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# FAITH AND SCIENCE IN OUR CATHOLIC SCHOOLS

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2018  
CATHOLIC CURRICULUM CORPORATION



## Catholic Curriculum Corporation Opening Message

### Our Purpose

The Catholic Curriculum Corporation is a consortium of seventeen Catholic school boards across central and western Ontario. As an important partner in Catholic education, we recognize that Catholic education exists to provide a holistic formation of people as living witnesses of faith. We demonstrate our mission when we engage with, and support, our member boards in sustained, substantive school improvement and student growth that is reflective of a Catholic professional learning community.

### Our Mission

Our mission is to build and sustain the Catholic capacity of educators through the development and provision of high quality Catholic curriculum, resources, support and professional development.

### Our Vision

*Faith Through Learning – A Distinctive Catholic Curriculum*

### Message from the Executive Director

On behalf of the Catholic Curriculum Corporation, I would like to thank Paul D’Hondt, project lead, and the team of contributors for their expertise and dedicated efforts in producing this resource. Thanks are also extended to Grant McMurray for his guidance as Curriculum Manager.

As our scientific understanding continues to increase, our students (and educators) may struggle to reconcile what our society touts as scientific progress and understanding, with what our faith tells us. Being unable to reconcile these two sources of knowledge can lead, in some cases, to our students separating what they believe from what they think. This resource explains some of the most common “hot spots” where people find conflict between science and Catholicism. Being a reference for teachers, topics such as evolution, stem cells, genetically modified organisms, the creation of the universe, and others are discussed. This resource is a timely and relevant tool for Catholic educators across all curriculum areas.

Once again, I offer sincere thanks to those who have supported our teachers with this resource. I wish continued success to all who use this resource while sharing and celebrating our Catholic mission in education.

Michael Bator,  
Executive Director

# **Faith and Science in our Catholic Schools**

The heavens declare the glory of God; the skies proclaim the work of his hands. - *Psalm 19:1*

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## **Rationale**

As our society's scientific understanding continues to increase, our students (and educators) may struggle to reconcile what society touts as scientific progress and understanding with what the Catholic faith tells us. Being unable to reconcile these two sources of knowledge can lead, in some cases, to our students feeling conflicted and separating what they *believe* from what they *think*. This project attempts to address some of the most common "hot spots" where some may find conflict between science and faith. Being a reference for educators, topics such as evolution, stem cells, genetically modified organisms, and the creation of the universe, as well as others are discussed. Each section indicates the specific location in the Ontario Curriculum where the topic may arise, explains what the current scientific understanding tells us about it, and finally discusses the Catholic Church's specific stance on the topic.

## **Aspirations of the Authors**

It is our hope that this project can be a reference for educators seeking to get a general overview of the "hot spot" topics that may arise in class. This resource is meant to be neither exhaustive (Church documents are beautifully written and provide a much better explanation of the topics at hand), nor authoritative - we, the writers, are merely Catholic teachers with a love of science. As well, the Catholic Church constantly evaluates new scientific understandings and technologies in light of new contexts and realities, so perspectives discussed here may end up being out-of-date at some point in the future.

It is hoped that this resource will be useful in supporting educators as they aid students in understanding scientific topics from within a Catholic context. There is a lot of misinformation present online and in our communities about how Catholics view science. Being able to focus in on the Catholic context can provide students with a richer, more complete understanding and appreciation of both the scientific topics and the Church teachings to which they relate.

## **Introduction**

The Catholic Church has a long history of supporting the quest for knowledge and the understanding of our natural world. From the very beginnings of universities,<sup>1</sup> to major scientific advancements made by Catholic clergy, the search for knowledge about the world has always been an important part of a Catholic practice. For example, Gregor Mendel, the “father of genetics” was an Augustinian friar;<sup>2</sup> George Lemaître, previous director of the Pontifical Academy of Sciences and “Father of the Big Bang Theory” was a Belgian priest;<sup>3</sup> and even Copernicus, who developed the heliocentric model of the solar system, had many roles in the Church.<sup>4</sup> Continuing today, the Holy See supports science in a variety of ways, including the Vatican Observatory which is an astronomical research and educational facility in Italy, and the many thousands of clergy and lay people who work in various areas of academia.

There is no denying the persistence of the idea in popular culture that Catholicism and science are in perpetual conflict. The most prevalent example that many point to is that of Galileo’s conflict with the Church in the early 1600’s. Unfortunately, the commonly understood story that Galileo was sent to trial due to his views (later found to be correct) of the solar system inadequately depicts the complexity of the entire affair.<sup>5</sup> In a context where neither geocentric or heliocentric models of the solar system could be proven, where Galileo’s ideas were contrary to most other scholars at the time (secular and religious), and where Copernicus had theorized about these same ideas many years before without similar condemnation, many scholars believe it was Galileo’s belligerence that eventually got him into trouble.<sup>6</sup> Over the many years following this, the church has reevaluated the entire affair several times (ie, allowing Galileo’s book to be published in 1758), and officially apologized in 1992.

### ***Science as Worship***

Beyond the history of the Church’s relationship with science is a more nuanced perspective in exploring how faith and science can relate to one another.

It is important to understand that science is both the body of knowledge amassed about our natural world and how it works, and as well a “tool” or a “procedure” for determining what is true about our world. Furthermore, it strives to limit bias and personal influence. For many scientists, “doing science” - the act of learning about our reality - can be a deeply spiritual experience. In

his great work *Summa Theologica* (1485), St. Thomas Aquinas described that exploring the Laws of Nature (the natural order of things) is “the human person’s participation in eternal law through the use of reason.”<sup>7</sup> Performing experiments to see how certain bacteria behave, or investigating which chemicals make up the atmosphere of one of Saturn’s moons, for example, can provide a window into God’s creation. In an interview with *Crux*, Br. Guy Consolmagno (Director of the Vatican Observatory) explained that “*worship is a way that we come closer to God; and that’s what we do when we study the cosmos.*”<sup>8</sup>

He continues by adding:

*“In particular I am inspired by the psalmist who wrote “The Heavens proclaim the glory of God” and St. Paul who reminds us that “from the beginning of time, God has made Himself known in the things He has created. We get to learn God’s personality by getting used to His way of making creation work... a way that is elegant, rational, and full of joy!”*<sup>8</sup>

For many students, the idea that “doing science” can be a way to learn more about God, as described above, may be a new one worth exploring in class, but it’s not a new idea. In 1870, the First Vatican Council proclaimed that:

*“God, the source and end of all things, can be known with certainty from the consideration of created things, by the natural power of human reason...: ‘ever since the creation of the world, his invisible nature has been clearly perceived in the things that have been made.’ (Romans 1:20)”*<sup>9</sup>

It might be useful to discuss with students the idea that our scientific explorations give us an ever-increasing, but always limited view of God’s mind and creation, as seen through our own human filters. Science can’t give us all the answers, but it can contribute to the understanding of God we get from scripture, through prayer, through our work, from the Church, and through tradition.

## **A Tool for Good**

Moving further, it's also useful to discuss the fact that science can be a tool for doing good in the world. In an address on April 3, 2017, Pope Francis spoke to the National Committee Biosafety, Biotechnology and Life Sciences about the themes found in the encyclical *Laudato Si'* (on the care for our common home). He explained that science and technology:

*“are at the service of a dignified and healthy life for all, now and in the future, and make our common home more liveable and supportive, more careful and guarded.”*

Pope St. John Paul II touched on these themes many times as well. In an address on November 11, 2002, to the Pontifical Academy of Sciences, he said:

*“But the cultural and human value of science is also seen in its moving from the level of research and reflection to actual practice. In fact, the Lord Jesus warned his followers: “everyone to whom much is given, of him will much be required” (Lk 12:48). Scientists, therefore, precisely because they “know more”, are called to “serve more”. Since the freedom they enjoy in research gives them access to specialized knowledge, they have the responsibility of using it wisely for the benefit of the entire human family. I am thinking here not only of the dangers involved in a science devoid of an ethic firmly grounded in the nature of the human person and in respect of the environment, themes which I have dwelt on many times in the past (cf. Addresses to the Pontifical Academy of Sciences, 28 October 1994, 27 October 1998 and 12 March 1999; Address to the Pontifical Academy for Life, 24 February 1998). I am also thinking of the enormous benefits that science can bring to the peoples of the world through basic research and technological applications. By protecting its legitimate autonomy from economic and political pressures, by not giving in to the forces of consensus or to the quest for profit, by committing itself to selfless research*

*aimed at truth and the common good, the scientific community can help the world's peoples and serve them in ways no other structures can.”<sup>10</sup>*

### **Science Makes Sense**

Lastly, it's interesting to explore the assertion that our faith provides a worldview in which doing science makes sense. In the 17th Century, it was Catholic theology that promoted the idea that the universe was governed by mathematical laws, and that we could discover and understand them.<sup>11</sup> This led to a radical change in Western science (Eastern scientific discoveries are also extremely interesting, and worth exploring, but aren't dealt with here). It was at this point that actual *experimentation* began to become more commonly used to test ideas, rather than simply relying on assumed understandings. For example, in Aristotle's time (384 B.C) it was thought that heavy objects would fall faster than lighter ones. This was assumed to be true until tested in the 1600's, and found to be false. Brother Guy, in his *Crux* interview<sup>8</sup> stated:

*“I do not rely on the Bible to tell me the answers to my scientific questions, but I do rely on the authority of Scripture to be reassured that those answers can be found and are worth pursuing.”*

It is his faith that provides him the framework with which to engage in his science. It's his view that our faith allows us to believe our senses and our rationale in the first place.

### **It's Just a Theory**

One rebuke to advances in science that occasionally arises is the argument that many scientific discoveries are “just theories”. For example, we have the Theory of Evolution and the Big Bang Theory, and it's not uncommon to hear that it's permitted not to take them seriously, as they are “just theories”. In science, the terms “theory” and “law” have very specific meanings, which are rather distant from the colloquial meanings we find in everyday conversation. A scientific law is a description of an event, and is often described mathematically. For example, we have the law of electric charges (oppositely charged particles will attract, etc), which describes what specifically occurs, and we have the equation to quantitatively describe exactly how much force



an attraction or repulsion generates. A “theory” on the other hand, is a much more thorough explanation of a concept. For example, we have cell theory, gravitational theory, germ theory, atomic theory, quantum theory, and the theory of general relativity. All of these are successful theories in their own right, and attempt to provide an in-depth explanation of many observed phenomena.

### ***A Note on Contextualism***

Throughout this work we will be relying heavily on Church documentation and scripture. In particular, the Catholic understanding of scripture found in *Dei verbum*,<sup>12</sup> that of contextualism - that scripture is to be interpreted as divinely inspired literature and the Word of God expressed in human terms.<sup>13</sup> It is through this view, and not one of literalism, that many of these ideas are discussed. More on this is found in CCC no. 110.<sup>14</sup>

### ***Final Thoughts***

A worldview based in faith can provide a lens in which the natural world is discoverable, worth exploring, and beautiful.

*“The Incarnation means that this creation has been sanctified by God’s presence. Only such a faith can also explain the beauty I experience in understanding that regularity and the love I have for nature and its beauty and its laws.” - Brother Guy Consolmagno in his book Brother Astronomer - Adventures of a Vatican Scientist.<sup>15</sup>*

Catholics exist in a world where their *reason* and their *faith* - both being gifts from God - are meant to complement each other. Having a scientific understanding of the natural world and a trained mind to explore it can be enriching to one's faith; having a spiritual outlook and religious understanding of the Incarnation can provide important context to that scientific understanding. They're both existing in support of each other. In a 1988 letter to Jesuit George Coyne, Pope St. John Paul II explained that:

*“Science can purify religion from error and superstition; religion can purify science from idolatry and false absolutes. Each can draw the other to a wider world, a world in which both can flourish.”<sup>16</sup>*

The “error and superstition” that John Paul II is referring to here could be those of pietism, fundamentalism, spiritualism, etc. The “idolatry and false absolutes” that he mentions could be the many ideologies that some use science to prop up: relativism, scientism, individualism, determinism, utilitarianism, and empiricism, for example.

