Catholicism and Science

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From the Garden of Eden to an Ancient Earth: Catholicism and the Life and Earth Sciences

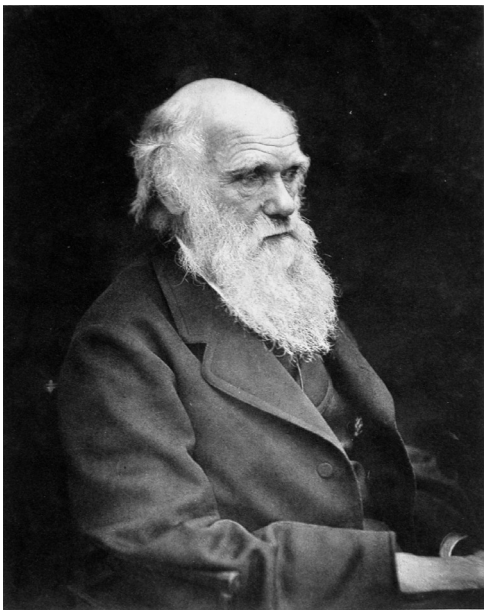
INTRODUCTION

In the relationship between religion and science in the Christian West, the great stories of the sixteenth and seventeenth centuries involved fundamental questions about the composition and operation of the world. From Copernicus to Newton and beyond, the investigation of these questions led to a thorough revision of cosmology, physics, and chemistry. In the eighteenth and nineteenth centuries the great stories would be about the sciences of geology and natural history. The exploration of questions about why rock formations appear old and how species are related to one another would lead to a radically new understanding that the earth and life itself have historical dimensions. And just as Catholicism had slowly accommodated heliocentrism and an atomic theory of matter, Catholics, like other Christians, would adapt to a growing scientific consensus about the age of the planet and how life had come to diversify and flourish on it.

In June 1788, an amateur Scottish geologist named James Hutton (1726–1797) sailed with two colleagues along the coast of northeastern Scotland in search of rocks (Repcheck, 2003:12–24). He was hoping to find a particular formation that would substantiate his long-held theory that the earth was very old. Beaching their boat at Siccar Point, Hutton and his companions stared with awe at the cliff formation rising above the rocky beach. Horizontal strata of red sandstone overlay vertically oriented strata of grey micaceous schist, a classic "angular unconformity." For Hutton, who had studied geology for decades, this angular unconformity or juxtaposition of two different kinds of rock could mean only

one thing. Clay alluvium had been deposited for eons along a coastline at the mouth of an ancient river, gradually hardening through metamorphosis into layered rock called schist. This stratum was tilted vertically by enormous forces deep within the earth and then sheared off by some other great force. The schist was later submerged again only to be covered by yet another layer of alluvium that hardened into red sandstone. Finally, the whole assemblage was once again raised above sea level. Hutton believed that all this geological change had been accomplished through forces acting uniformly throughout geological history. What it required above all was the vast expanse of time, orders of magnitude more time than the roughly 6,000 years of history provided by the biblical narrative. Hutton had found in the rocks testimony to his theory that the earth itself has an ancient history quite separate from that of humanity, and he published these ideas about "deep time" in his *Theory of the Earth*, 1888.

Nearly half a century later, a young Cambridge graduate named Charles Darwin (1809–1882) embarked upon a similar—if rather more extended—voyage of discovery. Finding medical studies distasteful, Darwin (on his father's insistence) had matriculated at Cambridge University to read theology in preparation for a clerical career. However, he was far more interested in studying natural history, and upon completing his degree he accepted an invitation to serve as expedition naturalist aboard the hydrographic survey vessel HMS *Beagle* that circumnavigated the globe from 1831 to 1836 (Browne, 1996:211ff; Desmond, 1994:101–191). Darwin spent his time cataloguing plant and animal specimens, collecting rocks and fossils, and conducting research into the natural history of the many lands he visited in South America and across the Pacific Ocean. He absorbed Hutton's ideas of "deep time" and uniformitarian geology through the pages of Charles Lyell's *Principles of Geology* (1830), which he had brought with him on board *The Beagle*. A keen observer of nature, Darwin developed a theory about the diversity of life and painstakingly assembled the supporting evidence. His explanation for the similarities between species—that they share common ancestry—and for the differences between them—that they have adapted to changing environments—was a challenge every bit as dramatic as that of Copernicus. Ironically, Darwin the student who so eagerly absorbed William Paley's providential interpretation of the adaptation of creatures to their environments would become Darwin the naturalist who stood Paley's argument for divine design on its head. This chapter recounts the story of how Catholic Christianity dealt with the discovery of the deep history of time and the supplanting of a miraculous with a naturalistic explanation for the diversity of life on earth. Not only science, but philosophy, theology, and every other discipline would be irrevocably altered.



Charles Darwin. (Image courtesy History of Science Collections, University of Oklahoma Libraries; copyright the Board of Regents of the University of Oklahoma)

NATURAL HISTORY BEFORE EVOLUTION

The idea that living things change over time was not born with Darwin but had a long period of gestation. Since antiquity students of nature had speculated about the origins of life, with Aristotle arguing that mice can be generated by decaying hay (as well as through normal procreation). For scholars in the Judeo-Christian tradition the creation story of Genesis 1–2 declared the starting point for terrestrial life, but it did not necessarily settle the question of whether God had created life in all its diversity in a mere six days. Was everything created at once, including dung beetles before there was dung, or maggots before there were decaying corpses? In *De genesi ad litteram* Augustine regarded a literal creation of everything in situ—including adult animals—as demeaning to the abilities of the Creator. While insisting that the universe had been brought into being in a single creative act, he thought that God had sown in nature the rational seeds (*rationes seminales*) of all that would later spring forth (McMullin, 1985:11–16). Augustine did not of course proffer an evolutionary theory; certainly he did not imply that one species comes from another (Woods, 1924:127–148). However, the concept of *rationes seminales* did introduce a

developmental or gradualist dimension that became part of the medieval natural historical discussion.

In early modernity the unearthing of fossil sea shells on mountaintops and the discovery of distant cultures with chronological records older than the Genesis creation began to challenge the traditional biblical chronology (Rossi, 1984:123–151). But natural history was still bound by tradition, and the printed floral books of the early sixteenth century in some respects merely recapitulated the themes of medieval herbals. Likewise, Conrad Gesner's (1516–1565) handsomely printed *Historia Animalium* engaged the reader in the systematic study of animals, but also evidenced a credulity that a century later would be unacceptable: among the species to appear in Gesner and in Edward Topsell's *History of Foure-footed Beasts* (1608) were mythical creatures such as the manticora—part man and part lion!

By the late fifteenth century, however, some natural historians were beginning to examine the Roman natural historian Pliny (23–79 CE) with a decidedly critical eye (Findlen, 1996:58). The information conveyed by printing moved well beyond a crude iconographic tradition, and served to educate naturalists uniformly in far-flung parts of Europe (Eisenstein, 1979:543–574). Albrecht Dürer's detailed drawings of plants, for example, paid careful attention to their ecologies. The emblematic worldview—in which to know a creature was to know all of its literary associations—would gradually give way to the methodology championed by Francis Bacon (1561–1626), for whom personal observation was of central importance. Discovery of the divinely ordained laws of nature was a touchstone of the Royal Society (1660), echoing Federico Cesi's *Lyncaeorum Academia* in Rome. Pursuing sound and critical science was regarded as a deeply religious activity, and it is no accident that Nehemiah Grew's important empirical researches in botany found their highest expression in his *Cosmologia Sacra* (1701).

