in terms of the material processes that are going on in the present order of providence. Indeed, any figurative, long-age evolutionary meaning is excluded, as St. Clement affirms that multiplication of creatures happened only *after* all of the different kinds of creatures had been made.

Pope St. Gregory the Great

One of the greatest Popes in the history of the Catholic Church, Pope St. Gregory upheld the traditional understanding of the Flood as a divine chastisement that killed every human being on earth except for Noah and his family on the ark.

at the time of the flood the human race outside the ark dies, but within the ark is preserved unto life, (Epistles, Book 11, Epistle 1)

Pope Pelagius I

Pope Pelagius I, in the sixth century, taught in a profession of faith that Adam and Eve “were not born of other parents, but were created, the one from the earth, the other, however, from the rib of the man.”⁷⁵ Thus, he made a clear distinction between creation—which is by God alone without generation—and generation, which involves the active participation of parents in the production of offspring of the same nature as themselves. In this way, Pope Pelagius forever ruled out the hypothesis of human

⁷⁴ CLEMENT I, *Letter to the Corinthians* (Nn. 31-33: Funk 1, 99-103).

⁷⁵ *Denz* 228a. Cf. “The first formation of the human body could not be by the instrumentality of any created power, but was immediately from God. . . Now God, though He is absolutely immaterial, can alone by His own power produce matter by creation: wherefore He alone can produce a form in matter, without the aid of any preceding material form . . . Therefore as no pre-existing body had been formed whereby another body of the same species could be generated, the first human body was of necessity made immediately by God” (*ST*, I, q. 91, a. 2.)

evolution which would involve the conception of the first human beings in the womb of evolved sub-human primates.

Pope Innocent III

In his letter of 1201 to the Bishop of Tiberias in Palestine, *Gaudemus in Domino*, Pope Innocent III wrote that:

In the beginning one rib was changed into one woman.⁷⁶

With these words Pope Innocent affirmed that monogamy is of the very nature of marriage, because of the way that God formed the first woman, Eve, from the side of the first man. Pope Innocent III also convened the Fourth Lateran Council in 1215 which approved the most important dogmatic decree on creation in the history of the Catholic Church, the *firmiter*, which defined that:

*God...creator of all visible and invisible things of the spiritual and of the corporal who by his own omnipotent power at once from the beginning of time created each creature from nothing, spiritual and corporal namely angelic and mundane and finally the human, constituted as it were, alike of the spirit and the body.*⁷⁷

For 600 years, according to the foremost Catholic Doctors and commentators on this dogmatic decree, the words “at once from the beginning” signified that God created all of the different kinds of corporeal creatures and angels by his omnipotent power and not by any kind of natural process.

Pope St. Pius V and the *Roman Catechism*

One of the great reformers of the Church, **Pope St. Pius V** promulgated the *Roman Catechism* in 1566 to all the bishops with instructions to have it translated and made available to everyone responsible for religious instruction. The writing of the *Roman Catechism* was presided over by a canonized saint, the Archbishop of Milan, St. Charles Borromeo, and the work has received the approval of more Popes and canonized saints than any catechism in the history of the Catholic Church. **Pope Clement XIII** said that it contains "that teaching which is the common doctrine of the Church, from which all danger of doctrinal error is absent"; **Pope Leo XIII** spoke of it as "that golden book," which is a "precious summary of all theology, both dogmatic and moral"; and **Pope St. Pius X** ordered that pastors should preach to the people out of the *Roman Catechism* during his pontificate.

What, then, did this “precious summary of all theology” teach about creation?

In the first place, the *Catechism* affirmed the creation of all things by divine fiat in the beginning:

⁷⁶ INNOCENT III, “Gaudemus in Domino” (DZ 408).

⁷⁷ LATERAN COUNCIL IV, Chapter I, “The Catholic Faith” (DZ 428).