Our popular culture holds that science and faith are continually at odds. It could be argued that this opinion is based on a misunderstanding of both science and religion. Perhaps it has grown in its prevalence from instances of cherry-picking scripture, the use of out-of-context snippets from Church documents or teachings, or from the overblown infamy of singular historic events, such as those regarding Galileo’s trial, whose importance in relation to the Church’s views on science are truly incongruous with the actual current stance of the Church. What tends to prevail is a fundamental misunderstanding of the goals of scientific exploration within the eyes of some in the Church. What is so often unseen is the partnership, admiration, and mutual mission of the Church and the global scientific community.

Demonstrating to our students that science, reason, and logic can co-exist with, and support one’s religious understandings is essential. Without this insight students could potentially choose either science or their faith as the major influence to their worldview, missing out on a more complete, and potentially beautiful, understanding. The knowledge that faith and science are not mutually exclusive and not, therefore, presenting us each with a fork in the road leading us to choose which lens through which to understand the world is absolutely critical for the Catholic students of the 21st century. It is imperative that they understand that they are not choosing between the two, but rather growing in their appreciation for both as they enrich their learning.

**Resources to consider:**

The Blog “The Catholic Faith and the Beauty of Science and Reason”<sup>17</sup> examines many of these ideas and includes a list of print and online resources for more information. The author, Justin McClain explains that:

*It is indispensable for Catholics in the 21st century to have at the very least a foundational understanding of not only basic scientific principles, but likewise, how Catholicism indicates how the sciences can be at the service of humanity, for God's greater honor. In order to learn more about the remarkable features of science, faith and reason, here are a few print and online resources that I recommend:*

- *The Believing Scientist: Essays on Science and Religion* by Stephen Barr (Eerdmans, 2016)
- *Faith, Science, and Reason: Theology on the Cutting Edge* by Christopher Baglow (Midwest Theological Forum, 2012)
- *Encyclical Letter Fides et Ratio: On the Relationship Between Faith and Reason* by Pope Saint John Paul (1998)
- *Particles of Faith: A Catholic Guide to Navigating Science* by Stacy Trasancos (Ave Maria Press, 2016)
- *Thomistic Evolution: A Catholic Approach to Understanding Evolution in the Light of Faith* by Fr. Nicanor Austriaco, O.P. (Cluny, 2016)
- *Pontifical Academy of Sciences: [www.pas.va](http://www.pas.va)*
- *Society of Catholic Scientists: [www.catholicscientists.org](http://www.catholicscientists.org)*
- *Vatican Observatory: [www.vaticanobservatory.va](http://www.vaticanobservatory.va)*

As well, *Ex Corde Ecclesiae* (from Pope St. John Paul II about Catholic Universities) and *Gravissimum Educationis* (1965, Second Vatican Council, about Catholic Education) both give important perspective on Education from a Catholic stance.

### **References:**

1. Woods, Thomas E. 2005. "The Catholic Church And The Creation Of The University". *CatholicEducation.Org*.  
<https://www.catholiceducation.org/en/education/catholic-contributions/the-catholic-church-and-the-creation-of-the-university.html>.
2. "Gregor Mendel". 2018. *En.Wikipedia.Org*. [https://en.wikipedia.org/wiki/Gregor\\_Mendel](https://en.wikipedia.org/wiki/Gregor_Mendel).
3. "Georges Lemaître". 2018. *En.Wikipedia.Org*.  
[https://en.wikipedia.org/wiki/Georges\\_Lema%C3%AEtre](https://en.wikipedia.org/wiki/Georges_Lema%C3%AEtre).
4. Wheeler, Mark. 1991. "Nicolaus Copernicus | Catholic Answers". *Catholic.Com*.  
<https://www.catholic.com/magazine/print-edition/nicolaus-copernicus>.

5. Carr, Bernadeane. 2004. "The Galileo Controversy | Catholic Answers". *Catholic.Com*. <https://www.catholic.com/tract/the-galileo-controversy>.
6. Sims Johnston, George. 2018. "The Galileo Affair". *Ewtn.Com*. Accessed August 2. <https://www.ewtn.com/library/HOMELIBR/GALILEO.HTM>.
7. Magee, Joseph. 2015. "St. Thomas Aquinas On The Natural Law". *Aquinasonline.Com*. <http://www.aquinasonline.com/Topics/natlaw.html>.
8. Camosy, Charles. 2018. "Vatican Astronomer Says Studying Cosmos Is 'Worship'". *Crux*. <https://cruxnow.com/interviews/2018/04/17/vatican-astronomer-says-studying-cosmos-is-worship/>.
9. "FIRST VATICAN COUNCIL (1869-1870)". 2018. *Ewtn.Com*. <http://www.ewtn.com/library/COUNCILS/V1.HTM>.
10. "Statement On The Cultural Values Of Science". 2002. *Pas.Va*. <http://www.pas.va/content/accademia/en/publications/extraseries/culturalvalues.html>.
11. Harrison, Peter. 2012. "Christianity And The Rise Of Western Science –ABC Religion & Ethics (Australian Broadcasting Corporation)". *Abc.Net.Au*. <http://www.abc.net.au/religion/articles/2012/05/08/3498202.htm>.
12. Pope Paul VI. 1965. "Dei Verbum". *Vatican.Va*. [http://www.vatican.va/archive/hist\\_councils/ii\\_vatican\\_council/documents/vat-ii\\_const\\_19651118\\_dei-verbum\\_en.html](http://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651118_dei-verbum_en.html).
13. *Ontario Catholic Secondary Curriculum Policy Document*. 2016. Ebook. Institute for Catholic Education. <http://iceont.ca/wp-content/uploads/2016/11/Secondary-Religious-Education-Policy-Documents-FINAL-MASTER-DOCUMENT-Nov-2016.FINAL-for-PRINT16-11-23-minus-COURSE-CODES.pdf>.
14. "Catechism Of The Catholic Church - Sacred Scripture". 2018. *Vatican.Va*. Accessed August 2. [http://www.vatican.va/archive/ccc\\_css/archive/catechism/p1s1c2a3.htm](http://www.vatican.va/archive/ccc_css/archive/catechism/p1s1c2a3.htm).
15. Consolmagno, Guy. 2000. *Brother Astronomer*. New York: McGraw-Hill.
16. "Letter To Father George V. Coyne, Director Of The Vatican Observatory (June 1, 1988) | John Paul II". 1988. *W2.Vatican.Va*. [http://w2.vatican.va/content/john-paul-ii/en/letters/1988/documents/hf\\_jp-ii\\_let\\_19880601\\_padre-coyne.html](http://w2.vatican.va/content/john-paul-ii/en/letters/1988/documents/hf_jp-ii_let_19880601_padre-coyne.html).
17. McClain, Justin. 2018. "The Catholic Faith And The Beauty Of Science And Reason". *National Catholic Register*. <http://www.ncregister.com/blog/mcclain/the-catholic-faith-and-the-beauty-of-science-and-reason>.

# **Evolution**

## **In the Curriculum**

- Grade 4 Science (fossils)
- Grade 11 and 12 Biology courses
- Informally discussed in Grade 9 Geography (CGC1D/P), Grade 9 and 10 Science (SNC1/2D), as well as Religious Education classes when discussing literalism/creationism.

## **What is it?**

Charles Darwin was an English naturalist who studied variation in plants and animals during a five-year voyage around the world in the 19th century. He explained his ideas on evolution in a book called *On the Origin of Species*, published in 1859. His theory is based on three observable facts about living organisms: 1) traits vary among individuals with respect to morphology, physiology, and behaviour, 2) different traits confer different rates of survival and reproduction, and 3) traits can be passed from generation to generation.<sup>1</sup> In subsequent generations members of a population are better adapted to survive and reproduce in the environment in which natural selection takes place - because those offspring that had beneficial traits (suited to the particular environment) were better able to survive and reproduce.

Darwin's Theory of Evolution is a slow gradual process. The beneficial mutations are passed onto the next generation. Over time, these beneficial mutations accumulate, and the result is an entirely different species (not just a variation of the original, but an entirely different creature).

*“Natural selection acts only by taking advantage of slight successive variations; she can never take a great and sudden leap, but must advance by short and sure, though slow steps.”<sup>2</sup>*

Unfortunately, Darwin failed to arrive at an understanding of the mechanism of inheritance of the traits, despite realizing its importance and devoting a vast effort to assembling evidence. In one of the great triumphs of scientific experimentation, Austrian biologist and monk Johann Gregor Mendel, Darwin's contemporary, solved this problem in the mid-nineteenth century.

Mendel would carefully breed and cross-breed pea plants to see how a few specific traits - one of which being height - were passed down. When Mendel bred a tall plant to a short one, all of the offspring were always tall, never blending to medium size. When he then bred those offspring together, three out of four of their offspring were tall, but one was short.<sup>3</sup> Height was passed down in a “particle” we now call a gene. A plant was short or tall depending on the random combination of genes it inherited. So, an adaptive mutation could spread slowly through a species and never be blended out. Darwin's theory of natural selection, building on small mutations, could work.

*"When two plants, constantly different in one or several traits, are crossed, the traits they have in common are transmitted unchanged to the hybrids and their progeny, as numerous experiments have proven; a pair of differing traits, on the other hand, are united in the hybrid to form a new trait, which usually is subject to changes in the hybrids' progeny."<sup>4</sup>*

It is a common misunderstanding that evolution occurs when an organism “evolves” a trait in response to its environment. Rather, random mutations occur that cause offspring to be slightly different from their parents - some of those mutations will be beneficial allowing those offspring to be more successful, but most will not. Those offspring with beneficial mutations will pass that trait on in subsequent generations.

### **Controversy**

In response to theories developed by scientists, some religious individuals and organizations began to question the legitimacy of scientific ideas surrounding evolution that contradicted the literal interpretation of the creation account in Genesis. From 1896:

*"I do not wish to meddle with any man's family matters, or quarrel with any one about his relatives. If a man prefers to look for his kindred in the zoological gardens, it is no concern of mine; if he wants to believe that the founder of his family was an ape, a gorilla, a mud-turtle, or a monar, he may do so; but when he insists that I shall trace my lineage in that direction, I say No sir!...I prefer that my genealogical table shall end as it now does, with 'Cainan, which was the son of Seth, which was the son of Adam, which was the son of God,' rather than invent one which reads, 'Which was the son of skeptic, which was the son of monkey, which was the son of oyster, which was the son of monar, which was the son of mud!'—a genealogical table which begins in the mud and ends in the gravel, which has a monar at the head, a monkey in the middle, and an infidel at the tail"<sup>5</sup>*

The controversy continues to this day, with the scientific consensus on the origins and evolution of life actively attacked by creationist organizations and religious groups who desire to uphold other forms of creationism. Most of these groups are explicitly Christian, and more than one sees the debate as part of the Christian mandate to evangelize. More recently, the intelligent design movement (which maintains that certain structures in nature are simply too complicated to have occurred naturally and must therefore have had divine intervention) has taken an anti-evolution position which avoids any direct appeal to religion. However, Leonard Krishtalka, a paleontologist and an opponent of the movement, has called intelligent design "nothing more than creationism in a cheap tuxedo." Former U.S. President George W. Bush commented endorsing the teaching of intelligent design alongside evolution "I felt like both sides ought to be properly taught ... so people can understand what the debate is about."<sup>6</sup> Scientists argue that intelligent design does not represent any research program within the scientific community and

is opposed by most of the same groups who oppose creationism. It simply isn't promoted by serious scientists.

### **What does the Church say?**

It should be noted that early contributions to the science of biology were often made by Catholic scientists such as Jean-Baptiste Lamarck and Gregor Mendel. Since the publication of Charles Darwin's *On the Origin of Species* in 1859, the attitude of the Catholic Church on the theory of evolution has slowly been refined. In the 1950 encyclical *Humani Generis*, Pope Pius XII confirmed that there is no intrinsic conflict between Christianity and the theory of evolution, provided that Christians believe that God created all things and that the individual soul is a direct creation by God and not the product of purely material forces.

*"Let them strive with every force and effort to further the progress of the sciences which they teach; but let them also be careful not to transgress the limits which We have established for the protection of the truth of Catholic faith and doctrine."<sup>7</sup>*

In an October 22, 1996 address to the Pontifical Academy of Sciences, Pope John Paul II updated the Church's position to accept evolution of the human body.