Natural historians continued to subordinate evidence to the judgment of theological assumptions, as did Nicholas Steno (1638–1686), a Danish Lutheran convert to Catholicism. A geologist ordained priest and then bishop, Steno made important discoveries about fossils and articulated three of the defining principles of the science of stratigraphy. However, the only framework available to him for interpreting his careful observations about marine fossils found on Italian mountains was Noah's flood, and his natural history remained firmly anchored within the received tradition of biblical theology (Cutler, 2003:115–122). Advances in scientific method and a critical understanding of observed phenomena fostered the empirical research of naturalists such as Robert Hooke and Anton van Leeuwenhoek, establishing the young science of biology on a firm footing by the end of the seventeenth century.

In the latter half of the seventeenth century the English "physico-theology" movement encouraged the closest partnership between religion and natural history that it would enjoy. Wrapping an ancient religious tradition in the mantle of the new science, most of its proponents maintained their Christian orthodoxy, although some (such as William Whiston) were much closer to the deist end of the spectrum of belief. The Boyle Lectures (founded in 1692) institutionalized this approach by providing a public forum for the articulation of the new science in the context of traditional Christian belief (Dahm, 1970:172). The Cambridge divine and scientist John Ray (1627–1705) perceived clear evidence of divine design in the intricate adaptations of plants and animals to their environments. He restated the design argument in a new guise in his treatise *The Wisdom of God Manifested in the Works of the Creation* (1691). But more importantly for biology, the book was a vast compendium of natural history, characterized by the observation of important nuances within species and the incipient recognition of ecological relationships. The most influential of these courses of lectures dealing with natural history in support of theistic belief was preached by William Derham (1657–1735) and published as *Physico-Theology, or, a Demonstration of the Being and Attributes of God from the Works of Creation* (1716).

The tradition of physico-theology depended fundamentally upon the cogency of the argument from design, or, in scholastic language, the proof from a "final cause." This teleological argument—found quite broadly within the Christian tradition—had been articulated in the context of systematic theology by St. Thomas Aquinas, who in turn had drawn upon St. John Damascene. But as the argument came to reflect and validate every imaginable natural historical detail as evidence of design, it began to wear thin. The case for design in nature as leading ineluctably to a creator met a forcible opponent in David Hume (1711–1776), a leading exponent of the Scottish enlightenment in the fields of history, economics, and philosophy. In his *Dialogues Concerning Natural Religion* (1750–1778) Hume attacked the argument from a number of angles, contending, for example, that order is perceived in mechanical processes such as the formation of snowflakes, not only where we would like to posit a designing mind. He also noted that the argument really only works where we compare an object we want to interpret as designed with another object we know to have been designed. We could only truly know that our universe had been designed if we were able to compare it with another instance of a universe known definitely to be a product of design. An even more damning critique (still bedeviling defenders of "Intelligent Design Creationism" today) is the problem of evil: if the universe has been designed by a wise creator, why has so much meaningless pain and suffering been designed or permitted to arise within the system?

Despite Hume's attack, physico-theology persevered with vigor and grace until Victorian times, nourished by the religious impulses of reverence and awe at the divine wisdom revealed in the works of creation. A classic example is the English clergyman Gilbert White's elegant collection of observations on local flora and fauna entitled *The Natural History and Antiquities of Selborne* (1789). A philosophically more rigorous contribution was William Paley's *Natural Theology* (1802), which interpreted the evidence of each species' special adaptation to its unique environment in terms of divine providential ordering. Paley's work embodying an anthropomorphic approach to natural history influenced a generation of students of impeccable Christian orthodoxy, including the young Charles Darwin. The eight Bridgewater Treatises of the 1830s epitomize the thematic depletion of the genre, although Charles Babbage's *Ninth Bridgewater Treatise* (1837) forwarded a modification of the thesis, namely, that an omnipotent God had the foresight to create laws permitting the development of new species under appropriate circumstances rather than through interference with the laws of nature themselves.

ENLIGHTENMENT AWAKENINGS TO THE HISTORY OF EARTH AND LIFE

The Professionalization of Natural History

Early in the eighteenth century natural history would split into two streams: one professional and increasingly secular; the other popular and persistently religious. Through a variety of channels cultural and intellectual factors would begin to erode the foundations of the physico-theological partnership of religion and science, to bring about its collapse in the nineteenth century. In one degree or another, the Enlightenment exaltation of reason at the expense of revelation is implicated in most of these factors, but social factors such as strenuous competition from academic natural historians also played an important role.

Swedish botanist and zoologist Carl Linnaeus (1707–1788) regarded himself as recorder of God's creation in creating his system of taxonomic nomenclature, but in his work he avoided as consistently as possible any appeal to God for causal explanations of natural historical phenomena. After 1700 the increasing sophistication of research tools and instrumentation, and the establishment of endowed chairs in European universities, led inevitably to the professionalization of the field. Natural history was on its way to becoming the largely secular professional discipline of biology that it would be in the nineteenth century, and there was less and less scope for amateur collectors of specimens to make respectable contributions. Impelled by the research of figures such as Linnaeus in

Sweden, Georges-Louis Leclerc, Comte de Buffon (1707–1788) in France, and Albrecht von Haller (1708–1777) in Germany, natural history on the professional level discarded in theory (if not in fact) the religious assumptions of physico-theology. As scientific sophistication spread to the wider culture, discoveries that had provoked awe and reverence in the early physico-theologians became regarded as merely commonplace.

From Teleology to Naturalism

An important Aristotelian legacy was the notion of *telos* signifying "end" or "purpose." For 2,000 years teleology had served as a fundamental organizing principle in science, and it played an especially crucial role in natural history. Organisms were believed to develop according to a preconceived plan and organs were regarded as having been designed to serve specific purposes, just as animals were believed to have been located in particular habitats to serve the needs of humans. In the eighteenth century this basic principle began to falter, and while it would be anachronistic to suggest that by 1859 teleological thinking already lay shipwrecked on the shoals of naturalism, its piecemeal dismantling cannot be ignored. Despite their personal and methodological differences as scientists, Linnaeus, Buffon, and Haller shared basic assumptions about the existence of final causes and immutable plans regarding the objects of their study. In contrast, their successors in the next generation of natural historians uniformly relied upon the assumptions of Enlightenment science, discarding as useless tools the teleologies and immutable plans presupposed from Aristotle to John Ray and William Derham. Their intentionally non-teleological approach found philosophical legitimation in Kant's *Critique of Teleological Judgment* (1790).

Contributing to the dissociation of natural history from a religious or spiritual interpretation of nature was an extension of the seventeenth-century mechanistic cosmological model into the biological sphere. The reintroduction of a Lucretian atomic theory of matter, purged of its atheistic elements, had reduced physical reality to matter in motion under the influence of Galileo and Descartes, and already essentially excluded the vast continuum of "vital" powers intrinsic to the Aristotelian universe. The logical sequel was to extend this reductionism to life itself, and to provide a purely naturalistic explanation of life from a mechanico-chemical perspective (Roger, 1986:279–286). The mechanistic interpretation of life may not ultimately have won many converts, but it further eroded the supports for a religious interpretation of nature.

"Higher Criticism" of the Bible

In the eighteenth century scholars began to recognize that the Book of Genesis is not a reliable guide to the history of the earth. There were several

dimensions to this. The interest of Renaissance humanists in reading the Bible in the original languages of Hebrew and Greek had initiated a process of critical inquiry that gathered momentum in succeeding centuries. In 1773 French physician Jean Astruc published a book entitled *Conjectures on the original documents that Moses appears to have used in composing the Book of Genesis*. (A convert to Catholicism, Astruc was the son of a Protestant minister from a family with medieval Jewish origins.) Remarking upon the fact that the biblical author alternated the use of the two Hebrew names for God in Genesis, *Elohim* and *Jehovah*, he proposed that Moses had amalgamated two preexisting documents. Astruc's insight was adopted by the Protestant theologian Johann Gottfried Eichhorn (1752–1827), the "father of modern biblical criticism." Independently, a Scottish Catholic priest, Alexander Geddes also anticipated the German school of higher criticism (Fuller, 1984:60–82). This historical-critical movement—which recognized the multiple authorship of the Hebrew Bible and that much of its content was derived from the oral or written traditions of other Semitic cultures of the Ancient Near East—began to call into question the reliability of the biblical witness to secular history, including the stories of creation (*Genesis* 1–2), and the account of a universal flood (*Genesis* 6–9).