As it was His own goodness that influenced Him when He did all things whatsoever He would, so in the work of creation He followed no external form or model; but contemplating, and as it were imitating, the universal model contained in the divine intelligence, the supreme Architect, with infinite wisdom and power attributes peculiar to **the Divinity created all things in the beginning. He spoke and they were made: he commanded and they were created.**⁷⁸

Commenting further on the first article of the Creed, the *Catechism* taught that:

The words heaven and earth include all things which the heavens and the earth contain; for besides the heavens, which the Prophet has called the works of his fingers, He also gave to the sun its brilliancy, and to the moon and stars their beauty; and that they might be for signs, and for seasons, and for days and years. He so ordered the celestial bodies in a certain and uniform course, that nothing varies more than their continual revolution, while nothing is more fixed than their variety.⁷⁹

With these words, this “precious summary of all theology” taught that the order of the celestial bodies was instituted by God from the beginning. There was no “evolution” of stars or planets. The *Catechism* then described the creation of the creatures of the earth by divine fiat:

The earth also God commanded to stand in the midst of the world, rooted in its own foundation, and made the mountains ascend, and the plains descend into the place which he had founded for them. That the waters should not inundate the earth, He set a bound which they shall not pass over; neither shall they return to cover the earth. **He next not only clothed and adorned it with trees and every variety of plant and flower, but filled it, as He had already filled the air and water, with innumerable kinds of living creatures.**⁸⁰

Thus, according to this “precious summary of all theology,” God created all of the creatures of the earth by His word, instantly and immediately. During the creation period, He made, specifically, trees, “every variety of plant and flower,” air creatures and water creatures and land animals. There was no evolution and no long interval of time. The *Catechism* goes on to affirm the special creation of Adam:

Lastly, He formed man from the slime of the earth, so created and constituted in body as to be immortal and impassible, not, however, by the strength of nature, but by the bounty of God. Man's soul He created to His own image and likeness; gifted him with free will, and tempered all his motions and appetites so as to subject them, at all times, to the dictates of reason. He then added the admirable gift of original righteousness, and next gave him dominion over all other animals.

⁷⁸ *Catechism of the Council of Trent*, Article I

<http://archive.org/stream/thecatechismofth00donouoft#page/n9/mode/2up> (accessed 1-15-13)

⁷⁹ Ibid.

⁸⁰ Ibid.

*By referring to the sacred history of Genesis, the pastor will easily make himself familiar with these things for the instruction of the faithful.*⁸¹

According to the *Catechism*, the plain sense of the sacred history of Genesis is so sure a guide to the truth of the creation and early history of the world and of man that the council fathers direct the pastor to read the sacred history so that he can “easily” make himself familiar with the facts. “Lastly” means God created man last. There has been no further creation since the creation of Adam and Eve—only variation within limits established at the time of creation. The *Catechism* goes on to affirm that God finished the work of creation with the creation of Adam and Eve:

We now come to the meaning of the word sabbath. Sabbath is a Hebrew word which signifies cessation. To keep the Sabbath, therefore, means to cease from labor and to rest. In this sense **the seventh day was called the Sabbath, because God, having finished the creation of the world, rested on that day from all the work which He had done. Thus it is called by the Lord in Exodus.**⁸²

The *Catechism* goes on to explain that:

the Church of God has thought it well to transfer the celebration and observance of the Sabbath to Sunday.

For, as on that day light first shone on the world, so by the Resurrection of our Redeemer on the same day, by whom was thrown open to us the gate to eternal life, we were called out of darkness into light; and hence the Apostles would have it called the Lord's day.

We also learn from the Sacred Scriptures that the first day of the week was held sacred because on that day the work of creation commenced, and on that day the Holy Ghost was given to the Apostles.⁸³

With these words, the *Catechism* teaches that pastors are to instruct the people that God literally created the heavens and the earth and all they contain in six literal days and rested on the seventh literal day. A specific example of a thing that God made on the day specified in Genesis 1 is “light” which is said to have been literally created on day one just as the sacred history of Genesis teaches. In summary, this *Catechism* “from which all danger of doctrinal error is absent,” and which has been extolled by St. Pius V, St. Pius X and so many other Popes for four centuries, teaches that God made the heavens and the earth and all they contain in six days and rested from the work of creation on the seventh day.