*"In his encyclical *Humani Generis* (1950), my predecessor Pius XII has already affirmed that there is no conflict between evolution and the doctrine of the faith regarding man and his vocation, provided that we do not lose sight of certain fixed points. ... Today, more than a half-century after the appearance of that encyclical, some new findings lead us toward the recognition of evolution as more than a hypothesis. In fact it is remarkable that this theory has had progressively greater influence on the spirit of researchers, following a series of discoveries in different scholarly disciplines. The convergence in the results of these independent studies—which was neither planned nor sought—constitutes in itself a significant argument in favor of the theory."<sup>8</sup>*

In speaking to more recent objections to the theory of evolution while he was the Vatican's chief astronomer, Fr. George Coyne, issued a statement on November 18, 2005 saying that:

*"Intelligent design isn't science even though it pretends to be. If you want to teach it in schools, intelligent design should be taught when religion or cultural history is taught, not science."<sup>9</sup>*

Cardinal Paul Poupard added that:

*"the faithful have the obligation to listen to that which secular modern science has to offer, just as we ask that knowledge of the faith be taken in consideration as an expert voice in humanity."<sup>10</sup>*

In closing, from Pope St. John Paul II:

*“There are no difficulties in explaining the origin of man in regard to the body by means of the theory of evolution. According to the hypothesis mentioned it is possible that the human body, following the order impressed by the Creator on the energies of life, could have gradually been prepared in the form of antecedent living beings [i.e. living beings that existed prior to humanity].”<sup>11</sup>*

In other words, Pope St. John Paul II is suggesting that human beings have evolved as described by modern science, following the relevant natural laws and processes initially inscribed on our universe by the Creator.

For further information about how Catholics read the Bible, and more specifically how we interpret early chapters of the Hebrew Scriptures (Old Testament), see *Dei Verbum*.<sup>12</sup> There are also many resources available that explain how the Catholic Church reconciles Genesis with scientific knowledge, including websites, YouTube videos, and articles. For example, see this video from Bishop Robert Barron.<sup>13</sup>

### **Suggested educator prompts**

- How do we account for the readings in the book of Genesis about Adam and Eve, and the Theory of Evolution?
- How have Catholic scientists and educators contributed to the Theory of Evolution?
- Is the Theory of Evolution hostile towards our Catholic beliefs?
- Why is it important for us to understand evolution?

### **Links to more information**

Gregor Mendel: Botanist and Scientist

<https://www.biography.com/people/gregor-mendel-39282>

Charles Darwin: On The Origin of Species

[https://en.wikipedia.org/wiki/On\\_the\\_Origin\\_of\\_Species](https://en.wikipedia.org/wiki/On_the_Origin_of_Species)

Scientific Insights into the Evolution of the Universe and of Life

<http://www.casinapioiv.va/content/accademia/en/publications/acta/evolution.html>

### **References:**

1. "Evolution". 2018. *En.Wikipedia.Org*. <https://en.wikipedia.org/wiki/Evolution>.
2. Darwin, Charles. 1859. *On The Origin Of Species By Means Of Natural Selection, Or The Preservation Of Favoured Races In The Struggle For Life*.



3. "Evolution: Library: What Darwin Didn't Know: Gregor Mendel And The Mechanism Of Heredity". 2018. *Pbs.Org*. [http://www.pbs.org/wgbh/evolution/library/06/1/l\\_061\\_01.html](http://www.pbs.org/wgbh/evolution/library/06/1/l_061_01.html).
4. Mendel, Gregor, Alain F Corcos, and Floyd V Monaghan. 1993. *Gregor Mendel's Experiments On Plant Hybrids*. New Brunswick, N.J.: Rutgers University Press.
5. Hastings, H. L. 1895. *Was Moses Mistaken*. Boston: Scriptural Tract Repository.
6. Bumiller, Elisabeth. 2005. "Bush Remarks Roil Debate On Teaching Of Evolution". *Archive.Nytimes.Com*.  
<https://archive.nytimes.com/www.nytimes.com/learning/students/pop/articles/bumiller3.html>.
7. "Humani Generis (August 12, 1950) | PIUS XII". 1950. *W2.Vatican.Va*.  
[http://w2.vatican.va/content/pius-xii/en/encyclicals/documents/hf\\_p-xii\\_enc\\_12081950\\_humani-generis.html](http://w2.vatican.va/content/pius-xii/en/encyclicals/documents/hf_p-xii_enc_12081950_humani-generis.html).
8. Pope John Paul II. 1996. "Pope John Paul II 22 October 1996 To Pontifical Academy Of Sciences". *Ewtn.Com*. <http://www.ewtn.com/library/PAPALDOC/JP961022.HTM>.
9. "Evolution And The Vatican". 2006. *The Globe And Mail*.  
<https://www.theglobeandmail.com/opinion/evolution-and-the-vatican/article1328300/>.
10. "Religion, Science Should Have Mutual Relationship, Says Cardinal". 2005. *Catholic News Agency*.  
[https://www.catholicnewsagency.com/news/religion\\_science\\_should\\_have\\_mutual\\_relationship\\_says\\_cardinal](https://www.catholicnewsagency.com/news/religion_science_should_have_mutual_relationship_says_cardinal).
11. John Paul II. 1986. "Humans Are Spiritual And Corporeal Beings". Lecture, General Audience, 1986.
12. "Dei Verbum". 1965. *Vatican.Va*.  
[http://www.vatican.va/archive/hist\\_councils/ii\\_vatican\\_council/documents/vat-ii\\_const\\_19651118\\_dei-verbum\\_en.html](http://www.vatican.va/archive/hist_councils/ii_vatican_council/documents/vat-ii_const_19651118_dei-verbum_en.html).
13. Barron, Robert. "How Should the Book of Genesis be Interpreted". YouTube video, 2:10. Posted [February 2011]. <https://www.youtube.com/watch?v=iXQnrgv27V8>

# **Genetically Modified Organisms**

## **In the Curriculum**

Genetic manipulation formally appears in Grade 10 Science (Biology: Tissues, Organs, and Systems of Living Things Unit), and continues in Grade 11 and 12 Biology and Health Science courses, however it could easily arise in discussion when discussing DNA in earlier courses.

## **What is it?**

A Genetically Modified Organism can be defined as:

*“organisms (i.e. plants, animals or microorganisms) in which the genetic material (DNA) has been altered in a way that does not occur naturally by mating and/or natural recombination.”<sup>1</sup>*

Scientists can selectively modify genes of plants, animals, and microbes in order for those organisms to develop certain desired traits as they grow. There are countless possible uses for this technology. For example, creating crops that are resistant to drought. This could be good because:

*“developing drought-tolerant crops by modern biotechnology may contribute to global food security because drought-tolerant crops may become a factor to maintain plant growth and productivity, and to increase the area of arable land worldwide.”<sup>2</sup>*

Other potential modifications may include nutritionally enriching foods in areas where crops aren't easily grown, creating pest resistant crops to reduce the amount of chemical pesticide required in a field, or even releasing Malaria-resistant mosquitoes which, by editing a single gene, are unable to carry the parasite that causes Malaria (and kills over 400,000 people every year).

Golden Rice is another great example of this potential.<sup>3</sup> Golden Rice is a genetically modified version of rice that contains significant amounts of Vitamin A for use in the developing world. This could help alleviate the over 1 million deaths and 500,000 cases of blindness each year caused by Vitamin A deficiency.

## **Controversy**

This technology, like any other new technology, isn't without opposition. Many question the safety of ingesting genetically modified food and the effects that creating it might have on the environment. Concerns have also been raised regarding the unforeseen circumstances resulting from the unintentional dissemination of new genes into the environment. Others

question the business practices of the corporations involved, or just have a “feeling” that modifying the genetics of organisms in this way is somehow “unnatural”.<sup>4</sup>

While the safety of genetically modified crops has been well established in research,<sup>5,6,7</sup> the business practices of the corporations behind them can be debated. It’s important, however, not to conflate the benefits and concerns of global agribusiness practices with those of GMO technology. Another area of intense controversy is the potential for genetic manipulation of human beings, as illustrated by the recent approvals in the UK for embryonic editing.<sup>8,9</sup>

### **What does the Church say?**

As this topic is complex and has significant nuance, the Church has said various things on the subject, depending on the context. For example, with regards to genetically modified crops, the Church doesn’t seem to have a view that it’s “unnatural”, rather:

*“In 2003, the head of the Pontifical Council for Justice and Peace, based at the Vatican, Cardinal Renato Martino, asserted that the Catholic Church supports genetic modification of food crops as an answer for world starvation and malnutrition and because “scientific progress was part of the divine plan”. Martino’s statement aligns with a papal address by John Paul II in November 2000, in which he states the Vatican’s support for the use of biotechnology in agricultural production as long as the “research is submitted beforehand to rigorous scientific and ethical examination”.*<sup>10</sup>

Many Church officials see the potential of this technology to alleviate suffering and provide for the poor. However, as in *Laudato Si’*, they have been very clear to highlight the need to ensure the technology is accessible by the world’s poor, and that corporate greed and profits are taken into consideration.<sup>11</sup> When properly regulated and monitored, the benefit to humanity could be immense. The United States Conference of Catholic Bishops affirmed this:

*“We join the Holy See in raising two key concerns: the urgent need to focus new developments in agricultural technology on reducing poverty and hunger, and the importance of ensuring open discussion and participation in decision making regarding the development and use of genetically modified products.”*<sup>12</sup>

The example of Golden Rice (explained above) demonstrates this well. The creators of this product, along with several agribusiness companies, have released the technology to the world to use for free - for the benefit of humanity. There are no fees, royalties, or commissions.

Another area to consider is that of gene therapy, which is:

*“when DNA is introduced into a patient to treat a genetic disease. The new DNA usually contains a functioning gene to correct the effects of a disease-causing mutation.”*<sup>13</sup>

The potential for this technology, as above, is significant, and Church officials have mentioned several times that using this technology to help heal the sick can be desirable.<sup>14</sup> The difficulty arises when the same techniques are used for “enhancement”. For example, it is conceivable that this technology could be used to create humans with increased IQ, longer life expectancy, enhanced senses, etc. This would cause moral problems on many levels and is therefore not supported by the Church. In fact, using these techniques on humans in ways other than therapeutic (ie., life-saving) is generally thought of as immoral. The Church uses the legal idea of “proportionality” when considering issues such as these. The benefits of such technologies have to be balanced against any known (or potentially unknown) costs or consequences. This is ongoing work, and new technologies must be scrutinized in such a way, as described in *Communion and Stewardship*.<sup>15</sup>

### **Suggested educator prompts**

- Why should we as Catholics consider the ethics behind these technologies?
- Can using and benefiting from genetically modified organisms be considered acceptable?
- How could using these technologies benefit the poor?
- What do we need to keep in mind as these technologies progress?

### **Links to more information**

The document “*For I Was Hungry & You Gave Me Food: Catholic Reflections on Food, Farmers, and Farmworkers*”<sup>16</sup> produced by the Committee on Domestic Policy of the United States Conference of Catholic Bishops (USCCB) is an excellent source for Catholic approaches to agriculture. The National Catholic Bioethics Centre is an excellent resource for bioethical considerations of life-issues.

### **References:**

1. "Q&A: Genetically Modified Food". 2014. *World Health Organization*. [http://www.who.int/foodsafety/areas\\_work/food-technology/faq-genetically-modified-food/en/](http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/).
2. Liang, Chanjuan. 2016. *Genetically Modified Crops with Drought Tolerance: Achievements, Challenges, and Perspectives*. 531-547.
3. "Golden Rice". 2018. *En.Wikipedia.Org*. [https://en.wikipedia.org/wiki/Golden\\_rice](https://en.wikipedia.org/wiki/Golden_rice).
4. "Q&A: Genetically Modified Food". 2014. *World Health Organization*. [http://www.who.int/foodsafety/areas\\_work/food-technology/faq-genetically-modified-food/en/](http://www.who.int/foodsafety/areas_work/food-technology/faq-genetically-modified-food/en/).
5. "Statement By The AAAS Board Of Directors On Labeling Of Genetically Modified Foods". 2012. *Aaas.Org*. [https://www.aaas.org/sites/default/files/AAAS\\_GM\\_statement.pdf](https://www.aaas.org/sites/default/files/AAAS_GM_statement.pdf).

