



THE AQUINAS REVIEW

VOL. 20, 2015
ISSN 1076-8319

THE AQUINAS REVIEW
OF
THOMAS AQUINAS COLLEGE

Vol. 20, 2015
ISSN 1076-8319

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The Aquinas Review is published annually by the Office of the Dean, Thomas Aquinas College, Santa Paula, California; Michael F. McLean, President; Brian T. Kelly, Dean. Unsolicited articles, reasoned criticisms of articles, and letters are welcome.

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Editor's Statement

RONALD P. MCARTHUR, the founding president of Thomas Aquinas College and the founding editor of this journal, died October 17, 2013 and, as we promised last year, this issue and the next of *The Aquinas Review* are dedicated to his memory. He was a man of great accomplishments in the academic world, but most fundamentally he was a man of faith. By that I do not mean that he was what we now call an optimist, a man who believed in himself or in the goodness of his fellow man; he would have considered such sentiments nonsense. Dr. McArthur was a man of The Faith, a man who believed that the all powerful, all knowing God became a man, Jesus Christ, that He founded His Church upon the Rock, Peter, and that this Church even now teaches the whole truth about God and man, a truth revealed by the God who can neither deceive nor be deceived.

That faith informed the two events that marked the turning points in Dr. McArthur's intellectual life. He was born in 1924 and raised in the San Francisco Bay area. After little more than a year in the Army towards the end of World War II, he enrolled at a local Catholic college, St. Mary's College in Moraga, California, planning to become a lawyer. But there he read Plato's *Apology* and for the first time realized that there was more to the life of the mind than practical training. "It changed my mind," he later said. "I saw then that ideas were important."

But an even greater revolution occurred in his thinking when he met the great Thomist, Professor Charles DeKoninck, during the latter's visit to St. Mary's in 1947. In an interview given in 2007, Dr. McArthur said, "When I saw DeKoninck, I was amazed. I heard him giving a lecture on the fall of the angels according to St. Augustine, and I said to myself, 'Does he know that? Does he actually know what he is talking about?'"

It sounded to me like he did know what he was talking about, and I thought that was just amazing. He was one of the greatest men I've seen in my life and he had one of the strongest intellects ... Those things had a terrific effect on me." And so, after graduation from St. Mary's, Dr. McArthur moved to Quebec in order to study with DeKoninck at Laval University.

At Laval, Dr. McArthur immersed himself in the study of St. Thomas Aquinas and Aristotle, not merely because he was attracted by their intellectual achievements, great as those were, but because their thought had been so strongly commended by the Church. Again, although his encounter with DeKoninck moved him to bring his intellectual powers to bear on his faith, faith always came first. As he often said to his students, "We can be surer that Christ is God than that two and two is four." For Dr. McArthur faith was the measure of reason, not *vice versa*.

And so it is fitting that the relation between faith and reason, and the primacy of faith, should be the theme of the first two articles in the present issue of this journal. The first article, "Intellectual Custom and the Study of St. Thomas," an adaptation of a lecture Dr. McArthur delivered many times throughout his years teaching at Thomas Aquinas College, argues that the Church is an indispensable guide for the intellectual life of man. The next, "Faith Seeking Understanding," by fellow founding tutor Dr. Jack Neumayr, explores in more detail the roles that faith and reason play in the science of Sacred Theology. Mr. Peter DeLuca, also a founding tutor, then looks at the relation between learning and political life in "Liberal Education and Citizenship." The final two articles are by longtime colleagues of Dr. McArthur. Dr. Thomas Kaiser asks, "Is DNA the Soul?" while Dr. Ronald Richard examines an aspect of the relationship between modern science and Aristotelian natural philosophy in "Aristotle and Galileo Reconciled."

Our next issue will feature Dr. McArthur's article, "The Natural Law: A Perennial Problem," as well as articles by two of his former students, Dr. John Francis Nieto and Dr. Glen Coughlin. The Editor's Statement will look at Dr. McArthur's role in the founding of Thomas Aquinas College and *The Aquinas Review*.

Anthony Andres
Editor

Preface

At Thomas Aquinas College we often say that the education we provide is only a beginning. For the most part, our students are reading the important works in our program for the first time, and the class discussion, while certainly helping them to better understand the principal arguments and themes in the readings and to acquire the intellectual virtues, only introduces them to the profoundest truths and deepest questions that have engaged mankind for centuries.