⁸¹ Ibid.

⁸² *Catechism of the Council of Trent*, Article III

<http://archive.org/stream/thecatechismofth00donouoft#page/n9/mode/2up> (accessed 1-15-13)

⁸³ Ibid.

Pope Leo XIII

The teaching of the *Roman Catechism* remained—and remains to this day—an authoritative summary of the teaching of the Church on creation. In the second half of the nineteenth century, however, some Catholic intellectuals began to embrace the ideas of Charles Lyell, Charles Darwin and other thinkers who claimed that natural science had refuted the “sacred history” of Genesis 1-11. In reality, Lyell, Darwin and their disciples unwittingly fulfilled the prophetic words of the first Pope who had warned of “scoffers” who would come in the latter days, denying God’s revelation about Creation and the Flood on the grounds that “things have always been the same” from the beginning of creation and that natural scientists could therefore explain the origins of man and all living things in terms of the same material processes that they observed in the world around them. For Darwin and his disciples, man was an evolved ape, the product of millions of years of “struggle for survival”; religion and morality were human inventions, whose only purpose was to help man to prevail in the struggle for existence.

Faced with this revolt against the Church’s teaching on origins, Pope Leo XIII published an encyclical on holy matrimony in which he upheld the Church’s teaching on Creation:

Though revilers of the Christian faith refuse to acknowledge the never-interrupted doctrine of the Church on this subject, and have long striven to destroy the testimony of all nations and of all times, they have nevertheless failed not only to quench the powerful light of truth, but even to lessen it. We record what is to all known, and cannot be doubted by any, that God, on the sixth day of creation, having made man from the slime of the earth, and having breathed into his face the breath of life, gave him a companion, whom He miraculously took from the side of Adam when he was locked in sleep (*Arcanum*, paragraph 5).

Pope St. Pius X

While many leading Catholic intellectuals in theology, philosophy and the natural sciences embraced evolution, St. Pius X recognized the grave threat that the new evolutionary science posed to the foundations of the Catholic Faith. In *Lamentabili* in 1907, St. Pius X condemned with the full authority of his office the proposition that “the progress of the sciences demands that the concept of Catholic doctrine about . . . creation be recast.”⁸⁴ Since it is impossible to reconcile evolution with the Catholic Faith without “recasting” the traditional doctrine of creation, in effect, this anathema made it impossible for the Church ever to endorse theistic evolution. When he heard that Fr. Marie-Joseph Lagrange was questioning the literal, historical truth of Genesis 1-11, St. Pius X ordered him to stop and he established a Pontifical Biblical Commission as an arm of the Magisterium to counteract the modernist trend in Scriptural exegesis. The PBC decrees of 1909 upheld the historical truth of Genesis, the creation of all things by God in the beginning of time, the special creation of Adam and the creation of Eve from Adam’s side. St. Pius X also exhorted pastors to preach from the *Roman Catechism* of the

⁸⁴ PIUS X, *Lamentabili*, Denz. 2064.

Council of Trent which clearly taught the traditional doctrine of creation and the special creation of man.