6. Key, Suzie, Julian K-C Ma, and Pascal MW Drake. 2008. "Genetically Modified Plants And Human Health". *Journal Of The Royal Society Of Medicine* 101 (6): 290-298. doi:10.1258/jrsm.2008.070372.
7. American Society of Plant Biologists. 2016. "REVISED POSITION STATEMENT ON PLANT GENETIC ENGINEERING". <https://aspb.org/wp-content/uploads/2016/05/Position-Statement-on-Plant-Genetic-Engineering-revised-2014.pdf>.
8. Callaway, Ewen. 2016. "UK Scientists Gain Licence To Edit Genes In Human Embryos". *Nature* 530 (7588): 18-18. doi:10.1038/nature.2016.19270.
9. "UN Panel Warns Against 'Designer Babies' And Eugenics In 'Editing' Of Human DNA". 2015. *UN News*. <https://news.un.org/en/story/2015/10/511732-un-panel-warns-against-designer-babies-and-eugenics-editing-human-dna>.
10. Omobowale, Emmanuel B, Peter A Singer, and Abdallah S Daar. 2009. "The Three Main Monotheistic Religions And Gm Food Technology: An Overview Of Perspectives". *BMC International Health And Human Rights* 9 (1). doi:10.1186/1472-698x-9-18.
11. "Laudato Si' (24 May 2015) | Francis". 2015. *W2.Vatican.Va*. [http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco\\_20150524\\_enciclica-laudato-si.html](http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html).
12. "For I Was Hungry & You Gave Me Food: A Catholic Agenda For Action - Pursuing A More Just Agricultural System - Part 4". 2003. *Uscceb.Org*. <http://www.usccb.org/issues-and-action/human-life-and-dignity/agriculture-nutrition-rural-issues/for-i-was-hungry-catholic-agenda-for-action-part-4.cfm>.
13. "What Is Gene Therapy?". 2016. *Yourgenome.Org*. <https://www.yourgenome.org/facts/what-is-gene-therapy>.
14. Taylor, Rebecca. 2012. "What Is The Catholic View On Genetic Engineering?". *Catholic Lane*. <http://www.catholiclane.com/what-is-the-catholic-view-on-genetic-engineering/>.
15. "Communion And Stewardship: Human Persons Created In The Image Of God". 2004. *Vatican.Va*. [http://www.vatican.va/roman\\_curia/congregations/cfaith/cti\\_documents/rc\\_con\\_cfaith\\_doc\\_2004\\_0723\\_communion-stewardship\\_en.html](http://www.vatican.va/roman_curia/congregations/cfaith/cti_documents/rc_con_cfaith_doc_2004_0723_communion-stewardship_en.html).
16. "For I Was Hungry & You Gave Me Food: Catholic Reflections On Food, Farmers, And Farmworkers". 2003. *Uscceb.Org*. <http://www.usccb.org/issues-and-action/human-life-and-dignity/agriculture-nutrition-rural-issues/for-i-was-hungry.cfm>.

# History of the Universe and Earth

## In the Curriculum

Origin/History of the Universe appears in the following subjects/courses:

- Grade 6 (Science - Earth and Space Systems strand)
- Grade 7 (Geography)
- Grade 9 Science (Earth and Space Science strand) (SNC1D/P)
- Grade 12 Earth and Space Science (SES4U)
- Informal discussions of space and history of the universe also occur in Grade 9 geography (CGC1D/P), Grade 11 Natural Disasters (CGF3M) and Environmental Geography (CGR4M), and in Religious Education classes when discussing creationism/literalism.

Origin/History of the Earth appears in the following subjects/courses:

- Grade 4 (Earth and Space Systems strand)
- Grade 7 (Geography)
- Grade 9 Geography (CGC1D/P)
- Grade 10 Science (SNC2D/P)
- Grade 11 Natural Disasters (CGF3M)
- Grade 12 Environmental Geography (CGR4M)
- Grade 12 Earth and Space Science (SES4U)

## What is it?

### History of the Universe

Early humans, theologians, and scientists have discussed, debated, and developed theories about the history and origin of the universe. Using modern science and mathematical models, most theories suggest that the universe is much older than previously thought.

*“Our universe began in a tremendous explosion known as the Big Bang about 13.7 billion years ago. Observations by NASA's Cosmic Background Explorer and Wilkinson Anisotropy Microwave Probe revealed microwave light from this very early epoch, about 400,000 years after the Big Bang, providing strong evidence that our universe did blast into existence.”<sup>1</sup>*

By taking observations of the speed of galaxies moving away from our own, scientists have concluded that this ‘Big Bang’ created all of the universe’s matter and energy as well as space and time themselves. Over time, matter cooled and new types of atoms were formed. These condensed into the stars and galaxies we see in our night sky today. Of course, it’s much more complicated (and fascinating) than described here.

## History of the Earth

*“The history of Earth concerns the development of planet Earth from its formation to the present day. Nearly all branches of natural science have contributed to understanding of the main events of Earth's past, characterized by constant geological change and biological evolution.”<sup>2</sup>*

Although our Universe originated around 13.7 Billion years ago, scientists believe our solar system, including the Earth, was formed somewhere around 4.5 Billion years ago. They have developed a geologic time scale that is used to divide the history of the Earth into smaller segments of time in order to better understand, classify, and describe details including geological, biological and climatic events that have taken place during the Earth's continued formation. Terms such as “archean”, “paleozoic”, “cretaceous”, “pleistocene”, and “calabrian” are used to specify which “eon”, “era”, “period”, “epoch”, or “age”, is being discussed, respectively.

Within each time segment, specific events are analyzed and recorded to explain how the Earth was formed and continues to change. Scientific methods for determining the age of the Earth and the processes of formation include rock and mineral dating, the use of fossils, stratigraphy, and principles of uniformity.<sup>3</sup>

It is important to study and understand the history of both the Universe and the Earth in order to answer some of society's most important questions, such as those related to energy, water, and mineral resources, the environment, climate change, and natural hazards like landslides, volcanoes, earthquakes, and floods.

### **Controversy**

In the first creation story in the Book of Genesis, it states that the Universe and Earth were formed during the creation period lasting six days. The second creation story doesn't have a timeframe. This literal interpretation of biblical text is in stark contrast to current theories and timelines which suggest a much longer age and time period of development. In fact, most Catholics do not interpret this part of the Bible in this way. The United States Conference of Catholic Bishops state that:

*“The Bible is the story of God's relationship with the people he has called to himself. It is not intended to be read as history text, a science book, or a political manifesto. In the Bible, God teaches us the truths that we need for the sake of our salvation.”<sup>4</sup>*

The stories in Genesis are beautiful but were never intended to convey historical truth. Fundamentalism and reading the Bible literally are actually newer approaches to interpreting the Bible - early Christian scholars understood the need to consider moral, mystical, and allegorical contexts of scripture in order to understand them better.

Most controversies surrounding the histories of the Earth and the Universe center around the scientific debate still occurring due to the recentness of these theories. The Big Bang model/theory is a relatively new scientific discovery based on Einstein's Theory of Relativity and observations of galaxies by Edwin Hubble in 1929.<sup>5</sup> Theories on the origin and formation of Earth are even newer. For example, Alfred Wegner only began to realize the potential of continental drift theory as part of Earth's history in 1915. Further experimentation and collection of evidence by J. Tuzo Wilson and Dan McKenzie in 1966,<sup>6</sup> have shown that plate tectonics is a better theory to demonstrate large scale changes in Earth's history. With such recent scientific discoveries, religious and scientific groups have had less time to analyze the evidence and formulate opinions in relation to existing Church teachings.

### **What does the Church say**

The church has very clearly stated her thoughts and acceptance of both of these scientific ideas. At the November 22, 1951 opening meeting of the Pontifical Academy of Sciences, Pope Pius XII declared that *"the Big Bang theory does not conflict with the Catholic concept of creation"*.<sup>7</sup> In fact, The Big Bang Theory was also originally hypothesised in 1927 by Jesuit priest and physicist Georges Lemaître which was based on the central proposition that the universe is continually expanding. More recently, Pope Francis was quoted as saying:

*"The Big Bang, which nowadays is posited as the origin of the world, does not contradict the divine act of creating, but rather requires it. The evolution of nature does not contrast with the notion of Creation, as evolution presupposes the creation of beings that evolve."*<sup>8</sup>

In regard to Earth's history and creation, we can look to the *Catechism of the Catholic Church*:

*The question about the origins of the world and of man has been the object of many scientific studies which have splendidly enriched our knowledge of the age and dimensions of the cosmos, the development of life-forms and the appearance of man. These discoveries invite us to even greater admiration for the greatness of the Creator, prompting us to give him thanks for all his works and for the understanding and wisdom he gives to scholars and researchers" (CCC 283)*

The church has clearly recognized the importance of research and scientific endeavour. We are in fact encouraged as Catholics to continue to learn and educate ourselves about the wonders of our Earth and Universe.



**In summary:**

*“When we read in Genesis the account of Creation, we risk imagining God as a magus, with a magic wand able to make everything. But it is not so. He created beings and allowed them to develop according to the internal laws that He gave to each one, so that they were able to develop and to arrive at their fullness of being. He gave autonomy to the beings of the Universe at the same time at which he assured them of his continuous presence, giving being to every reality. And so creation continued for centuries and centuries, millennia and millennia, until it became what we know today, precisely because God is not a demiurge or a conjurer, but the Creator who gives being to all things.”<sup>8</sup>*

Reading the scriptures, especially how the Gospel of John orients the creation story from Genesis is incredibly enriching, valuable, and necessary. It’s important for our students to not relegate it to the side-lines as they explore the scientific understandings of the beginning of our universe. The Catholic view is that they go together, each enriching the other. It is also important to note that Catholics are free to believe in the Creation story as literally described in Genesis. Ascribing to the contextual understanding of the history of the world isn’t necessary.

**Suggested educator prompts**

- How as Catholics do we interpret the readings in the book of Genesis?
- How have Catholic priests and scholars contributed to the understanding and observations of our Universe?
- What do Catholic teachings describe about our relation to our earth and responsibility for the stewardship of creation?

**Links to more information**

The Life of Fr. Georges Lemaître

<http://www.catholicherald.co.uk/commentandblogs/2016/01/06/inspirational-catholics-to-cheer-us-this-january/>

The Big Bang and Creation <https://catholicinsight.com/the-big-bang-and-creation/>

What is the Big Bang Theory Church Teaching <https://catholicexchange.com/is-the-big-bang-church-teaching>

Genesis and The Big Bang <https://www.catholicsentinel.org/Content/Faith-Spirituality/Living-Faith/Article/Genesis-and-the-Big-Bang-Both-contain-truth-/4/29/33633>

## **References:**

1. Watanabe, Susan. 2008. "NASA - Brief History Of The Universe". *Nasa.Gov*.  
[https://www.nasa.gov/mission\\_pages/spitzer/multimedia/timeline-2006121889912.html](https://www.nasa.gov/mission_pages/spitzer/multimedia/timeline-2006121889912.html).
2. "History Of Earth". 2018. *En.Wikipedia.Org*. [https://en.wikipedia.org/wiki/History\\_of\\_Earth](https://en.wikipedia.org/wiki/History_of_Earth).
3. Peppe, D. J. & Deino, A. L. 2013. "Dating Rocks and Fossils Using Geologic Methods." *Nature Education Knowledge* 4(10):1
4. Sperry, Mary Elizabeth. 2018. "Understanding The Bible". *Usccb.Org*.  
<http://www.usccb.org/bible/understanding-the-bible/index.cfm>.
5. "WMAP- Big Bang Expansion: The Hubble Constant". 2013. *Wmap.Gsfc.Nasa.Gov*.  
[https://wmap.gsfc.nasa.gov/universe/bb\\_tests\\_exp.html](https://wmap.gsfc.nasa.gov/universe/bb_tests_exp.html).
6. "Dan Mckenzie - The Geological Society". 2018. *Geolsoc.Org.Uk*.  
<https://www.geolsoc.org.uk/Plate-Tectonics/Chap1-Pioneers-of-Plate-Tectonics/Dan-McKenzie>.
7. "Address Of His Holiness Pope Pius XII To Cardinals, Legates Of Foreign Countries And Members Of The Pontifical Academy Of Sciences". 1951. *W2.Vatican.Va*.  
[http://w2.vatican.va/content/pius-xii/it/speeches/1951/documents/hf\\_p-xii\\_spe\\_19511122\\_di-serena.html](http://w2.vatican.va/content/pius-xii/it/speeches/1951/documents/hf_p-xii_spe_19511122_di-serena.html).
8. Pope Francis. 2014. "Plenary Session Of The Pontifical Academy Of Sciences; Inauguration Of The Bust In Honour Of Pope Benedict XVI (27 October 2014) | Francis". *W2.Vatican.Va*.  
[http://w2.vatican.va/content/francesco/en/speeches/2014/october/documents/papa-francesco\\_20141027\\_plenaria-accademia-scienze.html](http://w2.vatican.va/content/francesco/en/speeches/2014/october/documents/papa-francesco_20141027_plenaria-accademia-scienze.html).