Accordingly, it is fitting that the College publish *The Aquinas Review* to honor its patron and to provide a forum for a deeper consideration of those matters which constitute its curriculum and are central to genuine Catholic liberal education. Consistent with the nature of the College itself, this review is marked by fidelity to the *Magisterium* of the Catholic Church and a respect for the great tradition of liberal learning which is our common heritage.

The essays in *The Aquinas Review* reflect positions taken by their authors and not necessarily by the College itself. The editor – in collaboration with the editorial board – determines the contents of each issue. Any interested person may submit an essay for consideration or letters or comments on articles already published.

It is our hope that *The Aquinas Review* will be a source of wisdom to its readers and contributors.

Michael McLean
President, Thomas Aquinas College

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**INTELLECTUAL CUSTOM AND THE
STUDY OF ST. THOMAS**

Ronald P. McArthur

The *Dialogues* of Plato contain so much about so many things that our difficulties mount when we try to find with exactitude the whole intent of any one of them. Many of them show, however, and some in a manner which forces itself upon us, the importance of appetite in what looks at first to be the sphere of disinterested intelligence. Callicles, Gorgias and Protagoras, to take but a few prominent examples, show us that desire can play such a large role in the intellectual life that it is hard to disentangle the desire that reality be as we want it to be from what we can hold with evidence about that same reality. Socrates may be ironic, or simply playful, when he says, after a lifetime of intellectual activity, that he knows nothing. His statement nevertheless suggests a salutary truth: wisdom is so very difficult to achieve that only a very few are, finally, wise. While we may rejoice as Socrates dismantles the arguments of some of his opponents, and be delighted as they are forced to take ridiculous positions in upholding their initial assertions, that rejoicing should be

Ronald P. McArthur (1924–2013) was a graduate of St. Mary's College of California (1949) and received his Ph.D. from University Laval (1952). He was the founding president of Thomas Aquinas College (1971–1991) and the founding editor of *The Aquinas Review*.

momentary. Who among us would, upon reflection, see himself as so freed from the constraints of his own desires, that he is able to see with perfect equanimity the reality about which he holds so many opinions?

There are many reasons which explain why wisdom seems to be reserved for the few, and we all know some of the most obvious; there are a relatively few who have the opportunity to give themselves to the life of study; few who study with persevering effort the very difficult subjects they should learn; few who pray with constancy for Divine help; few who attain the moral purity so conducive to the life of wisdom – that life which Aristotle without Revelation thought more divine than human. There is, however, another reason. It is usually overlooked because we tend to minimize its importance. It is this reason I wish now to bring to your attention.

I

St. Thomas (*Summa Theologiae* Ia IIae, Q. 58, a. 1) distinguishes two meanings of the Latin word *Mos*:

Sometimes it means custom, in which sense we read (Acts 15:1): *Except you be circumcised after the manner (morem) of Moses, you cannot be saved.* Sometimes it means a natural or quasi-natural inclination to do some particular action, in which sense the word is applied to dumb animals. Thus we read (2 Macc. 1:2) that *rushing violently upon the enemy, in the manner of lions (Leonum more), they slew them:* and the word is used in the same sense (Ps. 67:7) when we read: *Who makes man in one manner (moris) to dwell in a house.*

When we use the word *mores* in English we mean, as the dictionary (The Concise Oxford) says, “Customs or conventions regarded as essential to or characteristic of a community.” And

the dictionary then informs us that the word is the plural of the Latin word *mos*, custom. So far, St. Thomas and the English dictionary agree, but the second meaning of the word, found as well in the Latin dictionary, is worth our attention. While *mos*, as custom, may be best known to us, St. Thomas yet shows us the connection of the *two* meanings by showing how the *second* meaning, “a natural or quasi-natural inclination to do some particular action ...” is closely connected to the first. For, as St. Thomas says, “... the other meaning of *mos*, i.e. *custom*, is akin to [a natural or quasi-natural inclination], because custom becomes a second nature, and produces an inclination similar to a natural one.”

Our habits, whether good or evil, become like nature; they are “quasi-natural inclinations.” Custom, in its turn, plays its role in engendering those inclinations. It is because of the importance of custom that Plato would educate the young by accustoming them to only the right music, art and literature. It is because of the crucial role our habits play that Aristotle claims that only those who are well brought up, and whose acquired inclinations tend towards the good, can study ethics with any profit.