Pope Pius XII

By 1950, the number of Catholic intellectuals who had accepted evolution had reached such proportions that Pope Pius XII had to address the topic of human origins in an encyclical. The encyclical *Humani generis* defended the traditional understanding of Genesis and cited eleven **opinions of the positive sciences not to be advanced or taught** in Sections 35-39:

1. Those having some sort of scientific foundation, in which the doctrine contained in Sacred Scripture or in Tradition is involved, are directly or indirectly opposed to the doctrine revealed by God
2. Acting as if the origin of the human body from preexisting and living matter were already completely certain and proved by the facts which have been discovered up to now and by reasoning on those facts
3. Acting as if there were nothing in the sources of divine revelation which demands the greatest moderation and caution in this question [of the origin of the human body from preexisting and living matter]
4. After Adam there existed on this earth true men who did not take their origin through natural generation from him as from the first parent of all
5. Adam represents a certain number of first parents
6. Denial of the doctrine of original sin, which proceeds from a sin actually committed by an individual Adam and which through generation is passed on to all and is in everyone as his own
7. A certain too free interpretation of the historical books of the Old Testament
8. Denial that the first eleven chapters of Genesis pertain to history in a true sense
9. Denial that if the ancient sacred writers have taken anything from popular narrations, they did so with the help of divine inspiration, through which they were rendered immune from any error in selecting and evaluating those documents
10. Popular narrations inserted into the Sacred Scriptures are considered on a par with myths or other such things
11. Our ancient sacred writers are not clearly superior to the ancient profane writers

The only opening that Pope Pius XII gave to the evolutionary hypothesis was to exhort Catholic scholars to examine the evidence for and against the hypothesis of human evolution. From that day until this, this “permission” to discuss evolution has been widely touted as “approval” of the evolutionary hypothesis. But it was nothing of the kind. In light of the Pope’s prohibition against the eleven opinions cited above, “permission” to discuss the evidence for evolution no more signaled papal “approval” of that hypothesis than Pope Paul VI’s “permission” to the Birth Control Commission to discuss contraception signaled “approval” of birth control.

Unfortunately, in both cases, the mass media and even many in Catholic academia have wrongly interpreted permission to discuss evolution as approval of the evolutionary hypothesis.

Pope St. John Paul II

No Pope has been more widely quoted in favor of an alleged magisterial endorsement of evolution than Pope John Paul II. No doubt Pope John Paul II believed his scientific advisors when they asserted that everything in the universe (except for man's soul) could have evolved through natural processes after the creation *ex nihilo* of some material elements and natural laws in the beginning. But the Pope never cited any evidence that their opinion was true beyond a reasonable doubt. Moreover, Pope St. John Paul II's endorsement of the evolutionary hypothesis was always tentative and never obliged our assent. For example, in one Wednesday audience he stated:

It can therefore be said that, from the viewpoint of the doctrine of the faith, there are no difficulties in explaining the origin of man, in regard to the body, by means of the theory of evolution. It must, however, be added that this hypothesis proposes only a probability, not a scientific certainty.

Furthermore, in the Pope's famous "speech" to the Pontifical Academy of Sciences in 1996—which was neither written, reviewed, nor delivered by the Pope!—the anonymous author of the letter admitted:

A theory's validity depends on whether or not it can be verified; it is constantly tested against the facts; wherever it can no longer explain the latter, it shows its limitations and unsuitability. It must then be rethought.

Statements like this one demand recognition of the fact that Magisterial authority cannot be used to endorse a merely probable hypothesis in natural science. It can only be used to define a doctrine of faith or morals that is contained in the Deposit of Faith. Thus, Pope John Paul II's tentative acceptance of the evolutionary hypothesis as a "probable" hypothesis in natural science can in no way abrogate the authoritative teachings of his predecessors on origins.

Pope Benedict XVI

The statements of Pope Benedict XVI have been less favorable to evolution than those of his predecessor. But in neither case has the Pope used his authority to make any authoritative pronouncement regarding evolution. In his first homily as Pope, Pope Benedict XVI stated categorically:

We are not some casual and meaningless product of evolution. Each of us is the result of a thought of God. Each of us is willed, each of us is loved, each of us is necessary.⁸⁵

⁸⁵ BENEDICT XVI, http://www.vatican.va/holy_father/benedict_xvi/homilies/2005/documents/hf_ben-xvi_hom_20050424_inizio-pontificato_en.html