# **Organ Donation**

## **In the Curriculum**

Organ donation does not specifically appear in curriculum documents, however informal inquiry into organ donation may take place in some of following subjects/courses:

- Grade 5 Science - Life Systems - Understanding Organ System
- Grade 10 Science (SNC2D/P)
- Grade 11 Biology (SBI3U/C)
- Grade 12 Biology (SBI4U)
- Grade 11 Healthy Active Living Education (PPL30)
- Grade 4 - 12 Religious Education and Family Life Education

## **What is it?**

Organ transplantation is one of the greatest marvels of modern science that is being used to improve the human condition by alleviating the many burdens that come from organ failure or the loss of faculties due to accidents or other circumstances. The procedure of organ transplantation is the transferring (engraftment) of human cells, tissues, or organs from a donor to a recipient with the aim of restoring functions in the body. The procedure of transplantation can take place using organs from a living donor or from a person who has died and who has donated the organs for transplantation. If the transplantation takes place between animal species to human, it is named xenotransplantation.<sup>1</sup>

Organ transplantation is a common occurrence in this day and age, especially in technologically developed countries and more rarely in underdeveloped countries. Organ transplantation is a craft that will continue to grow and develop as our technologies and scientific knowledge increase. According to the World Health Organization (WHO) organ transplantation is an established form of medical treatment acknowledged as a life-saving therapy for end-stage organ failure or chronic illnesses. The WHO indicates that over 130,000 solid organ transplants are performed worldwide and this number represents around 10% of the global need.<sup>2</sup> The report also mentions the huge discrepancy in the availability and access to services as rates of organ donation and transplantation vary widely between regions. The shortage of organ donations correlates to high mortality rates of people who are on waiting lists worldwide, even when some of the organs may become available, but the technology is not accessible.

## **Brief History of Organ Transplantation and Medical Procedures**

It is said that in ancient Greek, Roman, and Chinese mythology there were accounts of organ transplants performed by gods and healers, often involving cadavers or animals. These were simple tales. In 800 B.C., Indian doctors began grafting skin from one part of the body to another to repair wounds and burns. In the 16th Century, Italian surgeon Gasparo Tagliacozzi

reconstructed noses and ears using skin from patients' arms. In the early 1900s, European doctors did experiments transplanting kidneys from various animals, including monkeys, pigs, and goats. None of the recipients lived for more than a few days. In 1905 Eduard Zirm, an Austrian ophthalmologist, performed the world's first corneal transplant, restoring the sight of a man who had been blinded in an accident. In 1912, transplant pioneer Alexis Carrell received the Nobel Prize for his work in the field of organ transplantation. He later worked with aviator Charles Lindbergh to invent a device for keeping organs viable outside the body, a precursor to the artificial heart. In 1936, Ukrainian doctor Yu Yu Voronoy transplanted the first human kidney using an organ from a deceased donor. The recipient died shortly thereafter as a result of rejection. In the late 1940's and early 1950's, a team of doctors at Boston's Peter Bent Brigham Hospital carried out a series of human kidney grafts, some of which functioned for days or even months. In 1954, the surgeons transplanted a kidney from 23-year-old Ronald Herrick into his twin brother Richard; since donor and recipient were genetically identical the procedure succeeded. In 1960, British immunologist Peter Medawar, who had studied immunosuppression's role in transplantation failures, received the Nobel Prize for his discovery of the acquired immune tolerance. Soon after, anti-rejection drugs enabled patients to receive organs from non-identical donors. In the 1960's, the first successful lung, pancreas, and liver transplants took place. In 1967, the world marveled when South African surgeon Christiaan Barnard replaced the diseased heart of dentist Louis Washkansky with that of a young accident victim. Although immunosuppressive drugs prevented rejection, Washkansky died of pneumonia 18 days later.<sup>3</sup>

In 1984, as transplants became less risky and more prevalent, the U.S. Congress passed the National Organ Transplant Act to monitor ethical issues and to address the country's organ shortage. This type of legislation is now standard around the world. The law established a centralized registry for organ matching and placement while outlawing the sale of human organs. In 2005, Baltimore's Johns Hopkins Hospital pioneered the "domino chain" method of matching donors and recipients. Willing donors who are genetically incompatible with their chosen recipients are matched with strangers; in return, their loved ones receive organs from other donors in the pool. In 2010, Spanish doctors conducted the world's first full face transplant on a man injured in a shooting accident. A number of partial face transplants had already taken place around the world.<sup>3</sup> In our Canadian context, the development of organ transplantation is a common practice today. In Ontario there is a directory with a list of hospitals that specialize in different organ transplantation procedures.<sup>4</sup> Other forms of therapies related to organ transplants, organ harvesting, organ donation or tissue therapies are widely available.

### ***Controversy***

Religion and culture play a significant role in end-of-life experience and individuals' beliefs around death. This includes how people respond to illness, how we demonstrate grief, what rituals are important at the time of illness and death, and the role of family members as well as the community. Catholics have a distinct theological understanding of this stage of life. These beliefs influence thoughts and understanding around organ donation.

Catholic bioethical teachings are in constant adjustment due to the fact that scientific advances and medical procedures take place faster than the teachings can be developed, put into place, or be updated. In Canada, and in Ontario, most hospitals have a bioethical team where Catholic tradition is represented when deciding on organ donations, harvesting, transplantation, and therapies. Some of these procedures are becoming standard and legislated. Not all hospitals and health care providers are under Catholic administration, but those that are will follow Catholic bioethical teachings. There is a protocol that a hospital's Catholic Bioethical Team will follow to deal with cases with which they may or may not be in agreement.

Medical scientific advances and practices change rapidly and create social trends and environments that are completely unforeseen. As such, Catholic bioethical teachings are demanded to be observed by the scientific community members of the Roman Catholic tradition, since their everyday work must reflect the teachings of Christ as understood by the Church. These scientific advances and therapies may create social changes that may require renewed analysis from the teaching office of the Church, which revises the existing teachings and applies them to new contexts.

The process for developing the bioethical teachings includes going back to the Roman Catholic moral and ethical traditions and creating criteria for its application to new realities. This cat and mouse race may give the impression to people that Roman Catholics are involved in controversial battles, but instead they are developing, revising, or creating bioethical teachings that match moral and ethical teachings of the Church.

### **What does the Church say?**

#### **Ethical and Moral Teachings of the Roman Catholic Tradition**

For Roman Catholics, the development of the teachings around the practices of organ transplantation, organ harvesting, and organ donations have been a slow process. This is due to many factors related to the application of moral and bioethical teachings, interpretations of a belief system, as well as the technical circumstances surrounding the processes themselves.

*“Catholics encourage donation as an act of charity, and as a decision that belongs to each individual. There should be no undue pressure on someone to donate an organ. Ethical considerations must be taken into account. There can be no commercialization of human organs.”<sup>5</sup>*

Roman Catholics are fervent protectors of human life in all its stages, but they have also developed extensive doctrines on life after death and of the process of dying as well. Death is part human life and it's not a failure, but a natural stage of life. Being born, living, and dying with dignity is the essence of Roman Catholic moral teachings.

Acceptance of organ transplantation, organ harvesting, and organ donations have been slow due to the fact that many believe that there are times when one life cannot be taken from one individual “to patch up” another life, especially when living in secular societies where bioethical systems are not always compatible with Roman Catholic Church teachings. For example, if euthanasia is legal in a given country when is it morally right to harvest organs? If abortion is legal can we harvest the organs of the aborted babies? If capital punishment is legal can we harvest the organs of prisoners? If we can do whatever we want with our bodies, can we sell our organs in an open market? If artificial insemination and gestation is available can we create humans just to harvest their organs? These are all complex issues that need exploration.

Pope John Paul II wrote the encyclical *Evangelium Vitae* with the purpose of restating the bioethical teachings of the Church, and inviting all its members to engage in this new facet of Christian living.<sup>6</sup> The Pope makes mention of the promise of scientific advancements, the social changes taking place, new bioethical teachings, as well as the commandment to love one another and offer our lives for others without ignoring the great challenges. The World Health Organization is keenly aware of the selling of organs, the trafficking of organs, and in some places where capital punishment is legal, the setting up of clinics besides the execution centers to harvest the organs of prisoners. These are horribly unpredictable outcomes that many societies were not prepared to deal with. The W.H.O. has responded to these ethical challenges with the following statement:

*“The World Health Assembly has endorsed a set of guiding principles addressing ethical aspects of organ transplantation such as the voluntary and unpaid donation, but also the issues of universal access to transplant services, the availability, safety and quality of the procedures. There must be national accountability through development of sustainable transplant systems and achieving national self-sufficiency in order to stop organ trafficking and transplant tourism.”<sup>2</sup>*

The Catholic of Organization for Life and Family has basic guidelines when introducing the topic of organ donation, organ transplantation, and organ harvesting to students.<sup>1</sup> They have provided practical insights in line with long overarching moral and bioethical principles in the Church teachings. There are cases that the media uses to bring attention to various related topics, and while it can be instructive to use them, they are not official teachings even if they are written by members of the Roman Catholic Tradition.<sup>7</sup> There are a great number of Catholic newspapers that report daily on these subjects, explain how the teachings continue to be introduced or revised, or which share how the Pope addresses new challenges on the subject. Individual cases and particular practices do, at times, present a need for teachings to be revised.<sup>8</sup>

### ***In summary:***

Catholic teaching holds that organ donation and transplantation are good things provided they help the people involved. It cautions against the commodification of human life, and the “slippery slope” that may occur from such a reality.

The Church does not shy away from the challenges that arise as the human journey expands, and our technological abilities increase. The Church teaches that messages of Jesus are timeless and are just as relevant to the human journey today as they were in ancient times and will be in the future. We build on the wisdom of our ancestors, growing and adapting to the present-day challenges we face in our modern world. The teachings of the Church continue to come forth on this subject, some will be revised, some will be updated, and new ones will be introduced.

It is important as teachers and educators of youth, and as members of the teaching branches of our tradition, that we be aware of personal biases as we interpret the teachings for youngsters. The Church is diverse in its practices and ways of life but we teachers are at the service of the truth, and when the truth has been unveiled to us we need to keep an open mind, and if we fail to do so, that our failure is on the side of love<sup>9</sup>.

### **Suggested educator prompts**

- As Catholics, what do we believe about life ? How does this connect to the process of organ donation?
- What are some of the moral and ethical concerns around organ donation and transplantation?