The Historicization of Earth and Life Sciences

The Book of Genesis does not indicate the date on which the world was created, an omission that not a few scholars had tried to rectify (McCalla, 2006:28–39). The most famous calculation was made by the same biblical exegete who made the first serious examination of the Septuagint (the Greek translation of the Hebrew Bible): James Ussher, Archbishop of Armagh and Anglican Primate of All Ireland. In his scholarly *Annals of the Old Testament, Deduced from the First Origins of the World*, Ussher reckoned creation to have occurred at nightfall preceding October 23, 4004 BC (Roberts, 2007:41). Ironically, within a century the calculation of creation—in both method and rationale—would be an obsolete exercise. By the mid-eighteenth century the evidence from literary criticism militating against every passage of the bible being literally true coincided with another serious challenge to the received tradition of natural history: a secularizing trend toward the "historicization" of the life and earth sciences.

Two growing mountains of evidence—one geographical and the other temporal—suggested that the biblical cosmogony and global flood story were seriously flawed and becoming untenable (Cohn, 73–120). First, almost from the moment of the European discovery of the "new world," an endless stream of information about previously unknown plants and animals began inundating the consciousness of natural historians. Whereas

John Ray listed 1,500 species of animals in 1691, Carl Linnaeus in the 1758 edition of his *Systema Naturae* included 4,400 species of quadrupeds alone, and further geographical exploration offered no end to this explosion of knowledge. It began to appear impossible to reconcile such an abundance of species with a hexaemeral (six-day) creation. Moreover, the fact that marsupials are found only in Australia and that Africa and the Americas have their own collections of indigenous animals rendered implausible at best the story of Noah having saved at least two of each species in his ark. Nor could the Noah story credibly account for the postdiluvial radiation of all species throughout the world from Mount Ararat (Browne, 1983:1–31). Natural historians henceforth would increasingly be forced into the uncomfortable position of having to choose between their empirical evidence and the dictates of a literalist biblical tradition.

The temporal factor influencing the historicization of natural history was the gradual discovery of the "deep history" of time (Rudwick, 2007). As noted above, James Hutton concluded that the sedimentary strata of the earth and the fossils they contained were far older than the few thousand years permitted by a literal reading of Scripture. His belief in the antiquity of the earth was supported by the French vertebrate paleontologist Georges Cuvier (1769–1832), who established as fact that species had in the past been driven extinct. In his *Discourse on the Revolutionary Upheavals on the Surface of the Earth* (1812), Cuvier agreed that the earth is immensely old. In contrast to Hutton's "uniformitarian" assumption, however, Cuvier took a contrary position that later was labeled "catastrophism"—that the earth has periodically undergone major regional upheavals triggering spasms of extinction. Cuvier preferred to avoid supernatural connotations by applying the term "revolutions" to what he thought were purely natural events. "Catastrophists" such as the Reverend William Buckland in England, however, sought to unite scriptural and geological history, arguing that the most recent revolution had been the Biblical Flood (Brooke, 1991:192–225; UCMP Web page).

Catholic participation in the geological debates was delayed, with the first contribution being French Abbé Sorignet's *Sacred Cosmogony* (1854; trans. 1862), in which he declared that geology that is not in harmony with scripture is unsound. An American Catholic priest, Clarence Walworth, rejected Sorignet's argument in his *The Gentle Skeptic* (1863), contending that the six days of creation were merely metaphorical expressions employed by the author to classify the works of creation (O'Leary, 2006:11). Among the more comprehensive contributions to the discussion was Irish priest Gerald Molloy's *Geology and Revelation* (1870), which relied substantially upon Charles Lyell's *Principles of Geology* (O'Leary, 2006:12). He also drew upon *Twelve Lectures on the Connection between Science and Revealed Religion* (1836) by Cardinal Nicholas Patrick Wiseman (later made

first cardinal archbishop of Westminster). Like Walworth, Molloy was concerned about maintaining the credibility of Catholics in intellectual discussions, and emphasized the "two books" metaphor, the medieval and early modern trope that God is the author of both the "Book of Nature and the Book of Scripture" (Hess, 2003:124–126). Through a range of geological arguments Molloy's recurrent theme was the "accommodationism" employed by Galileo: the Bible was written not to teach science, but to serve the spiritual needs of believers, and the scriptural authors accommodated the needs of simple people when speaking about scientific matters.

The fascinating history of evolutionary ideas before Darwin is as convoluted as that of the geological discovery of deep time, and too intricate to review here (see Bowler, 2003:48–140). Suffice it to say that Darwin matured as a naturalist in a context in which evolutionary thinking had been current for half a century. His grandfather Erasmus Darwin (1731–1802) was a physician and physiologist who proposed a theory of organic development in *Zoonomia* (1796). As a deist, Erasmus Darwin argued that in order to meet the challenges posed by their external environments God had designed living organisms to be self-improving. Similar ideas were proposed in France by Cuvier's rival, the strict materialist Jean Baptiste Lamarck (1744–1829), a professional naturalist. In his *Philosophie Zoologique* (1809), Lamarck developed a theory of linear progress (in contrast to Erasmus Darwin's theory of divergence) and of evolution through the transmission of acquired characteristics. Though he was largely discredited for this, he was supported by Paris zoology professor Étienne Geoffroy Saint-Hilaire. Lamarck made the first significant attempt to construct a theory of descent of all living beings from common ancestry (Bowler, 2003:85–94). In this atmosphere, William Paley's rearticulation of the argument in *Natural Theology* (1802) for a divinely designed and providentially arranged world was scientifically already out of date.

Moreover, the tradition of constructing "chronicles of the world" underwent a gradual shift from portrayals of human history as synchronous with that of the world to a variety of schemata that included increasingly greater lengths of prehuman earth history (Rudwick, 1986:296–321). In the previous hundred years the timeline of earth history had lengthened dramatically from the 6,000 years of Archbishop Ussher's calculation to the hundreds of thousands of years of German geologist C. G. Füchsel (1762), a defender of the Mosaic scriptural account who had interpreted the six days of creation as long ages. A decade later James Hutton mused that in the record of the terrestrial crust "we find no vestige of a beginning, no prospect of an end," and in 1787 his contemporary Abraham Werner suggested an age of a million years. Charles Darwin judged that it would require hundreds of millions of years for evolutionary change to happen,

and Lord Kelvin in 1862—basing his reckoning upon the cooling of the sun—calculated between 24 and 400 million years.

In any case, by the mid-nineteenth century the earth was recognized by scientists as being tens of millions of years old and organic life as in some fundamental way developmental. Professional natural historians had every good reason to believe that the history of creation was not coterminous with human history, and that over time species have come into existence and gone extinct. A permanent rift developed between scriptural geologists who insisted that Genesis interprets nature, and secular geologists and biblical exegetes of the historical-critical school who maintained that nature interprets Genesis (Moore, 1986:335–340). At the same time progressive scripture scholars appreciated the Bible as a complex, multisourced document, in which the hexaemeral creation story in Genesis served the function of cosmogonic myth, and the Noachian deluge was an archetypal story that need not be read literally.

When in this intellectual cultural context Charles Darwin developed a carefully substantiated case for evolution in *On the Origin of Species* (1859), his theory met a mixed reception, with some theologians accepting it and some scientists opposing it (Dupree, 1986:355–362). Darwin himself gradually abandoned Christianity as he found its teleological presuppositions to be incompatible with empirical evidence. John Brooke has inferred that Darwin's gradual loss of traditional faith had as much to do with his emotional response to the tragic death of his daughter Annie as it did with his developing perspective on natural selection (Brooke, 2002:38–41). The theory of evolution was in some respects consonant with his agnosticism, but not necessarily causative of it.