This statement was widely interpreted as a rejection of evolution, but it was much too vague to be treated as any kind of authoritative teaching. On the one hand, the words could be interpreted to mean that evolution is false, and that all living things are the descendants of the original fiat creation in the beginning. A less radical reading might interpret the words to mean that human evolution is false—by that reading the Pope’s words might be an indirect affirmation of the truth that man was specially created by God. On the other hand, the Pope might merely have meant that atheistic evolution is false, and that if the body of the first human evolved from that of a chimpanzee, God guided the process. Anyone who has studied the authoritative teachings of the Magisterium on creation can see that only the first two interpretations of the Pope’s words could be considered orthodox; the third interpretation would stand in contradiction to almost two thousand years of Magisterial teaching.

The important point to make in regard to this statement by Pope Benedict XVI as well as other statements he has made in homilies or press conferences is that they are not authoritative unless they pronounce on a doctrine of faith or morals contained in the Deposit of Faith, in precise terminology, and in continuity with prior authoritative magisterial teachings. Any tentative or ambiguous teaching—such as the statement on evolution in the Pope’s first homily quoted above—must be understood in the light of prior clear and authoritative Magisterial teachings.

The Pope is alleged to have said on another occasion that it is absurd to oppose “evolution” to “creation,” but on this alleged occasion the Pope did not define his terms, thus emptying the statement of any value as an articulation of Catholic doctrine. Indeed, the statement, if accurate as reported, was made off the cuff and without any stated intention to define a doctrine of faith or morals. Consequently, it cannot abrogate or call into question the authoritative teachings of all of the Pope’s predecessors from St. Peter to Pope Benedict XVI. The Pope’s statement about evolution in his first homily could only be called “authoritative” if interpreted in keeping with the constant teaching of all of the Fathers, Doctors, Popes and Councils in their authoritative teaching. In contrast, a statement asserting the compatibility between evolution and creation would require a detailed explanation to give it an orthodox meaning, precisely because its plain sense clashes so violently with the authoritative teaching of the past.

It is certain that Pope Benedict understood the need to give much greater attention to the traditional doctrine of creation. In 1989, then-Cardinal Ratzinger publically lamented the almost total neglect of the traditional theology of creation and its accompanying metaphysics.⁸⁶ In 2009 Pope Benedict XVI made an important contribution to the balanced examination of the evolutionary hypothesis when he gave his blessing to a conference at Gustav Siewerth Akademie in Germany entitled “The Theory of Evolution and the Sciences: A Critical Examination.” In his letter of blessing through the

⁸⁶ The complete quotation is: “I must draw attention to the almost total disappearance of the theology of the doctrine of creation. In this connection, it is symptomatic that in the two Summas of modern theology, teaching of creation as contained in the faith is omitted and replaced by vague considerations of existential philosophy.... The decline in metaphysics has accompanied the decline in the doctrine of creation.” RATZINGER, J., “Address to presidents of the European doctrinal commissions,” Vienna, Austria, May 1989.

Secretariat of State, the Holy Father prayed that “under the guidance of the Holy Spirit, may your scientific discussions during your event lead you to a deeper knowledge of Creation and of its divine plan.”⁸⁷ The published proceedings of the conference included papers by Catholic theologians, philosophers, and natural scientists who argued that the scientific evidence does not support the fundamental tenets of evolutionary theory, including the descent of all living things from one or a few common ancestors through natural processes over long ages of time. Other contributors demonstrated the incompatibility of evolutionary theory, even in its so-called “theistic” form, with the traditional theology and philosophy of the Church.

Ultimately, it is only against the background of the whole authoritative Magisterial teaching of the Church on creation that one can correctly weigh and interpret the statements of the recent Popes on creation and evolution. The same thing is true of their statements on biotechnology. A number of PAS reports on biotechnology cite Blessed Pope John Paul II’s statement:

I wish to recall the important advantages that come from the formation of new edible plant species for the benefit of all, especially people most in need.