### **Links to more information**

- **Canadian Organization for Life and Family - Giving Something Of Ourselves: A Message On Organ And Tissue Donation And Transplantation**  
<http://colf.ca/en/publications/item/108-giving-something-of-ourselves-a-message-on-organ-and-tissue-donation-and-transplantation>
- **One Life, Many Gifts -**  
[http://www.onelifemanygifts.com/en/about\\_us/](http://www.onelifemanygifts.com/en/about_us/)
- **Religion and Ethics** [http://www.onelifemanygifts.com/docs/curriculum\\_booklets/10-RELIGION%20AND%20ETHICS.pdf](http://www.onelifemanygifts.com/docs/curriculum_booklets/10-RELIGION%20AND%20ETHICS.pdf)

## **References:**

1. "Giving Something Of Ourselves: A Message On Organ And Tissue Donation And Transplantation - Catholic Organization For Life And Family (COLF)". 2005. *Colf.Ca*. <https://www.colf.ca/en/publications/item/108-giving-something-of-ourselves-a-message-on-organ-and-tissue-donation-and-transplantation>.
2. "WHO Task Force On Donation And Transplantation Of Human Organs And Tissues". 2018. *World Health Organization*. <http://www.who.int/transplantation/donation/taskforce-transplantation/en/>.
3. "Organ Transplants: A Brief History". 2012. *HISTORY*. <https://www.history.com/news/organ-transplants-a-brief-history>.
4. "Canadian Society Of Transplantation - Programs & OPO's". 2018. *Cst-Transplant.Ca*. <http://www.cst-transplant.ca/cgi/page.cgi/transplant-programs-opos.html>.
5. Rainsberry, Linda. 2009. "One Life...Many Gifts". *Onelifemanygifts.Com*. [http://www.onelifemanygifts.com/en/curriculum\\_booklets/](http://www.onelifemanygifts.com/en/curriculum_booklets/).
6. "Evangelium Vitae (25 March 1995) | John Paul II". 1995. *W2.Vatican.Va*. [http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf\\_jp-ii\\_enc\\_25031995\\_evangelium-vitae.html](http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_25031995_evangelium-vitae.html).
7. McElwee, Joshua. 2011. "Pope Benedict's Organs". *National Catholic Reporter*. <https://www.ncronline.org/blogs/ncr-today/pope-benedicts-organs>.
8. Allen, John L., Jr. 2007. "Bioethics: The Nightmare Scenario Of Organ Donation". *Natcath.Org*. [http://natcath.org/NCR\\_Online/archives2/2007d/111607/111607h.htm](http://natcath.org/NCR_Online/archives2/2007d/111607/111607h.htm).
9. "Pope Francis: 'Organ Donation Is A Testimony Of Love For Our Neighbour' | ICN". 2014. *Indcatholicnews.Com*. <https://www.indcatholicnews.com/news.php?viewStory=25737>.



# **Stem Cells**

## **In the Curriculum**

Discussions about stem cells may arise in Grade 8 Science (Cells unit), Grade 10 Science (Biology:Tissues, Organs, and Systems of Living Things unit), and throughout the Grade 11 and 12 Biology courses. Of course, discussions may arise for other reasons as well.

## **What is it?**

Our bodies have many different types of cells: nerve cells, skin cells, muscle cells, blood cells, etc. In all, there are around 200 different types in a human being.<sup>1</sup> Each type has specific properties and structures that allows it to perform its function. For example, a red blood cell delivers oxygen around the body, where a nerve cell conducts electrical signals to other cells and tissues. Their structures, therefore, are very different. These cells are considered to be *specialized*.

Stem cells, on the other hand, are considered to be *unspecialized*. They have not yet gone through the process of “differentiation” to become a specialized cell. The Oxford Dictionary describes them as:

*“an undifferentiated cell of a multicellular organism which is capable of giving rise to indefinitely more cells of the same type, and from which certain other kinds of cell arise by differentiation.”<sup>2</sup>*

They are like a “blank slate” that could potentially become any other type of cell. The National Institute of Health explains that the potential of stem cells lies in that “under certain...conditions, they can be induced to become tissue - or organ-specific cells with special functions.”<sup>3</sup>

When cells get damaged or die, which happens regularly, our bodies use stem cells to help repair the tissue. It’s a fascinating function of many organisms. This is merely a glimpse into the concept supporting stem cells, though it’s much more complicated than described here.

Scientists have been hopeful about using stem cells as a therapy to address many diseases and conditions; to aid the body in creating new cells where old ones are dying or aren’t working properly. Although this has been largely over-hyped in the media,<sup>4</sup> there are certain procedures that are currently being employed; the most widespread being bone marrow transplant for patients with leukemia. In this case, the procedure can help:

*“restore healthy bone marrow in patients with leukemia. Stem cells help stimulate new bone marrow growth and restore the immune system.”<sup>5</sup>*

In certain patients, this is a very successful treatment. Other treatments for additional conditions, such as neurodegenerative diseases, are currently being developed, but most aren't widely accepted or available.

### ***Types of Stem Cells***

There are two general types of stem cells: *embryonic* and *somatic* (there are other types as well, but they are more complicated and don't add anything to this discussion). Embryonic stem cells are retrieved from a fertilized live embryo, destroying it in the process. Somatic (or adult) stem cells are retrieved from an adult host, with few major side-effects, as in the example of bone marrow. Many claim an advantage of embryonic stem cells over adult ones is that they can differentiate into almost any type of cell, where somatic cells are currently more limited. It should be noted that there are currently no mainstream therapies that use embryonic stem cells. There are, however many uses for them in other research.<sup>3</sup>

Scientists have also been able to revert adult cells back into a state similar to embryonic stem cells. These are called "induced pluripotent stem cells". Research is continuing in this field.<sup>6</sup>

### **What does the Catholic Church say?**

Clarified in *Humanae Vitae* (1968), the church reaffirms the importance of respecting innocent life from conception to natural death.<sup>7</sup> This includes an embryo. Therefore, anything intentionally done to harm it, including harvesting stem cells, is considered morally unacceptable.

*"Because the Church opposes deliberately destroying innocent human life at any stage, for research or any other purpose, it opposes embryonic stem cell research as currently conducted."<sup>8</sup>*

However, research into therapies using somatic (adult) stem cells are fully supported and even encouraged by the church. Since embryos are not harmed, and the therapies could help alleviate much suffering, somatic stem cell research is considered morally acceptable. In 2011, Pope Benedict XVI made a speech at a conference:

*"No such ethical problems arise when stem cells are taken from the tissues of an adult organism, from the blood of the umbilical cord at the moment of birth, or from fetuses who have died of natural causes (cf. Congregation for the Doctrine of the Faith, Instruction Dignitas Personae, 32).<sup>9</sup>*

Even cells obtained from fetal tissue from spontaneous miscarriages can be used, as described by the Catholic Organization for Life and Family:

*"We have no objection to CIHR [Canadian Institutes for Health Research] funding research on stem cells taken from non germ cell human fetal tissue resulting from spontaneous abortions; provided there is informed consent, privacy and confidentiality are respected, and there is no commercialization."<sup>10</sup>*

Furthermore, the Church has spent millions of dollars funding ethical research in this area:

*“when scientists proposed avenues for possibly obtaining embryonic stem cells or their pluripotent equivalent without creating or harming embryos, Catholic leaders were among the first to welcome this idea.”<sup>8</sup>*

Stem cells are an intriguing area of study and could hold much promise in supporting therapies to help alleviate suffering. It is a rather simple distinction between research and therapies which are morally acceptable to the Church, and those which aren't.

### **Suggested educator prompts**

- How are the various types of stem cells different? How are they similar?
- Why would the Catholic Church be concerned about embryonic stem cells? Are people concerned about somatic stem cells?
- When is it necessary to consider the ethical aspects of scientific advances?

### **Links to more information**

The website of the United States Conference of Catholic Bishops entitled “Catholic Support for Ethically Acceptable Stem Cell Research”<sup>8</sup> is a great resource.

### **References:**

1. "The Cells In Your Body - Science Netlinks". 2018. *Sciencenetlinks.Com*. <http://sciencenetlinks.com/student-teacher-sheets/cells-your-body/>.
2. "Stem Cell | Definition Of Stem Cell In English By Oxford Dictionaries". 2018. *Oxford Dictionaries | English*. [https://en.oxforddictionaries.com/definition/stem\\_cell](https://en.oxforddictionaries.com/definition/stem_cell).
3. "Stem Cell Basics I". 2016. *NIH Stem Cell Information Home Page*. <https://stemcells.nih.gov/info/basics/1.htm>.
4. Caulfield, Timothy. 2017. "Beware The Hype On Stem-Cell Breakthroughs". *The Globe And Mail*. <https://www.theglobeandmail.com/life/health-and-fitness/health/beware-the-hype-on-stem-cell-breakthroughs/article34348535/>.
5. "Leukemia Stem Cell Transplantation | CTCA". 2018. *Cancercenter.Com*. <https://www.cancercenter.com/leukemia/stem-cell-transplantation/>.
6. "Types Of Stem Cells". 2015. *Closerlookatstemcells.Org*. <http://www.closerlookatstemcells.org/learn-about-stem-cells/types-of-stem-cells#induced-pluripotent>.

7. "Humanae Vitae (July 25, 1968) | Paul VI". 1968. *W2.Vatican.Va*.  
[http://w2.vatican.va/content/paul-vi/en/encyclicals/documents/hf\\_p-vi\\_enc\\_25071968\\_humanae-vitae.html](http://w2.vatican.va/content/paul-vi/en/encyclicals/documents/hf_p-vi_enc_25071968_humanae-vitae.html).
8. "Catholic Support For Ethically Acceptable Stem Cell Research". 2018. *UscCb.Org*.  
<http://www.usccb.org/issues-and-action/human-life-and-dignity/stem-cell-research/catholic-support-for-ethically-acceptable-stem-cell-research.cfm>.
9. "Address Of His Holiness Pope Benedict XVI To The Participants Of The International Conference Promoted By The Pontifical Academy Of Culture". 2011.  
[https://w2.vatican.va/content/benedict-xvi/en/speeches/2011/november/documents/hf\\_ben-xvi\\_spe\\_20111112\\_stem-cells.html](https://w2.vatican.va/content/benedict-xvi/en/speeches/2011/november/documents/hf_ben-xvi_spe_20111112_stem-cells.html).
10. "Response To The Discussion Paper Published By The Canadian Institutes Of Health Research Entitled Hu - Catholic Organization For Life And Family (COLF)". 2001. *Colf.Ca*.  
<http://www.colf.ca/en/in-action/item/76-response-to-the-discussion-paper-published-by-the-canadian-institutes-of-health-research-entitled-hu>.

# **The Environment**

## **In the Curriculum**

- It should be noted the front matter of every Ontario curriculum policy document published since 2007, has a section entitled “*Some Considerations for Program Planning*” that supports environmental education in that subject or discipline.

### *Elementary*

- Although no specific or overall expectations explicitly address environmental education, in English, French, PHE, and the Arts, the learning context (e.g., a topic or thematic unit related to the environment) and/or learning materials (e.g., books, websites, media) could be used to foster in students the development of environmental understanding
- Environmental Education Scope and Sequence K to 8, from the Ontario Ministry of Education, can be found at:  
[http://www.edu.gov.on.ca/eng/curriculum/elementary/environmental\\_ed\\_kto8\\_eng.pdf](http://www.edu.gov.on.ca/eng/curriculum/elementary/environmental_ed_kto8_eng.pdf)

### *Science*

- K to 12 - Fundamental concepts include: sustainability and stewardship, systems and interactions, matter, energy, structures and functions, and change and continuity
- Gr. 1 to 8 - The following strands specifically connect to environmental education:
  - Understanding Life Systems
  - Understanding Structures
  - Understanding Matter and Energy

### *Social Studies/History/Geography*

- Gr. 1 to 6 - The following strands specifically connect to environmental education
  - People and Environment
- Gr. 7 and 8 Geography
  - Gr. 7 - A. Physical Patterns in a Changing World and B. Natural Resources around the World: Use and Sustainability
  - Gr. 8 A. Global Settlement: Patterns and Sustainability and B. Global Inequalities: Economic Development and Quality of Life

### *Secondary*

- Gr. 9 Canadian Geography (CGC1D/P)
- Gr. 10 Civics and Citizenship (CHV2O)
- Gr. 11 and 12 Geography (All courses)
- Gr. 9 and 10 Science (SNC1D/P, SNC2D/P)
- Gr. 11 and 12 Biology (SBI3U/C, SBI4U/C)
- Gr. 11 and 12 Chemistry (SCH3U/C, SCH4U/C)
- Gr. 11 Environmental Science (SVN3M, SVN3E)

- Grade 11 and 12 Physics (SPH3U/C, SPH4U/C)
- Environmental Education Scope and Sequence 9 to 12, from the Ontario Ministry of Education, can be found at:  
[http://www.edu.gov.on.ca/eng/curriculum/secondary/environmental\\_ed\\_9to12\\_eng.pdf](http://www.edu.gov.on.ca/eng/curriculum/secondary/environmental_ed_9to12_eng.pdf)
- It should be noted once again that this is often a topic of discussion in classes as it is often in the news and is experienced through daily interactions with the world around us

### **What is it?**

The Merriam Webster dictionary defines the environment as:

*“the natural world, as a whole or in a particular geographical area, especially as affected by human activity.”*

The fostering of the relationship between humanity and the environment in our modern context is a global quest that connects environment research, national policies, regional responses, the emergence of organizations, religious traditions, cultures, communities, individual spiritualities, and systems of education. It is no surprise that our provincial system of education developed curriculum to educate the new generations in sustainable environmental living.