CARDINAL NEWMAN: SCIENCE IN CATHOLIC THOUGHT AT MID-CENTURY

In order to gauge the relationship between science and religion in mid-nineteenth-century Catholic perspective, let us consider the thought of one of the greatest of English Victorian thinkers, John Henry Newman (1801–1890). An Anglican priest and member of the High Church Oxford Movement, Newman converted to Catholicism in midlife, and later was created cardinal. In both phases of his religious life Newman was strongly motivated by pastoral concerns. Not long before the appearance of *The Origin of Species*, he wrote *The Idea of a University* (1858) offering some intriguing Catholic perspectives on the proper relationship between theology and science. Or rather, we should say that he offered a perspective that allowed interpretation in at least two ways. First, Newman articulated what is essentially a two-languages position, arguing that since theology is the "philosophy of the supernatural world" and science the "philosophy

John Henry Newman (1801–1890). An Anglican priest and member of the High Church Oxford Movement, Newman converted to Catholicism and was created cardinal. In his classic *The Idea of a University* (1858) he argued for the complementarity of theology and science. (Artist: Herbert Rose Barraud. Credit: National Portrait Gallery, London.)

of the natural, Theology and Science, whether in their respective ideas, or again in their own actual fields, on the whole, are incommunicable, incapable of collision, and needing, at most to be connected, never to be reconciled" (Newman, 1907:431).

But, second, Newman remained serenely confident that truth is ultimately one, even if it is known through different modalities. The theologian has no reason to become alarmed that discoveries arrived at by means of any scientific method other than theology can truly contradict formal religious dogma. In fact, Newman argued, theology is the one science that from its "sovereign and unassailable position" can remain epistemologically unperturbed:

> He is sure, and nothing shall make him doubt, that, if anything seems to be proved by astronomer, or geologist, or chronologist, or antiquarian, or ethnologist, in

contradiction to the dogmas of faith, that point will eventually turn out, first, *not* to be proved, or, secondly, not *contradictory*, or thirdly, not contradictory to any thing *really revealed*, but to something which has been confused with revelation. (Newman, 1907:466–467)

Newman cautioned both scientists and theologians to observe the integrity of their respective disciplines and to avoid trespassing on intellectual territory outside their competence. As a nontheologian Galileo would have been better off, he thought, "to hold his doctrine of the motion of the earth as a scientific conclusion" rather than pontificating in the *Letter to the Grand duchess Christina* about what the scriptures teach us. Speaking of contemporary theologians, Newman scolded

religious men, who, from a nervous impatience lest Scripture should for one moment seem inconsistent with the results of some speculation of the hour, are ever proposing geological or ethnological comments upon it, which they have to alter or obliterate before the ink is well dry, from changes in the progressive science, which they have so officiously brought to its aid. (Newman, 1907:472)

This position clearly reflects a commitment to theology in dialogue with scientific culture, not a theology hermetically sealed off from science. Newman seems neither to have specifically endorsed or denied human evolution, but he was among the first theologians to accept the scientific principle of the mutation of species. (Elder, 1996:75–76). As a friend of the English biologist St. George Mivart, Newman endorsed the latter's evolutionary ideas, speculating in a letter to E.B. Pusey in 1870 that Darwin's views about human descent did not contradict scripture.

EARLY VATICAN REACTIONS TO DARWINISM

We should not expect to find a monolithic Catholic reaction to evolution, on the part either of the papacy, or of the bishops and priests, or of Catholic scholars or lay persons. Turning centuries of established tradition on its head was no mean task, as the biblical critics who contributed to the Anglican *Essays and Reviews* (1860) were well aware. Various forces within Catholicism would serve to modify or deflect the trajectory of the gradual acceptance of evolution. The earliest official statement by the Catholic hierarchy based its rejection of human evolution on both scripture and tradition. In 1860, at a provincial Council of Cologne, during deliberations about principles of Christian anthropology, the council declared as contrary to scripture and faith both the opinion that the human body was derived from the spontaneous transformation of an inferior nature, and the view that the entire human race had not descended from Adam (Alszeghy, 1967:25). However, it is important to note that the primary objection was to

"spontaneous" transformation, permitting the hypothesis that God might have aided in the evolutionary process.

The reaction of the papacy to evolution was strongly conditioned by political circumstances. In the wake of the French Revolution (1789–1799), the Catholic Church had been split between liberal and conservative factions, with more bishops supporting the ultramontane or conservative party. Ultramontanists found ideas about civil equality, religious toleration, freedom of the press, and the separation of church and state threatening. Not surprisingly papal policy for most of the middle of the century reflected rigidity:

> An institution so politically, economically, and socially conservative was not likely to be progressive, flexible, and innovative when responding to intellectual challenges in religious matters. (O'Leary, 2006:45–46)

In the face of such a wide range of challenges, Pope Pius IX issued in 1864 his *Syllabus of Errors*, a broad attack on liberalism in politics, the sciences, and critical biblical scholarship. The *Syllabus* not only reaffirmed the supremacy of theology over philosophy, but sanctioned a particular methodology by condemning the proposition that "The method and principles by which the old scholastic doctors cultivated theology are no longer suitable to the demands of our times and to the progress of the sciences" (*Syllabus*, 13). Pius insisted that philosophy should operate with one eye on supernatural revelation. Even taking into account the Vatican's justifiable need to defend itself against the aggressive nature of some anti-Catholic factions within Italy, the *Syllabus of Errors* comes across as stridently defensive. In the year of its publication (1864) Darwin's *Origin of Species* was translated into Italian, initiating rancorous debate that the Church interpreted as an attack on its teachings (O'Leary, 2006:52).

A few years later Pope Pius IX convened the first Vatican Council (1868) to reassert the power of the papacy. His boldest move was to push through the College of Cardinals the doctrine of papal infallibility on doctrinal matters of faith and morals when the pope is speaking *ex cathedra* (that is, "from the chair" of the Roman Pontiff). The delegates to the council also argued in the *Dogmatic Constitution on the Catholic Faith* to defend theology against the false claims of philosophy and science:

> Hence all faithful Christians are forbidden to defend as the legitimate conclusions of science those opinions which are known to be contrary to the doctrine of faith, particularly if they have been condemned by the Church; and furthermore they are absolutely bound to hold them to be errors which wear the deceptive appearance of truth. (Pope Pius IX, *DCCF*, 1870a:4.9)

But the bishops did not explicitly name developmental biology, and the declaration that "faith and reason [can] never be at odds with one another but mutually support each other" leaves considerable room for interpretation. The *Dogmatic Constitution on the Church* did not forbid the sciences to employ their own proper principles and method, although it did place constraints upon them:

> While she admits this just freedom, she takes particular care that they do not become infected with errors by conflicting with divine teaching, or, by going beyond their proper limits, intrude upon what belongs to faith and engender confusion. (Pope Pius IX, *DCC*, 1870b:10)

Pope Leo XIII declared in *Providentissimus Deus* (1893) that the science is "admirably adapted to show forth the glory of the Great Creator, provided it be taught as it should be," but that if it be "perversely imparted to the youthful intelligence" it can prove most fatal by destroying the principles of true philosophy and corrupting morality. Science thus serves a protective role, assisting in detecting attacks on the Sacred Books, and in refuting them. In fact,

> There can never, indeed, be any real discrepancy between the theologian and the physicist, as long as each confines himself within his own lines, and both are careful, as St. Augustine warns us, "not to make rash assertions, or to assert what is not known as known." (Leo XIII, 1893:13)

In fact, Pope Leo appealed to the rule of St. Augustine that in cases of conflict, it was the Church's right and responsibility to enforce an interpretation of scientific evidence consonant with scripture:

> Whatever they can really demonstrate to be true of physical nature, we must show to be capable of reconciliation with our Scriptures; and whatever they assert in their treatises which is contrary to these Scriptures of ours, that is to Catholic faith, we must either prove it as well as we can to be entirely false, or at all events we must, without the smallest hesitation, believe it to be false. (Leo XIII, 1893:13)

But even here it seems to me we see an ambiguity pregnant with possibility. Almost in echo of the language used in the Galileo controversy—that the scriptures teach us how to go to heaven not how the heavens go—Pope Leo XIII declared that we must bear in mind that the sacred writers, "or to speak more accurately, the Holy Ghost Who spoke by them, did not intend to teach men these things (that is to say, the essential nature of the things of the visible universe), things in no way profitable unto salvation." In other

words, biblical writers were not writing as scientists in quest of the secrets of nature, but rather described and dealt with their subject in figurative language, or in terms that were commonly used at the time. Even the "Angelic Doctor," St. Thomas Aquinas, maintained that the sacred writers "put down what God, speaking to men, signified, in the way men could understand and were accustomed to." Pius XII would articulate the same idea in *Divino Afflante Spiritu* (1943).

> In Scripture divine things are presented to us in the manner which is in common use amongst men. For as the substantial Word of God became like to men in all things, "except sin," so the words of God, expressed in human language, are made like to human speech in every respect, except error. (Pius XII, 1943:37)

The key issue for Catholics (as for others) was whether we are bound to reinterpret the findings of science so as to be consonant with a theological worldview that in essential respects was out of date. Still, evolution as a Catholic problem had less to do with biblical literalism than it did with the Church's adherence to Neo-Scholasticism. When the latter began to fade as a principal metaphysical system, the way was opened for an exploration of evolutionary ideas.

ST. GEORGE JACKSON MIVART: EVOLUTION IN THEISTIC PERSPECTIVE

One of the early significant endorsements of the theory of evolution from a solidly theistic perspective was by the English anatomist and convert to Catholicism, St. George Jackson Mivart (1827–1900). In his *On the Genesis of Species* (1871), Mivart expounded arguments important enough for Darwin to pay serious attention to in subsequent editions of on the *Origin of Species*. Mivart had taught himself zoology, and developed a specialization in the anatomy of newts and monkeys. With the sponsorship of Thomas Huxley, he became a Fellow of the Royal Society and made the acquaintance of Darwin. The relationship soured after Mivart's publication of his own book and worsened following the appearance of Darwin's *Descent of Man*, not so much on account of Mivart's opposition to elements of Darwin's theory as because of the personal nature of his attacks upon the latter. Mivart was a strong believer in biological evolution with the important stipulation that it should be framed in opposition to an atheistic worldview. As a response to what he feared was the challenge of a thoroughly naturalistic evolution, he placed a protective belt around the creation of the human soul in order to integrate biological evolution with the Roman Catholic doctrine of theological anthropology.

Mivart supported his arguments for the compatibility of the theory of evolution with Christian doctrine by adducing the opinions of the early church fathers and medieval theologians as to how the universe might be regarded as unfolding from "seeds." Most important among these was Augustine's "derivative sense in which God's creation of organic forms is to be understood," namely the conferral on the world of the power to evolve from *logikoi spermatikoi*, or "word empowered seeds" (Mivart, 1871:281). As a preliminary line of argument Mivart declared that creation in fact forms part of revelation, and that revelation appeals for its acceptance to reasons. Thus we are led in the direction of a philosophical theology in which the intelligent acceptance of theism on purely rational grounds served to prepare the way for acceptance of the reasonableness of revelation (Mivart, 1871:261). Part of Mivart's strategy in the early part of his twelfth chapter, on "Theology and Evolution," was to claim that Darwin and Spencer had created straw person characterizations of teleology or "ultimate cause." Next he argued that the claims of theism are made entirely in analogical language (Mivart, 1871:264), and that since theists declare at the outset their conception of God to be utterly inadequate, scientists who ridicule belief in God as Creator on the grounds of lack of physical evidence are guilty of what we today might call "scientism" (Mivart, 1871:272–273).

Mivart constructed protective belts at two points to safeguard Christian doctrine from physicalist reductionism. The first is "absolute or primary creation," which stands completely outside the purview of physical science. While derivative creation—or the action of evolution upon the animate world to provide a diversity of species—is not a supernatural act, primary creation is a supernatural act. Mivart believed that careful distinction between these categorically different levels of creation not only could dispel theological reluctance to adept evolution, but could obviate a simplistic rejection of the doctrine of creation on the part of scientists. The second protective belt was drawn around the human soul in a move often repeated by Catholic theologians up to Popes John Paul II and Benedict XVI. Mivart could in no way countenance the derivation of the spiritual component of humanity from the slime of the earth.

One of the least satisfactory aspects of Mivart's argument for the integration of evolutionary theory with a perspective of providentialist theology was his treatment of the problem of pain suffered through eons of evolution. He tried to minimize animal pain, by suggesting that

> only during consciousness does it exist, and only in the most highly organized men does it reach its acme. The author has been assured that lower races of men appear less keenly sensitive to physical pain than do more cultivated and refined human beings. Thus only in man can there really be any intense degree of suffering,

because only in him is there that intellectual recollection of past moments and that anticipation of future ones, which constitute in great part the bitterness of suffering. (Mivart, 1871:277)

Today we would regard this as a cavalier dismissal of the reality of non-human animal experience (to say nothing about its pseudo-distinction between races of humans). Whatever truth there may be to the differentiation between physical and psychological pain, Mivart's minimization of the former was not a sufficiently convincing refutation of Darwin's recognition that the process of natural selection has involved countless generations of conscious beings in a systematic web of suffering. Mivart's metaphysic of design predisposed him to an inevitably beneficial reading of evolution: "The natural universe has resulted in the development of an unmistakable harmony and beauty, and in a decided preponderance of good and happiness over their opposites" (Mivart, 1871:278). This reads uncomfortably and unconvincingly like a utilitarian justification of suffering, or like Paley's imagined world in *Natural Theology* of his vicarage garden buzzing with joyful insects. Later thinkers (including Catholics) began to reject such simplistic harmonization, realizing that no Christian theology of nature is adequate that does not at least address the theodicy problem seriously (Haught, 2005:12).

When Mivart taught that God could infuse a soul into a body prepared by a preceding process of evolution, he was strongly criticized by some Catholic scholars, but the authorities did not intervene; in fact, in 1876 Pope Pius IX conferred upon him the degree of doctor of philosophy. In 1891, Cardinal Zeferino Gonzáles corrected Mivart's theory that God could render the hominid body capable of receiving a spiritual soul through the "special action" of evolution. Gonzáles thought this correction was necessary to preserve human dignity and to distinguish us from the beasts (Garrigan, 1967:84).

What landed Mivart in trouble with Rome had nothing to do with evolution, but rather with his questionable ideas about the theology of hell. Attempting to mitigate for apologetic reasons the traditional gloomy doctrine of eternal punishment, he argued in 1893 that most human beings are incapable of committing mortal sin, and that after death, influenced by their natural love for God they will attain a state of mortal happiness commensurate with their abilities. Mivart's articles on this subject were placed on the Index in 1893, but beyond the official pronouncement, there was no substantial campaign of enforcement or repression. It was Mivart himself who rashly insisted on provoking the authorities, who ultimately prohibited him from receiving the sacraments (Artigas, 2006: 248–264).