While this statement could be understood to indicate an openness to the production of genetically modified food plants, “new” edible plant varieties could also be formed through conventional breeding. More importantly, both Pope John Paul II and Pope Benedict XVI have made clear that the Church’s evaluation of any technology must always be made within the framework of her teaching on faith and morals. Indeed, even if the philosophy behind GMO food crop experimentation did not contradict the Church’s authoritative teaching on creation, as has been demonstrated above, the Magisterium would still insist upon a much higher standard of testing for safety than has been generally applied to GMO food plants. As Blessed Pope John Paul II said in an address quoted in the multi-language statement of 2009:

This is a principle to be remembered in agricultural production itself, whenever there is a question of its advance through the application of biotechnologies, which cannot be evaluated solely on the basis of immediate economic interests. **They must be submitted beforehand to rigorous scientific and ethical examination, to prevent them from becoming disastrous for human health and the future of the earth** (emphasis added).⁸⁸

IV. Recommendations:

A) Crisis of Confidence in the Pontifical Academy of Sciences

⁸⁷ *Evolution Theory and the Sciences: A Critical Examination*, edited by Albrecht Graf von Brandenstein-Zepelin and Alma Von Stockhausen. 2012. Gustav-Siewerth-Akademie, p. 8.

⁸⁸ JOHN PAUL II, *Address to the Jubilee of the Agricultural World*, 11 November 2000.(quoted in multi-language statement of 2009).

As an advisory body to the Pope who presides in love over the Church, the “pillar and foundation of the truth,” the Pontifical Academy of Sciences is uniquely qualified to provide a forum for the balanced examination of controversial issues in natural science. In recent years, however, a disturbing pattern of partisanship has emerged in the Academy’s handling of scientific controversies. Two well-known examples will be mentioned here, which will underscore the urgency of the recommendations we are about to make with regard to the Academy’s handling of controversies in biotechnology. The first example concerns the Academy’s handling of the controversy over “brain death” criteria for human death. The second concerns the Academy’s handling of the origins controversy, especially in the recent “Darwin year.”

Mercedes Wilson of the Pontifical Academy of Life has described her efforts to organize a conference under the auspices of the PAS to discuss the pros and cons of the “brain death criteria” for human death within the framework of Catholic theology, philosophy and Magisterial teaching. Wilson writes:

[In 2005] I submitted to the Academy a list of potential presenters that included scientists, physicians, philosophers, and theologians, all of whom are in agreement with the teachings of the Magisterium of the Catholic Church.

The Academy submitted its list, the makeup of which was quite alarming. Some of them had been notorious opponents of the teachings of the Catholic Church. In fact, one of the presenters admitted to me moments before the conference began that "brain dead" donors are alive, but since their quality of life is so poor, it was better for their organs to be used to save someone's life. I asked him, Do you believe in God? And he replied, No! What's more, some of the presenters at the conference were personally involved in the business of vital organ transplantation.

Some of the doctors who were to address conference participants were actively transplanting organs. The conflict of interest was as obvious as it was serious. I suggested that the presenters should have impeccable credentials in the field of science, philosophy, and theology and at the very least be supportive of the teachings of the Magisterium, which respects life from the moment of conception until its natural end.

My list of presenters awakened a contentious period of negotiations. I was flatly told that if I did not agree to accept an even number of presenters, the meeting would not take place. Wanting the conference to convene in the hope of getting the truth known, I reluctantly agreed to that condition. I was later told that I would be required to fund at least 70% of the cost of

the conference. If I did not agree to do so, the important and potentially historic conference would not take place.⁸⁹

Wilson goes on to describe how she raised the funds to organize the conference only to find that the Academy refused to publish the proceedings:

During the conference, there were heated debates between the two forces. . . . Our presenters emphasized that the leadership of the Catholic Church cannot support a declaration of true death unless there is no doubt that the soul has separated from the body. Pope John Paul II stated in his written remarks, February 3, 2005 (read in his absence due to illness), to the participants of this Pontifical Academy of Sciences conference entitled "The Signs of Death":

Within the horizon of Christian anthropology, it is well known that the moment of death for each person consists in the definitive loss of the constitutive unity of body and spirit. Each human being, in fact, is alive precisely insofar as he or she is '*corpore et anima unus*' (body and soul united) (*Gaudium et Spes*, n. 14), and he or she remains so for as long as the substantial unity-in-totality subsists.