To highlight how the environment is addressed in our schools, in 2007, the Ontario Ministry of Education Working Group on Environmental Education published a report, *Shaping Our Schools, Shaping Our Future: Environmental Education in Ontario*, which defines environmental education as:

*... education **about** the environment, **for** the environment, and **in** the environment that promotes an understanding of, rich and active experience in, and an appreciation for the dynamic interactions of:*

- *The Earth’s physical and biological systems*
- *The dependency of our social and economic systems on these natural systems*
- *The scientific and human dimensions of environmental issues*
- *The positive and negative consequences, both intended and unintended, of the interactions between human-created and natural systems.<sup>1</sup>*

The Pontifical Academy of Sciences (PAS) and the Pontifical Academy of Social Sciences (PASS) have held a series of meetings related to the degradation of the environment, climate change, extinction and sustainable development in “A Statement Of The Problem And The Demand For Transformative Solutions” the PAS concluded that:

*“This century is on course to witness unprecedented environmental changes. In particular, the projected climate changes or, more appropriately, climate disruptions, when coupled with ongoing massive species extinctions and the destruction of ecosystems, will doubtless leave their indelible marks on both humanity and nature. As*

*early as 2100, there will be a non-negligible probability of irreversible and catastrophic climate impacts that may last over thousands of years, raising the existential question of whether civilization as we know it can be extended beyond this century. Only a radical change in our attitude towards Creation and towards our fellow humans, complemented by transformative technological innovations, could reverse the dangerous trends that have already been set into motion inadvertently.”<sup>2</sup>*

It is clear that the concerned scientific community in partnership with other environmental organizations around the world are already engaged in attempting to reverse the harm already done and preventing further damage.

### **Controversy**

The Roman Catholic tradition is deeply rooted into the Judeo-Christian ideology where God was first known as a loving creator, who created and organized the heavens and the earth and entrusted its humans, who are also creatures, to be co-creators and stewards of creation. For millennia humans believed that their role was to feed from the endless harvest that had been planted for them survive, to live on and to prosper, without looking into the responsibility of being stewards of the Earth. In today's world, this role has taken on an unprecedented urgency due to the advancement of environmental research and the wealth of knowledge that we have gathered from the natural sciences regarding the health of the living systems and ecosystems that have supported our survival for millennia. This urgency is not driven simply by the innovation of new teachings, but because there is a crisis in the natural world; a crisis that indicates that our survival as a human species is in danger, as are so many other living creatures on our planet.

This urgency has forced our Roman Catholic tradition to revise, update, and introduce new teachings on the environment in the hope that our spirituality will help us to form a new language to describe and name our experience as stewards of creation. In the process, we may form new attitudes towards the environment and the use of natural resources, moving from the mentality of consumerism and exploitation to one of interdependence, sustainability and reverence.<sup>3</sup> These new teachings invite us to develop new technologies to ease the burden on the most affected ecosystems, in hopes of restoring them to their health so we can continue to receive the benefits they have given us for many generations.

The official teachings of the Church on the environment, like all new teachings, follow the same process of revising the older teachings on the topic, looking at the new challenges, finding ways to explain them again, listening to where God is calling, and responding to the challenges. This process demands that the Church create teams of scientists, access research, draft formats for teaching and protocols to respond to challenges, all while being rooted in our tradition.<sup>4</sup> This is one of the main roles of the Pontifical Academy of Sciences. The transitional time as the new teachings reach the majority of the members of the Church creates clashes between the old ways of being and “knowing” and the invitation to walk on the new path. This may seem to be

controversial to media outlets that are reporting on the process and theological schools of thought that are working at hammering out those principles.

Today we see that as new teachings on the environment are developed, some have been received with open arms by the ones who have been waiting for them. Other segments of these teachings have encountered resistance by those whose social, political, economic, and personal interests conflict with the new teachings. One of the political ideologies most affected is capitalism, a political ideology linked to free enterprise that serves as the bedrock for all our modern lifestyles. This ideology states that market forces alone will establish all balances and equilibria in our social and natural environments. Obviously, the teachings of the Church have denied supremacy to this political ideology and invites humanity to build its lifestyles on the principles of the tradition where God is the Creator, the Earth is God's garden, and human beings are the tenants.<sup>5</sup>

### **What does the Church say?**

In addition to the main principles of Catholic social teaching, there is a long history of Papal responses to the environment and our call to stewardship and respect for the common good. John Paul II critiqued the indiscriminate use of science and technology, economic involvement in deforestation, soil erosion, herbicide use, and listed consumerism and instant gratification as root causes of our ecological crisis. Benedict XVI built upon his predecessors' work with focus on creating sustainable development for our future generations. Most impressively, the Vatican has become the first carbon neutral country in Europe which has been the result of the installing solar panels and reforestation projects.

This call to stewardship is ever-present in the spirit of the new encyclical *Laudato Si* which introduces the Gospel of Creation. This call to stewardship extends as far back as the Book of Genesis where humanity's role as stewards and co-creators was given in the creation stories and the story of Noah. The following is a summary of the main ecological teachings by Pope Francis.

Pope Francis provides an overview of the environmental crisis by drawing on both Church teachings and contemporary scientific findings to pose important questions for reflection.<sup>6</sup> He specifically addresses pollution and climate change, water as a natural resource, and the loss of biodiversity. A clear theme in this document is that everything is connected: we are part of nature, we are included in it, and we are in constant interdependence with nature. The Pope affirms that our decisions have an inevitable effect on the environment which in turn affects the lives our global sisters and brothers.

Pope Francis states that Christian spirituality encourages moderation and simplicity in everything. He criticizes a technological mindset which views technology as a primary key to human existence. He also comments on the unchecked reliance on technology without due reflection or how the technology will reinforce our selfishness and indifference towards others



and the world. "A constant flood of new consumer goods can baffle the heart and prevent us from cherishing each thing and each moment." We are also reminded that a blind pursuit of money and "the principle of the maximization of profits"<sup>7</sup> set aside the interests of the marginalized and poor in developing countries, and that this leads destruction of the environment. Pope Francis clearly criticizes those who deny, ignore, or act with indifference to the negative impact of humans on climate change.

In *Laudato Si*, Pope Francis invites humanity to join a global dialogue and be in solidarity with others on our planet. The Pope refers to the findings of Bishop's Conferences in Africa, Asia, Europe and the Americas. He urges that all people should be included in the debate about our common home:

*"The majority of people living on our planet profess to be believers. This should spur religions to dialogue among themselves for the sake of protecting nature, defending the poor, and building networks of respect and fraternity. ... The gravity of the ecological crisis demands that we all look to the common good, embarking on a path of dialogue which demands patience, self-discipline and generosity, always keeping in mind that "realities are greater than ideas".<sup>7</sup>*

The Catholic Church's work on the environment and climate change is a clear example of science informing faith, and faith in turn informing science. Since the publication of *Laudato Si* members of the PAS have made explicit connections between the science and our faith. Professor V. Ramanathan, from the Scripps Institution of Oceanography, made explicit connection to the Pope Francis' call to stewardship and to "hear the cries of the poor".<sup>8</sup> There is "a need for an alliance between science policy and religion. *Laudato Si* already says that a new dialogue which includes everyone, and it says that the solution we all know is not just a technological solution, we need a societal transformation..."<sup>8</sup>

In closing, Pope Francis calls for an ecological conversion. He reminds us that we face an urgent crisis, yet God is present as humanity strives to change the course of history and place itself in a space where it can listen to the cry of the earth and the cry of the poor and respond to their calling.

### **Suggested Educator Prompts**

- What does the Church say about the environment?
- What does Pope Francis say are the biggest challenges facing Creation today?
- What can we do in our own personal lives to change our destructive relationship with Creation?
- How can we live more reverently towards the earth?
- What does it mean to live with moderation and simplicity?

### **Links to more information:**

Papal Statements on Human Dignity and the Environment

<https://www.devp.org/en/encyclical>

The Pontifical Academy of Sciences - Climate Change and the Common Good

[http://www.pas.va/content/dam/accademia/pdf/statement\\_climate\\_change\\_common\\_good%20\(inal\).pdf](http://www.pas.va/content/dam/accademia/pdf/statement_climate_change_common_good%20(final).pdf)

Prof. Veerabhadran Ramanathan | Laudato Si' and the Path to COP22 - The Encyclical Laudato Si' and the current horizons of scientific research

[http://www.pas.va/content/accademia/en/publications/scriptavaria/laudato\\_si\\_cop22/ramanathan.html](http://www.pas.va/content/accademia/en/publications/scriptavaria/laudato_si_cop22/ramanathan.html)

Laudato Si: Pope Francis' Encyclical - Development and Peace

<https://www.devp.org/en/encyclical>

Laudato Si': Animated clip for kids from Development and Peace

<https://www.youtube.com/watch?v=KIVulSZGdug>

Laudato Si: Animated Brief for youth from Development and Peace

[https://www.youtube.com/watch?v=\\_TFCXO8tD58](https://www.youtube.com/watch?v=_TFCXO8tD58)

Our Relationship with the Environment: The Need for Conversion Commission for Social Affairs  
Canadian Conference of Catholic Bishops (2008)

[http://www.cccb.ca/site/images/stories/pdf/enviro\\_eng.pdf](http://www.cccb.ca/site/images/stories/pdf/enviro_eng.pdf)

A Prayer for Our Earth - A prayer from Laudato Si

<https://www.youtube.com/watch?v=uSDFigs1Fpk>

Prayers to Care for Creation - USCCB

<http://www.usccb.org/prayer-and-worship/prayers-and-devotions/prayers/prayers-to-care-for-creation.cfm>

### **References:**

1. Bondar, Roberta. 2007. *Shaping Our Schools, Shaping Our Future*. [Toronto. Ont.]: Queen's Printer for Ontario.

2. "Health Of People And Planet: Our Responsibility". 2017. *Pas. Va.*

<http://www.pas.va/content/accademia/en/events/2017/health.html>.

3. "You Love All That Exists... All Things Are Yours, God". 2003. *Cccb.Ca*.  
<http://www.cccb.ca/site/Files/pastoralenvironment.html>.
4. McCarthy, John, SJ. 2011. "Catholic Social Teaching And Ecology Fact Sheet".  
*Ecojesuit.Com*. [http://www.ecojesuit.com/wp-content/uploads/2011/06/CST\\_ENG.pdf](http://www.ecojesuit.com/wp-content/uploads/2011/06/CST_ENG.pdf).
5. "Central Themes In Recent Church Teaching On The Environment". 2013. *Cccb.Ca*.  
[http://www.cccb.ca/site/images/stories/pdf/Church\\_Teaching\\_on\\_the\\_Environment.pdf](http://www.cccb.ca/site/images/stories/pdf/Church_Teaching_on_the_Environment.pdf).
6. Pope John Paul II. 1995. "Evangelium Vitae (25 March 1995) | John Paul II". *W2.Vatican.Va*.  
[http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf\\_jp-ii\\_enc\\_25031995\\_evangelium-vitae.html](http://w2.vatican.va/content/john-paul-ii/en/encyclicals/documents/hf_jp-ii_enc_25031995_evangelium-vitae.html).
7. Pope Francis. 2015. "Laudato Si' (24 May 2015) | Francis". *W2.Vatican.Va*.  
[http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco\\_20150524\\_enciclica-laudato-si.html](http://w2.vatican.va/content/francesco/en/encyclicals/documents/papa-francesco_20150524_enciclica-laudato-si.html).
8. Ramanathan, v. 2018. "The Encyclical Laudato Si' And The Current Horizons Of Scientific Research". *Pas.Va*.  
[http://www.pas.va/content/accademia/en/publications/scriptavaria/laudato\\_si\\_cop22/ramanathan.html](http://www.pas.va/content/accademia/en/publications/scriptavaria/laudato_si_cop22/ramanathan.html).