EVOLUTION AND RELIGION: GERMANY AND FRANCE

Dupree has sketched the diversity of nineteenth-century Protestant reaction to Darwin's theory of evolution, showing that there were scientists and churchmen both in support of and opposed to the theory (Dupree, 1986:355–362). Naturally we might expect to discover a comparable diversity among Catholic theologians and scientists. In European circles the fortunes of evolution varied widely, with scholars who had significant experience in biological science taking a more open and exploratory position than their more tradition-minded colleagues. The Jesuit German biblical exegete J. Knabenbauer offered the following careful judgment in 1877, published in *Stimmen aus Maria-Laach* ("Voices from Maria-Laach"):

> Considered in connection with the entire account of creation, the words of Genesis cited above proximately maintain nothing else than that the earth with all that it contains and bears, together with the plant and animal kingdoms, has not produced itself nor is the work of chance; but owes its existence to the power of God. However, in what particular manner the plant and animal kingdoms received their existence: whether all species were created simultaneously or only a few which were destined to give life to others: whether only one fruitful seed was placed on mother earth, which under the influence of natural causes developed into the first plants, and another infused into the waters gave birth to the first animals—all this the Book of Genesis leaves to our own investigation and to the revelations of science, if indeed science is able at all to give a final and unquestionable decision. In other words, the article of faith contained in Genesis remains firm and intact even if one explains the manner in which the different species originated according to the principle of the theory of evolution. (Knabenbauer, 1877:78)

What is particularly intriguing about this favorable judgment on the evolutionary hypothesis is that Knabenbauer's order—the Society of Jesus—were staunch opponents of the anti-Catholic secularizing forces in Bismarck's *Kulturkampf*, or "culture war." Whether Knabenbauer's primary purpose was to defend the integrity of science or the credibility of Catholicism, he demonstrated that one could be a loyal son of the Church and at the same time integrate evolutionary thinking into theology.

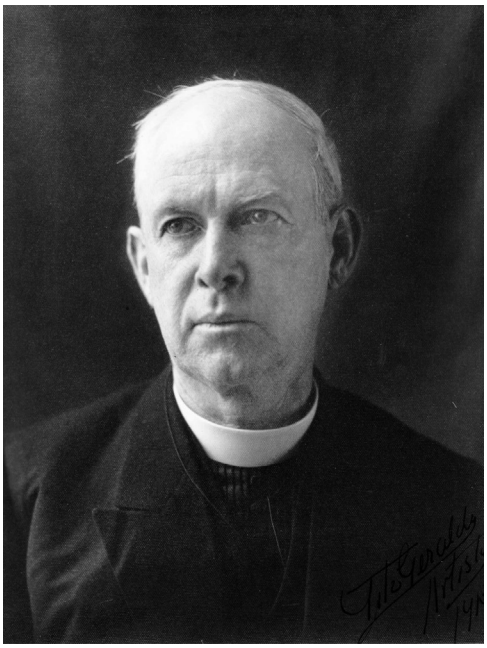
Darwinism fared less well in nineteenth-century France, where Lamarckian ideas continued to flourish, and where Catholicism, in a fragile political position since the French Revolution, was preoccupied with its own survival amidst the welter of secular forces and occultist elements. French Catholicism at the turn of the century tended to exalt the mysterious and miraculous (and even the irrational), and did not offer fertile ground for an assimilation of Darwinist evolutionary ideas (Burrow, 2000:51, 225–226).

Among the important exceptions to this generalization was Fr. Dalmace Leroy, a French Dominican whose lifelong fascination with natural history led him in 1887 to publish *The Evolution of Organic Species*. In response to reviews critical of his book he published a revised and expanded edition in 1891, under the altered title *Evolution Limited to Organic Species*, explaining that he had carefully excluded Adam and Eve from consideration in the evolutionary story. Nevertheless, his book was denounced to the Index in 1894, and following lengthy negotiations Leroy agreed to retract it in 1895. He retained reservations, however, for he sincerely believed that the credibility of the Catholic Church was at stake in its steadfast refusal even to consider the evolutionary preparation of the human body for reception of the infused soul. The cardinals forbade Leroy's book but did not publish the decree condemning it. The detailed records in the Vatican Archives show that this was by no means a simple affair, and that there was incertitude among the theologians of the Congregation of the Index. The case stands as clear evidence that the Catholic Church in the generations after Darwin had no official doctrine regarding evolution (Artigas et al., 2006:52–123).

ENTHUSIASTIC APPROPRIATION: THE CASE OF JOHN AUGUSTINE ZAHM

The vigorous discussion of the theory of evolution at the turn of the century reflects the struggle internal to the American Catholic community over their integration into American culture. Free scientific inquiry and the separation of church and state were values not to be taken lightly. Appleby has shown that the reception of Darwinism was conditioned in part by the ongoing "conflict between 'scholastic' (i.e., Aristotelian) and 'modern' (i.e., Newtonian) methods and ways of conceptualizing nature and human development" (Appleby, 1999:198). Evolution was therefore judged according to the norms of the Neoscholastic worldview that had become entrenched in Catholic seminaries in the nineteenth century.

John Zahm (1851–1921) was one of the foremost American apologists for the harmonization of evolutionary theory with Catholic dogma. Ordained a priest in the Holy Cross order in 1875, he was a professor of physics and chemistry at the University of Notre Dame. In the year of publication of his book *Evolution and Dogma* Zahm was transferred to Rome as procurator general for the Holy Cross Community, which some opponents incorrectly interpreted as censure for his dubious views. This was in fact not the case, but the appearance of the French and Italian editions of his book inevitably led to intensified debate about these issues for a year, until the Sacred Congregation of the Index issued an injunction against its further publication



John Augustine Zahm (1851–1921). Holy Cross priest and professor of physics and chemistry at the University of Notre Dame, who become one of the foremost American apologists for the harmonization of evolutionary theory with Catholic dogma. (Courtesy of the Notre Dame Archives)

and distribution in 1899, although this injunction appears never to have been enforced.

Zahm demonstrated an ease and familiarity with evolution that sounds surprisingly contemporary to us. He noted that Darwinism "is not evolution, as is so often imagined, but only one of numerous attempts which have been made to explain the *modus operandi* of evolution" (Zahm, 1978:207). He was well aware of the baggage Darwinian evolution bore in its being associated with atheism, citing Canadian geologist William Dawson who maintained that "the doctrine of evolution carried out to its logical consequences excludes creation and Theism" (Zahm, 1978:209). He was also alert to evolutionary controversies in Europe, appealing, for example, to the opinion of French priest Monsabré that

> far from compromising the orthodox belief in the creative action of God [evolution] reduces this action to a small number of transcendent acts, more in conformity with

the unity of the Divine plan and the infinite wisdom of the Almighty, who knows how to employ secondary causes to attain his ends. (Zahm, 1978:212)

Zahm recognized the paucity of fossil transitional forms, and appealed to Darwin's own treatment of this regarding our incomplete knowledge of the geological record (Zahm, 1978:161, 173). He was convinced that although we do not at present understand the production of variation—Mendelian genetics would not be incorporated into the neo-Darwinian synthesis for some time yet—we would eventually arrive at this understanding. And he critically reviewed the evidence on both sides of the controversy about Lamarckian transmission of acquired characteristics, weighed Darwinian and non-Darwinian approaches, and concluded that a true, all-embracing theory of evolution still awaited scientists (Zahm, 1978:195–202). Zahm retained serene confidence that progressive science and revealed theology are consonant endeavors:

Whatever may be the final proved verdict of science in respect of man's body, it cannot be at variance with Catholic dogma. Granting that future researches in paleontology, anthropology, and biology, shall demonstrate beyond doubt that man is genetically related to the inferior animals, and we have seen how far scientists are from such a demonstration, there will not be, even in such an improbable event, the slightest ground for imagining that then, at last, the conclusions of science are hopelessly at variance with the declarations of the sacred text, or the authorized teachings of the Church of Christ . . . We should be obliged to revise the interpretation that has usually been given to the words of scripture which refer to the formation of Adam's body, and read these words in the sense which evolution demands, a sense which, as we have seen, may be attributed to the words of the inspired record, without either distorting the meaning of terms or in any way doing violence to the text. (Zahm, 1978:364–365)

Zahm's book invited attention in Rome in part because of the existing campaign against "Americanism." New World political values were often regarded with suspicion by conservative Europeans, for American Catholics who had adopted the values of freedom of the press, liberty of conscience, and the spirit of free scientific inquiry were less likely to follow Vatican dictates. Nevertheless, Zahm was deferential to authority, and when rumors reached him that his book was about to be placed on the Index, he promptly wrote to the publisher of the Italian edition to slow its distribution. The decree of condemnation was never published, and Zahm never issued a retraction. Convinced that he had worked for the honor and glory of God in writing about evolution and dogma, he was content to follow the orders of the hierarchical church he loved and served (Artigas, 2006:194–196).