At the end of the conference, a majority of the participants concluded that "brain death" is not true death. As long as the heart is beating, the donor is alive and his soul has not departed from the body. The chancellor of the Pontifical Academy of Sciences asked to review the papers of all the participants, as he intended to include their individual contributions during the discussions, in order to publish them as part of the proceedings.

Sadly, two months later, April 2, 2005 our dear Holy Father John Paul II died. The proceedings of the conference, however, were prepared by the chancellor of the Pontifical Academy of Sciences and were ready for publication in November 2005. Soon thereafter, much to our surprise, we were informed that the proceedings would not be published by order of "higher authorities" within the Vatican. Nevertheless, the presenters who concluded that "brain death" was not true death, agreed to publish the proceedings themselves with the assistance of the National Research Council of Italy. The title of the book is FINIS VITAE: Brain Death is NOT True Death.⁹⁰

Most Catholics would be scandalized by this report. But, sad to say, the story gets worse. Wilson concludes her testimony with this:

⁸⁹ WILSON, A.W., "Save the Brain Dead Victims,"

http://www.lifeissues.net/writers/wils/wils_03braindeath.html (accessed 12-26-12).

⁹⁰ Ibid.

Surprisingly, on September 11, 2006, the Pontifical Academy of Sciences was asked by "higher authorities" to convene another conference with the same title ("The Signs of Death") and had the audacity to relegate the conference of February 3-4, 2005 requested by His Holiness John Paul II as a "pre- conference."

Only two of the participants who had opposed the "brain death" criteria of the 2005 conference were invited to participate at the new conference. The rest of the participants of the September 11, 2006 conference were notorious supporters of "brain death" criteria and some of them were involved in the marketing of human organs.

Curiously, the 2006 conference and proceedings were highly publicized and fully funded by the Vatican. The published proceedings of that conference recognized "brain death" as true death.⁹¹

The Academy's handling of the arguments for and against the evolutionary hypothesis appears to have been even more partisan and unbalanced than its handling of the brain death controversy. In the months leading up to the Darwin year 2009, a number of Catholic scientists wrote to the Pontifical Academy of Sciences and offered to share their research calling into question fundamental tenets of the evolutionary account of origins. Of all of the Catholic scientists who offered to share their evolution-challenging research with the Academy, only one, Polish scientist Dr. Maciej Giertych, was even invited to participate as an observer—and solely on the condition that he not ask a single question! Dr. Giertych's account of his experience as an observer at the PAS's 2008 conference on evolution is eerily reminiscent of Mercedes Wilson's account of the Academy's 2006 conference on "brain death." Summing up his experience, Dr. Giertych concluded:

The conference lacked even a single paper that would be critical of the theory of evolution from the scientific point of view. Those present, primarily retirees, have never heard about scientific results that question the theory of evolution. With such a choice of speakers also the Church did not hear about them.

I understand that the Church wants to know what the world of science is proposing, also what the atheists propose. However by setting up the conference in such a manner the Church will never be informed about the full picture. It will hear only the voice of its critics (known on a daily basis from a multitude of sources). These critics have not received a critique against which they would have to defend themselves with scientific arguments.⁹²

⁹¹ Ibid.

⁹² GIERTYCH, M., report on two conferences on origins in Rome, November 2008.