# **Vaccinations**

## **In the Curriculum**

- Grade 10 Science (systems unit)
- Grade 11 and 12 Biology courses
- Grade 11 Environmental Biology
- Grade 12 Science (SNC4M,4E)
- This topic is often in the news, and is also discussed in relation to vaccination programs occurring in schools, as well as Health Unit suspensions when vaccinations are not complete.

## **What is it?**

The *Ontario Science Curriculum (2008)* defines a vaccine as “a product that protects an organism from disease by producing immunity to a pathogen.”<sup>1</sup>

First invented in the 18th century, vaccination has become one of the greatest advances in Global Health. From smallpox and polio, to measles, rotavirus, and influenza, vaccination programs have prevented the deaths of millions of people worldwide. From 2011-2020 alone, it is estimated that 23.3 million deaths will have been averted.<sup>2</sup>

Vaccination works by introducing (usually by injection) a biological preparation into the body. This preparation consists of small parts of the original pathogen (eg. certain proteins from the original disease-causing virus) or a weakened or dead version of the original pathogen itself. When this is done, the immune system “learns” how to recognize and fight the invading agent, so it can effectively kill it in the future before it has time to wreak havoc in the body. It is the body’s immune system that kills the invading pathogen, the vaccine simply gives it the opportunity to learn how before it actually encounters it.

## **Controversy**

Despite the incredible success of vaccination programs around the world in the past 100 years, there has been some controversy surrounding them. The most prominent area with controversy is that of side-effects. Like most medical interventions, there are some (rare and usually mild) side effects from receiving a vaccine. Reports of more widespread side effects, like the erroneous example of the MMR vaccine causing autism, have been dealt with in the scientific literature. Most side-effects are soreness, redness, and fatigue. The specific example of the MMR vaccine is illustrative; Andrew Wakefield published an article in 1998 linking the combined vaccine for measles, mumps, and rubella to autism-like symptoms.<sup>3</sup> This was understandably picked up by many media outlets leading to skepticism about the safety of vaccinations and ultimately fewer people getting vaccinated. Shortly thereafter, it was determined that his study was scientifically meaningless for a variety of reasons, and retracted.<sup>4</sup> Much damage was already done, however. Wakefield, having deliberately committed this fraud for monetary gain, has even lost his medical license. Even though there has never been a credible link between MMR and autism, scientists around the world went to work investigating his claim anyway. It has since been discredited over and over again in the scientific literature.<sup>5</sup> On balance, the good done by vaccines far outweighs the risks and side-effects.

From a Catholic perspective, there are two other areas in which some controversy may arise when dealing with vaccinations. The first of these is the claim that certain vaccines are made with “aborted fetal tissue”. As Catholics oppose abortion, stemming from the belief that all human embryos have inherent dignity, and must be protected, the claim that certain vaccines are made with tissue from an aborted fetus is concerning. It is, however, more complicated than this simplified depiction of vaccine ingredients.

This claim stems from the fact that two cell lines (WI-38 and MRC-5) were originally derived from elective abortions in 1964 and 1970.<sup>6</sup> Cells from the aborted fetus were extracted and replicated to be used to generate certain vaccines. The National Catholic Bioethics Centre explains that:

*“The cell lines under consideration were begun using cells taken from one or more fetuses aborted almost 40 years ago. Since that time the cell lines have grown independently. It is important to note that descendent cells are not the cells of the aborted child. They never, themselves, formed a part of the victim's body.”<sup>7</sup>*

It is also false to think that any cells from the aborted fetus or the descendent cells are present in the vaccine; they are solely used in its preparation. In Ontario, 3 vaccines are developed using WI-38 or MRC-5 lines: those designed to prevent rubella, varicella, and hepatitis A/B. All others (to our knowledge at time of writing) are not produced in this way. The Catholic Church has dealt with this issue extensively. See below.

The second area in which some controversy arises relates to the HPV vaccine, which is used to vaccinate against the Human Papillomavirus, a pathogen that can cause certain cancers. It has been suggested, by both clergy and lay people, that since HPV is predominantly transmitted through sexual contact, that vaccinating against it may lead to increased sexual promiscuity.<sup>8</sup> After education campaigns and much research, many have backtracked on these concerns.<sup>9</sup> For example, a large research study conducted by the Canadian Medical Association found no evidence that vaccination increased the risk of sexual activity.<sup>10</sup>

### **What does the Church say?**

The situation where aborted fetal tissue was used to prepare certain vaccines has been explored extensively by the Pontifical Academy of Life.<sup>6</sup> This document explores the various concerns raised about how these vaccines are generated, and parses the various moral implications involved. As those three vaccines (in Ontario) have a relationship, albeit a distant one, to two abortions, using it could be considered as *passive material cooperation*. The National Catholic Bioethics Centre also works through the various components of the document in an attempt to clarify it further.<sup>7</sup> They explain that using vaccines that have an historical association with abortion should be avoided if possible, if alternatives exist.

*“Sometimes alternative products, which are not associated with these cell lines, are available for immunization against certain diseases. For example, there is a rabies vaccine (RabAvert) and a single dose mumps vaccine (Mumpsavax) without any association with abortion that are equally safe and effective. If doing so is practical, you should ask your physician to use an alternative vaccine, but there is no moral obligation to use products that are less effective or inaccessible.”<sup>7</sup>*

However, there are certain instances where an equally effective vaccine isn't readily available. In this case,

*“one is morally free to use the vaccine regardless of its historical association with abortion. The reason is that the risk to public health, if one chooses not to vaccinate, outweighs the legitimate concern about the origins of the vaccine. This is especially important for parents, who have a moral obligation to protect the life and health of their children and those around them.”*

Going further:

*“There would seem to be no proper grounds for refusing immunization against dangerous contagious disease, for example, rubella, especially in light of the concern that we should all have for the health of our children, public health, and the common good.”*

At time of writing, this is the case in Ontario.

The document from the Vatican clearly dictates that although it is permissible, and even recommended to use these vaccines to protect the common good, Catholics must advocate for the creation of new vaccines that do not use those cells lines in future, in order to avoid the difficult moral choice between acting on their conscience, and putting “the health of their children and of the population as a whole at risk. This is an unjust alternative choice, which must be eliminated as soon as possible.”<sup>6</sup>

### **HPV Vaccine**

Several Catholic medical and ethical institutes have provided guidance regarding the use of the HPV vaccine. For example, the Catholic Medical Association states very clearly that:

*“The fact that HPV is spread primarily by sexual contact does not render vaccination against it unethical. Healing and preventing diseases, no matter what their source, are acts of mercy and a moral good.”<sup>11</sup>*

They also clarify that the main vaccine used in North America is Gardasil®, which has no known ethical production concerns as it's produced using yeast cells. They do, however, also state that this vaccination should not be mandatory. They outline conditions in which withholding educational opportunities (in Ontario this is seen as Health Unit suspensions) could be considered:

- “1. The disease is potentially serious;*
- 2. Non-vaccinated students would pose a substantial risk to others were they allowed to attend school;*
- 3. The vaccine that prevents it is safe and effective;*
- 4. The vaccine meets reasonable standards for cost-effectiveness; and*
- 5. The vaccine is provided to students who cannot afford it.*

*Criterion #2 is not met by HPV infection. We presume that genital HPV infection is not transmitted while students are in school, and excluding non-vaccinated students from school would not prevent extramural transmission.”*

Other diseases that students are vaccinated against are contagious, and would therefore meet all the conditions, and these suspensions by the various Health Units could be considered.

### **Suggested Educator Prompts**

- How do vaccines work?
- What are the main reasons some people might object to them?
- In your opinion, are those objections justified?
- What does the church say about each of those objections?
- How did the Pontifical Academy of Life balance it's opinion between a distant, passive cooperation in abortion with the protection of health and life of people?

### **Links to more information:**

The National Catholic Bioethics Centre

<https://www.ncbcenter.org/resources/frequently-asked-questions/use-vaccines/>

Letter from the Vatican in response to a concern over vaccines derived from aborted fetal tissue.

<https://www.ncbcenter.org/files/1714/3101/2478/vaticanresponse.pdf>

A Catholic Reproduction Centre's position on HPV vaccine.

[https://www.popepaulvi.com/PDF/sister/CervicalCancerVaccine\\_200709.pdf](https://www.popepaulvi.com/PDF/sister/CervicalCancerVaccine_200709.pdf)

### **References:**

1. Ontario Ministry of Education. 2009. "The Ontario Curriculum, Science Grades 11 And 12". Toronto: Queen's Printer for Ontario.
2. "CDC Global Health - Infographics - The Global Impact Of Vaccines". 2017. *Cdc.Gov*. [https://www.cdc.gov/globalhealth/infographics/immunization/global\\_impact\\_of\\_vaccines.htm](https://www.cdc.gov/globalhealth/infographics/immunization/global_impact_of_vaccines.htm).
3. Wakefield, AJ, SH Murch, A Anthony, J Linnell, DM Casson, M Malik, and M Berelowitz et al. 1998. "RETRACTED: Ileal-Lymphoid-Nodular Hyperplasia, Non-Specific Colitis, And Pervasive Developmental Disorder In Children". *The Lancet* 351 (9103): 637-641. doi:10.1016/s0140-6736(97)11096-0.
4. Sathyanarayana Rao, TS, and Chittaranjan Andrade. 2011. "The MMR Vaccine And Autism: Sensation, Refutation, Retraction, And Fraud". *Indian Journal Of Psychiatry* 53 (2): 95. doi:10.4103/0019-5545.82529.
5. "Vaccines & Autism". 2018. *Science-Based Medicine*. <https://sciencebasedmedicine.org/reference/vaccines-and-autism/>.
6. Sgreccia, Elio, President of the Pontifical Academy of Life. 2005. "Moral Reflections On Vaccines Prepared From Cells Derived From Aborted Human Foetuses". *Ncbcenter.Org*. <https://www.ncbcenter.org/files/1714/3101/2478/vaticanresponse.pdf>.

7. "National Catholic Bioethics Center: Use Of Vaccines". 2006. *Ncbcenter.Org*. <https://www.ncbcenter.org/resources/frequently-asked-questions/use-vaccines/>.
8. "Letter From The Bishops Of Saskatchewan To Catholic School Boards And Catholic Parents Concerning The Proposed Publicly Funded HPV Vaccination Program". 2017. *Scsba.Ca*. <https://www.scsba.ca/wp-content/uploads/2016/11/Letter-from-the-Bishops-of-Saskatchewan-HPV-vaccine-Wording-update-Sept-2017.pdf>.
9. "Catholic Bishops Issue New Letter Calling HPV Vaccine 'A Matter Of Public Health'". 2017, , 2017. <https://www.cbc.ca/news/canada/saskatoon/catholic-bishops-issue-new-letter-hpv-vaccine-public-health-1.4342982>.
10. Smith, Leah M., Jay S. Kaufman, Erin C. Strumpf, and Linda E. Lévesque. 2014. "Effect Of Human Papillomavirus (HPV) Vaccination On Clinical Indicators Of Sexual Behaviour Among Adolescent Girls: The Ontario Grade 8 HPV Vaccine Cohort Study". *Canadian Medical Association Journal* 187 (2): E74-E81. doi:10.1503/cmaj.140900.
11. "Catholic Medical Association Position Paper On HPV Immunization". 2007. *Cathmed.Org*. <https://www.cathmed.org/assets/files/Position%20Paper%20on%20HPV%20Immunization.pdf>