It is relatively easy to see the role of custom in the moral life. Our manner of acting, as adults, and the general culture which surrounds us, have an almost decisive influence on the young, and incorporate them into a way of life. The family is a clear case; its absence even clearer. The same, however, is true in the more restricted life we call intellectual. And if we ask what custom does in this case we can answer: It presents to the intellect, by means of various doctrines and opinions, certain ways of thinking about things, and by so doing proportions the intellect to those very things. There are an infinity of examples, but let a few suffice for our purpose: 1) We are accustomed to the view that all social life should be understood in terms of *rights*, and

hence this is the way we think about politics or society, almost to the exclusion of anything else; 2) we are likewise accustomed to calling the things we desire our *values*, and so, again, our political thought is laced together with talk about values; 3) almost all college students are moral relativists, a view they pick up in their culture; 4) almost all incoming college Freshmen will tell you that lines are made up of points, a commonplace they have received from their teachers.

By constantly hearing something said over and over, the intelligence tends to accept it as true, whether or not it *is* true, and the will inclines towards what it hears. Custom, generally, leads us to judge by what we are used to hearing, are in the *habit* of hearing. This, again, is true not only in practical matters, *but as well in the life of the intellect when it considers things speculatively.*

Aristotle gives eloquent witness (*Metaphysics* II, c. 3):

The way we receive a lecture depends on our custom; for we expect a lecturer to use the language we are accustomed to, and any other language appears not agreeable but rather unknown and strange because we are not accustomed to it; for the customary is more known. The power of custom is clearly seen in the laws, in which the mythical and childish beliefs prevail over our knowledge of them, because of custom. Some people do not accept statements unless they are expressed mathematically; others unless they are expressed by way of examples; and there are some who demand that a poet be quoted as witness. Again, some demand accuracy in everything, while others are annoyed by it, either because they are not able to follow connections or because they regard it as petty.

Maimonides, in *The Guide of the Perplexed* (I, 51), gives his own witness to the close tie between custom and habit:

Man has in his nature a love of, and an inclination for,

that to which he is habituated. Thus you can see that the people of the desert – notwithstanding the disorderliness of their life, the lack of pleasures, and the scarcity of food – dislike the towns, do not hanker after their pleasures, and prefer the bad circumstances to which they are accustomed to good ones to which they are not accustomed. Their souls accordingly would find no repose in living in palaces, in wearing silk clothes, and in the enjoyment of baths, ointments, and perfumes. In a similar way, man has love for, and the wish to defend, opinions to which he is habituated and in which he has been brought up and has a feeling of repulsion for opinions other than those. For this reason also man is blind to the apprehension of the true realities and inclines toward the things to which he is habituated.

Montaigne, in his essay on custom (I, 23), reaffirms the same power of custom and the intellectual habits it inculcates:

... the principal effect of the power of custom is to seize and ensnare us in such a way that it is hardly within our power to get ourselves back out of its grip and return into ourselves to reflect and reason about its ordinances. In truth, because we drink them with our milk from birth, and because the face of the world presents itself in this aspect to our first view, it seems that we are born on condition of following this course. And the common notions that we find in credit around us and infused into our soul by our father's seed, these seem to be the universal and natural ones. Whence it comes to pass that what is off the hinges of custom people believe to be off the hinges of reason.

St. Augustine, with his own account of his meeting and acquaintance with St. Ambrose, gives us a luminous example of the role of custom in the life of the intelligence. Trained in

Rhetoric and a teacher of it, and, by the time he came to Milan, skeptical because of his disappointment with the Manicheans, Augustine heard Ambrose preach. Here is his account:

I attended carefully when he preached to the people, not with the right intention, *but only to judge whether his eloquence was equal to his fame or whether it flowed higher or lower than had been told me*. His words I listened to with the greatest care: his matter I held quite unworthy of attention. I enjoyed the *charm* of his speaking, though for all his learning it was not as *pleasing or captivating* as that of Faustus ... Thus I did not take great heed to learn what he was saying *but only to hear how he said it ...* (*Confessions* V, cc. 14-15; emphases mine)

Even in the case of a singularly endowed mind, and the mind of one who, for all his sins and corruptions, had by his own assessment diligently sought the truth, there was no escaping the power of the custom which had formed his intellect, a rhetorical formation which is evident in all his writings. Hence he was concerned not so much with the truth in hearing St. Ambrose, but with the *mode* of expression, and that according to his own predilections.