Artigas, Glick, and Martinez show that the popular assumption of Rome having taken a heavy-handed role in quelling Catholic enthusiasm for biological evolution is quite simply false. The Jesuit journal *La Civiltà Cattolica*—whose editors enjoyed a close relationship with the Vatican—launched an extended campaign against the theory, but their influence was limited. None of Charles Darwin's books were placed on the Index, nor were those of Thomas Huxley ("Darwin's bulldog"), Herbert Spencer, or Ernst Haeckel. The six cases that came to the attention of the Congregation of the Index during the quarter century under review all involved books written by Catholics who had attracted ecclesiastical attention, presumably because their works had greater potential to disturb the life of the Church (Artigas, 2006:14). Only the case of the Florentine priest Rafaello Caverni reached the ultimate conclusion of condemnation. Even here, however, the reason for the condemnation of his *New Studies of Philosophy* (1877) was not made public (Caverni was careful to except human beings from his defense of the theory) and the word "evolution" does not appear in the title (Artigas, 2006:35, 50–51).

That there was no Catholic conspiracy against evolution is further clarified by the fact that the Vatican investigations of proponents of evolution were undertaken not by its doctrinal authority—the Holy Office of the Inquisition—but rather by the congregation of the Index. Much had changed since the days of the Galileo affair, an event that seems to have been present in the consciousness of the participants on both sides. In 1616 and 1632 Galileo's ideas were condemned quite quickly and without much time for deliberation. In contrast, the discussion of evolution had lasted for several decades, but despite established theological opposition, these cases led to no public condemnation of evolution (Artigas, 2006: 270–283).

STUDIED REJECTION OF DARWINISM: MARTIN S. BRENNAN

Of course, not all American Catholics were ardent champions of evolution. One reason is that American clergy in a dynamic and expanding frontier church had more pressing pastoral concerns than assessing arcane intellectual arguments they might not fully understand (Appleby, 1999:178). But even those who were attracted to the life of the mind, such as St. Louis seminary science professor Martin Brennan, did not always jump on the evolutionary bandwagon. Two years after the appearance of Zahm's book Brennan published *The Science of the Bible* (1898), a careful assessment of all the contemporary sciences in light of Scripture. Conversant with recent theory in physics, chemistry, biology, and geological "deep time," his sober review of the evidence led him ineluctably to the conclusion that Darwin's theory was simply wrong.

The weakest link in the chain of argument, in Brennan's view, was Darwin's confounding of "variety" with "species" (the same claim, curiously, that is made by some creationists today who concede micro- but not macroevolution). Brennan also regarded the incompleteness of the fossil record (which might hide missing links and connections) as damaging to the Darwinian hypothesis. Accepting the now-disproven argument of Sir William Thompson (Lord Kelvin) about the thirty-million year life of the sun, he concluded that solar physics offers good reason to believe that far too little time has elapsed to accomplish all the species diversification demanded of Darwin's descent by natural selection (Brennan, 1898:282, 286, 292). Brennan concluded that

> [Darwin's] hypothesis, like all novelties and sensations in the scientific world, however popular and successful at first, is being tested in the crucible of facts and is declared a failure because it cannot satisfactorily answer the difficulties pressed against it. (Brennan, 1898: 294)

Thus, for Brennan, a special creative act was required at the origin of each species. Quoting Joseph Le Conte, Asa Gray, and Louis Agassiz, he denied the transmutation of species and contended that God had created the same number of species in the beginning as exist today. Moreover, regarding human evolution

> Genesis tells us that God created man to his own image; . . . Evolutionists rely upon biology and anthropology to establish their theories. But both biology and anthropology very plainly and positively favor the statement of Moses. (Brenann, 1898:315)

This proved to Brennan's satisfaction that "it is absolutely impossible for man to have been evolved by transmutation from any inferior species, but must have come by a special creative act of the almighty as the great Hebrew prophet records" (Brennan, 314).

After a further critical discussion of Darwin's and others' positions regarding evolution, Brennan concluded that "The truest results of biology and anthropology, instead of contradicting, confirm the Mosaic record. God called man into being by a special creative act. The whole human family belongs to the one same species, and man's Simian descent must be abandoned." He calculated human antiquity on earth at somewhere between 8,000 and 10,000 years. But that Brennan was not an unswerving Noachian literalist is demonstrated by his careful calculations and argument for a strictly local flood (Brennan, 1898:356; 385–386).

The difference in perspective between Martin Brennan and John Zahm is instructive. The fact that two scholars—both teaching in Catholic

institutions in the American Midwest, and publishing within two years of each other—should come to opposite conclusions on the cogency of the theory of evolution, indicates the enigmatic role that personal predilection played in the halting Catholic acceptance of evolution.

A PROGRESSIVE VIEW FROM THE AMERICAN HIERARCHY: BISHOP JOHN L. SPALDING

In contrast to Martin Brennan stands John L. Spalding, Bishop of Peoria, Illinois, who in *Religion, Agnosticism, and Education* (1902) took as his starting point the intelligibility of the world: "We find that thoughts and things are coordinate. Ideas have their counterparts in facts. Everywhere there is law and order." Every aspect of animate nature unfolds by an inner drive, in which Spalding saw a divine planning:

> In the minute cell there is the potency which creates the most perfect form. And, if it could be proven that the infinite variety of nature is but the result of the manifold evolution of a single elementary substance, we should still inevitably see the work of reason in it all. Hence when we know the world as an effect, we necessarily think of its Cause as having knowledge and wisdom; though the knowledge and wisdom of the Infinite are doubtless something inconceivably higher than what these terms can mean for us. (Spalding, 1902:95–96)

As a bishop, Spalding was in the delicate position of having both to represent faithfully the teaching magisterium of the Church and to reflect American values such as the separation of church and state and of academic freedom. In his fifth chapter, on "Education and the Future of Religion," he made a passionate plea for freedom of speculation:

> To forbid men to think along whatever line, is to place oneself in opposition to the deepest and most invincible tendency of the civilized world. Were it possible to compel obedience from Catholics in matters of this kind, the result would be a hardening and sinking of our whole religious life. We should more and more drift away from the vital movements of the age, and find ourselves at last immured in a spiritual ghetto, where no man can breathe pure air, or be joyful or strong or free. (Spalding, 1902:175)

Spalding did not mince his words about the implications for education of a dogged adherence to outdated authority. He declared that "Aristotle is a great mind, but his learning is crude and his ideas of nature are frequently grotesque." Equally bluntly, he asserted that "Saint Thomas is a powerful intellect but his point of view in all that concerns natural knowledge has long since vanished from sight" (cited in Appleby, 1999:182).