One is stunned by the similarities between the Academy's handling of the brain death and evolution controversies and its handling of the GMO controversy. In none of the three cases did the Academy provide a forum where Catholic scientists of equal qualifications could fairly debate the pros and cons of brain death, evolution, or GMO crops. In all three cases, (with the exception of two anti-brain death scientists invited to the 2006 conference on brain death) the conferences organized by the PAS only allowed scientists committed to a particular point of view to participate, many of whom had a vested interest in a particular outcome.

This situation is now well enough documented that informed Catholics can no longer place confidence in the Academy's scientific conclusions. In regard to the three life-and-death matters considered here, the Academy's conclusions have not been reached through an authentic dialogue among competent experts, impartially considering multiple hypotheses before arriving at the best explanation of the available evidence. Instead, in all three cases the Academy only provided a forum for scientists committed in advance to a particular point of view and deliberately excluded qualified Catholic scholars with alternative points of view.

It is not too late for the Academy to restore the confidence of the Catholic faithful. But it can only do so by taking immediate action to demonstrate its commitment to providing an open forum for Catholic scholars loyal to the Magisterium, of varied points of view, for the presentation and evaluation of competing hypotheses in important scientific controversies. To that end, the following urgent recommendations should be implemented.

B) The Pontifical Academy of Sciences should sponsor an open forum on the evidence and arguments for and against the evolutionary hypothesis

In light of the incompatibility between the speculations of biological evolution and the traditional Catholic doctrine of special creation on the one hand and the overwhelming scientific evidence *against* the evolutionary hypothesis and *for* special creation on the other, the Pontifical Academy of Sciences should sponsor an open forum on the evidence and arguments for and against the evolutionary hypothesis. To insure fairness and objectivity, scientists of comparable qualifications on both sides of the controversy should be given equal opportunities to present their arguments and to be cross-questioned in an open forum.

C) The Pontifical Academy of Sciences should sponsor an open forum on GMO agriculture

In light of the grave risks inherent in the use of recombinant DNA technology for the production of food plants, the Pontifical Academy of Sciences should sponsor an open forum on the evidence and arguments for and against the use of this technology, especially in the developing world. To insure fairness and objectivity,

scientists of comparable qualifications on both sides of the controversy should be given equal opportunities to present their arguments and to be cross-questioned in an open forum.

D) The Pontifical Academy of Sciences should fund long-term studies of GMO food safety

In light of the Church's status as "the pillar and foundation of the Truth," and in view of the highly-charged atmosphere surrounding the controversy over GMO food safety, the Pontifical Academy of Sciences should form a team of scientists made up of an equal number of GMO food safety skeptics and advocates to assemble a team of competent researchers to perform GMO food safety trials in the most thorough and rigorous manner possible, with funding provided by the Pontifical Academy. The results could then be discussed by competent experts on both sides of the controversy at conferences organized by the Academy.

Conclusion

Acceptance of the unsubstantiated evolutionary hypothesis has contributed to a nonchalant attitude on the part of many natural scientists to the grave dangers inherent in the production of genetically modified food. In the light of the traditional teaching of the Catholic Church on creation and the scientific safety studies that have been conducted to date, the current use and abuse of genetically modified food plants violates the created order and poses a serious threat to mankind. Catholic Church leaders, theologians, philosophers, natural scientists, and lay faithful should demand that the Pontifical Academy of Sciences stop advocating for genetically modified agriculture unless and until fair and objective studies of the arguments for and against the evolutionary hypothesis, the brain death criterion for human death, genetically modified agriculture and other, related issues, can be presented by Catholic experts with appropriate qualifications in a fair and open forum. Until then, Catholic Church leaders and the lay faithful should avoid genetically modified food, promote alternative, ecologically-sound solutions to world hunger, and, at least for the time being, cease looking to the Pontifical Academy of Sciences for guidance in dealing with these and other, related, issues.

Through the prayers of Our Lady Seat of Wisdom, may the Holy Spirit lead us into all the Truth!