Long before his acquaintance with St. Ambrose however, Augustine, as he so recognized, had already been influenced by custom. He tells us that Cicero's *Hortensius*, which contained an exhortation to philosophy, had changed the direction of his mind.

The book excited and inflamed me; in my ardor the only thing I found lacking was that the name of Christ was not there. *For with my mother's milk my infant heart had drunk in, and still held deep down in it, that name according to Your mercy, O Lord, the name of Your Son, my Savior, and whatever lacked that name, no matter how*

Ronald P. McArthur

learned and excellently written, could not win me wholly.
(*Confessions* III, c. 4; emphases mine)

When, however, he started to study the Scriptures, "... they seemed to me," he says, "unworthy to be compared with the majesty of Cicero," an author who wrote in the style to which he was accustomed (*Confessions* III, c. 5).

The proper words to describe our assent or dissent in relation to a given intellectual discourse will most likely be "I like what I hear, it is what I'm used to hearing," and "I do not like what I hear, I'm not used to hearing it." Such is the case when we base our acceptance or rejection not upon evidence and the ability to consider reasonably what we hear, but upon our appetite, which moves us to respond as we do.

We can, I think, clarify and give substance to the role of appetite in the intellectual life if we pay attention to some distinctions we learn from St. Thomas. He teaches us (*Summa Theologiae* Ia, Q. 82, a. 4) that the intellect moves the will in the species of final cause – nothing is desired unless it is presented by the intellect and seems good – while the will moves the intellect in the species of agent cause, for the will is the moving cause of all the powers of the soul except the vegetative.

This latter dependency, of the intellect upon the will, applied more properly to the speculative intellect, leads, as St. Thomas shows, to a further distinction (*De Virtutibus in Communi*, a. 7). There is a twofold dependence of the activity of the speculative intellect upon the will. Thinking is, first of all, natural, and seems good to the will; and so the intellect thinks, and in thinking can sometimes come to *know*. In this case the *thinking* depends upon the will, but not the knowledge, for it comes from the evidence of the object; it is the object which determines the intellect once thinking to think as it does.

There is another case, however, when the intellect presents

an object which, without evidence, seems good to hold. Here, not only does the thinking itself depend upon the will, but *what* the intellect thinks as well. The determination of the intellect to its object comes in this case from the will itself.

We can make, again with St. Thomas, some further clarifications (*De Veritate*, Q. 14, a. 1). Our intellect is in potency to all intelligible forms, as is prime matter to all sensible forms. It is not in the beginning more determined one way than another. Anything which is indeterminate in this way is *brought* to a determination. The possible intellect must therefore be moved, and it will be so moved, granted the first movement of thinking, either by the object it thinks about or by the will. When, faced with an object, it is not more disposed to accept one part of a contradiction rather than another, the intellect will be in a state of *doubt*. When it adheres more to one part of a contradiction than to another, with fear that the other might be true, there will be *opinion*. When the intellect is determined to one part of a contradiction without fear that the other might be true, there will be *understanding*, through immediate evidence, or *science*, if of a conclusion depending finally upon immediate evidence.

When, however, the will moves the intellect to accept something determinately, not because it apprehends it as knower, but solely because it seems good, there will be *faith*.

In this situation [says St. Thomas] our understanding is determined by the will, which chooses to assent to one side [of a contradiction] definitely and precisely because of something which is enough to move the will, though not enough to convince the understanding – namely, since it seems good or fitting to assent to this side. And this is the state of one who believes what another says because it seems fitting or useful to do so. (*De Veritate*, Q. 14, a. 1)

The object of faith is not manifest, and the will does not add to the object as *true*. The intellect adheres to the object because it seems good to the will. The intellect in this case is held captive by the will.

When the intellect is moved by the will to posit an act of human faith it is never certain of attaining the truth. All the intellect has are signs, which are many times precarious. Such signs in the intellectual life are a) the reputation of a teacher, b) when what he says is a reaffirmation of what one has heard before, c) when what he says fits with an antecedent disposition.