Spalding noted that if Catholics hope to champion revealed truth effectively, they must be prepared to do so intentionally in light of modern scientific research:

> If, in consequence, we find it necessary to abandon positions which are no longer defensible, to assume new attitudes in the face of new conditions, we must remember that though the Church is a divine institution, it is none the less subject to the law which makes human things mutable, that though truth must remain the same, it is capable of receiving fresh illustration, and that if it is to be life-giving, it must be wrought anew into the constitution of each individual and of each age. (Spalding, 1902:177)

But Spalding was equally aware of the dangers of reductionism, warning that overemphasis on scientific theories about the universe has created an atmosphere that attaches comparatively little importance to any factors other than heredity and environment:

> The opinion tends to prevail that the mind and character of man, like his body, like the whole organic world, is the product of evolution, working through fatal laws, wherewith human purpose and free will—the possibility of which is denied—cannot interfere in any real way. (Spalding, 1902:198)

He asserted that no educator could accept this position without losing conviction in the ultimate and transcendent value of his work. But, "fortunately, one may admit the general prevalence of the law of evolution without ceasing to believe in God, in the soul, and in freedom" (Spalding, 1902:198).

GENETICS AND MENDEL THE MONK

There were many stages to the gradual assimilation of evolutionary theory into the framework of Catholic theology. In a real sense this parallels—if somewhat more slowly and with a different dynamic—the stages of its development within biological science. Darwin's idea of natural selection as articulated in 1859 was by itself an insufficient theory, for it could not explain why the variations upon which selection operated occur naturally within populations. For that, science had to wait for genetics, a piece of the puzzle supplied in part by another Catholic scientist.

Less famous than Darwin, although of no less significance for the success of the evolutionary theory, was Gregor Mendel (1822–1884), "father of modern genetics." Born in Brünn (then part of the Austrian Empire), Mendel studied at the Philosophical Institute at Olmütz, and entered the Augustinian Order at the Abbey of St. Thomas in Brünn (Martin Luther

Gregor Mendel (1822–1884). Augustinian friar whose research into the hybridization of pea plants helped to launch the modern science of genetics. (National Library of Medicine)

had belonged to the same order three centuries earlier). After studying at the University of Vienna, Mendel returned to his monastery to teach physics (Henig, 2000:40–46). As a scholar, he was inspired by his professors and his monastic colleagues to study the problem of genetic variation in plants, and over the course of nearly a decade, he cultivated and studied 29,000 pea plants. He discovered that in breeding hybrid peas, offspring in the first generation carried dominant and recessive traits in the ratio of 3:1. He presented his findings on "Experiments in Plant Hybridization" at the annual meeting of the Natural History Society of Brünn, and the paper was published in 1866 in the society's proceedings. Seriously criticized by the botanical establishment, the paper languished and was rarely cited over the next thirty-five years (Henig, 2000).

Mendel was elected abbot of his monastery in 1868, thus effectively ending his scientific career as he assumed an increasing burden of administrative and spiritual obligations. Providentially, his seminal paper on genetics was rediscovered in 1900 by the geneticists Hugo de Vries (Dutch) and Carl Correns (German), and thence it passed into history as one of the

cornerstones of the neo-Darwinian synthesis. It was a Mendelian convert, the Dane Wilhelm Johannsen, who gave the name "gene" to the hypothetical unit of hereditary information. Mendel himself had referred to these units as "factors," characters and cells," and (considering his Catholic philosophical commitments) probably envisioned them as immaterial essences. It was only later that the laws of heredity were definitely shown to be carried by material chromosomes (Larson, 2004:162–166).

CONCLUSION: FROM THE GARDEN OF EDEN TO MENDEL'S GARDEN OF PEAS

For fifteen hundred years, the Christian community–including its clergy and theologians, its philosophers and scientists–had been committed to the only plausible account of life on earth, that narrated by Moses in the Book of Genesis. We have traced how this story began to lose its cogency, first in astronomy and physics, and then in geology and natural history, all the way to the discovery of genetics. We have also noted that there was considerable nuance to the various responses of Catholics in the nineteenth century to the theory of evolution. The pace of change in science and in other disciplines would only accelerate as the twentieth century dawned, provoking predictable responses. The numerous trends perceived by Rome as threatening to the established order were bundled into the term "modernism." These included Enlightenment secularism, a rationalist approach to biblical criticism, the replacement of Thomism with modern philosophical systems, and the historicizing view that the Catholic Church and its doctrines and practices can legitimately evolve over time. Pope Leo XIII had addressed the issue of critical biblical scholarship in *Providentissimus Deus* (1893), affirming the legitimacy of such an approach provided it was conducted in a spirit of faith. Pope Pius X launched a wider attack in his encyclical letter *Pascendi Dominici Gregis* (1907), lamenting that sacred studies (particularly in seminaries) were being neglected because the study of the natural sciences was so time consuming (Pius X, 1907:47). Meanwhile, judicious and balanced exegesis was being conducted quietly behind the scenes, as in Joseph Pohle's interpretation of the Genesis "days" of creation in light of expanding geological knowledge (Pohle, 1912: 117–123).

To early twentieth-century Catholics who were committed to Thomism—and the Thomist influence on seminary education can hardly be underestimated—Darwinian evolution seemed philosophically absurd, "deriving more perfect from the less perfect," being from nothing, an effect without a cause (Paul, 1979:62). H. Muckermann wrote in the *Catholic Encyclopedia* that an explanation of life "must ultimately be sought in a

creative act of God, who endowed matter with a force *sui generis* that directed the material energies toward the formation and development of the first organisms" (Muckerman, 1907). And to demonstrate the fluidity of concepts in this discussion, William Hauber could on the one hand write approvingly of ornithologist Richard Goldschmidt's claim that it is consistent with the evidence to suppose that nature could produce "in one generation a full-fledged bird, ready for flight, and fit to survive in a hostile environment" (Hauber, 1942:162). On the other hand, he could note that "although St. Thomas had no reason to be an evolutionist, his theory of the tendency of matter to move toward greater and greater perfection in form was entirely compatible with biological evolution." Henry Woods firmly rejected the assumption that Augustine's doctrine of creation finds its logical conclusion in the theory of biological evolution (Woods, 1924:127–148), whereas Henry de Dorlodot agued that "the teaching of the fathers is very favorable to the theory of absolute natural evolution" (Dorlodot, 1922:169).

In the three quarters of a century of Roman Catholic deliberation about evolution before Teilhard's adoption of the theory, the focus of Catholic reaction was on two fronts: (1) the theoretical plausibility of the hypothesis and the extent of the supporting evidence—and here they mirrored to some extent the debate between scientists—and (2) the compatibility of the theory of descent with modification with the doctrine of creation in the Book of Genesis. Catholic thinkers spent relatively little time at this stage assessing the impact of evolution on doctrines such as theodicy, soteriology, Christology, or eschatology. This would be the ongoing task of theologians—Christian and otherwise—in the generations after the assimilation of the neo-Darwinian synthesis.

Zahm argued in his section on evolution and creationism for an admirable synthesis, of which no doubt Teilhard would be proud:

> Then too, it will be manifest, that although truth was on the side championed by Aristotle, Sts. Athanasius, Gregory of Nyssa Augustine and Thomas Aquinas, by Buffon, Geoffroy Saint-Hilaire, Lamarck, Spencer, Darwin, Huxley, Mivart and their compeers, nevertheless, the opponents of the evolutionary idea, the Fathers and Schoolmen who favored the doctrine of special creation, the Linnaeuses, the Cuviers and the Agassizs, who resolutely and consistently combated evolution to the last, were all along but helping on and corroborating what they were intent on weakening and destroying. (Zahm, 1978:398)

Half a century later, Teilhard de Chardin would say in *The Phenomenon of Man*, that "religion and science are the two conjugated faces or phases of the same act of complete knowledge—the only one that can embrace the past and future of evolution so as to contemplate, measure, and fulfill

them" (Teilhard, 283). Newman, Mivart, Zahm, and other early Catholic proponents of biological and human evolution would see as a logical extrapolation from their work Teilhard's claim that "[t]he human is not the static center of the world, as was thought for so long; but the axis and the arrow of evolution—which is much more beautiful" (Teilhard, 1975:7).