We cannot avoid the role of human faith in the intellectual life because when we begin to think, the intellect is not capable of judging what is proposed. We are, as it were, *born* into the intellectual life, and before the intellect can reasonably assent to anything, it has heard all sorts of opinions and untethered statements, and it is moved to judge according to what it has heard before, rejecting what seems strange to it. The will, to repeat, moves the intellect to represent to itself as a good (for the *truth* is a good) that which it has heard in its *milieu*. This is a determination of the intellect before the intellect poses a genuine act of knowledge. The intellect is determined by the fluctuations of the milieu in which it has participated; they impose a determination with which the intellect comes into the intellectual life.

There is then an *Intellectual Mos*, in both senses of the word with which we began: *A natural or quasi-natural inclination of the intellect*, of which the will is the principle, in dependence upon the time and *custom* within which it exists.

II

Man, by nature a social and political animal, is not meant to live alone. He needs others, *whom he uses as if they were himself*. This is easily seen in any society, where among other

dependencies, he takes, because of his ignorance, what others say *as if what is said were known to him*. Without a trust in the words of others, human society would be impossible, and it is for this reason that Cicero teaches that truthfulness is a part of justice (*De Officiis* I, 7), a doctrine with which St. Thomas agrees (*Summa Theologiae* IIa IIae, Q. 109, a. 3). There are good customs; without them we would be “the worst of animals.” There are also bad customs, and we would rid ourselves of them if we could; the only way, however, would be by substitution, for it is impossible to live without some custom.

Because the human intellect is weak, and because the pure life of intelligence is, properly, a divine life, there is a necessity of first believing before we *can* acquire knowledge or even good opinion. St. Thomas gives witness by reflecting upon the order of disciplines in relation to our order of knowing. While *Metaphysics* is the highest natural wisdom, which considers being as being and the first principle of being, and while it confirms and defends the other disciplines, it is yet learned last. Along the way, however, the learner will accept on faith that the order of learning and the things he learns will lead, finally, to the apprehension of God as the first principle of all reality. He will also believe some truths from outside the first disciplines he learns, which only later will he understand. He will not be able to defend even the first principles of the disciplines he learns until he studies *Metaphysics*, which defends itself and all the other disciplines.

The unwillingness to submit to intellectual masters condemns the intellect to wander aimlessly and without profit, a wandering which seems nevertheless to bespeak an autonomy freed from the slavery of a mindless repetition of old and irrelevant doctrines hardened into dogmas. The autonomy is an illusion. Gilson has well shown, for example, how Descartes, in attempting to re-think the whole philosophical enterprise,

to free himself from every influence, yet uses scholastic terms and expressions, even though transformed, which he no doubt received from his Catholic teachers. When, therefore, Rousseau, in his *Discourse on the Sciences and Arts*, admits finally that some few thinkers might be necessary for the well-being of mankind, he yet restricts severely their number to those “Whom nature destined to be her disciples”, who “need[ed] no teachers”:

Verulam [Bacon], Descartes, Newton, these preceptors of the human race had none themselves; indeed, what guides would have led them as far as their vast genius carried them? Ordinary teachers would only have restricted their understanding by confining it within the narrow capacity of their own. The first obstacles taught them to exert themselves, and they did their utmost to traverse the immense space they covered. If a few men must be allowed to devote themselves to the study of the sciences and arts, it must be only those who feel the strength to walk alone in their footsteps and go beyond them.

While there might be some truth in Rousseau’s position, it is fair to note that Euclid’s *Elements* played an immense role in Newton’s *Principia* and Descartes’s *Geometrie*, and that Bacon would have been hard pressed to write about his idols without the benefit of previous thinkers, or to determine clearly his method without comparing it to a version of the Aristotelian tradition he hoped to displace. And all were probably taught to read and write, and thought and wrote using the customary grammar of their languages. No one escapes the effect of intellectual custom, no matter how far he extends the province of learning, or how much he opposes his predecessors. (This is the inescapable truth which leads some to the conclusion that no doctrine can even be understood without knowing the times in which it is written, itself a doctrine which makes liberal education impossible.)

“We stand,” says St. Bernard, “on the shoulders of giants,” whose doctrines were no doubt understood only after having been believed to be worthy of a most serious attention.

St. Augustine saw clearly the universal importance of custom in the intellectual life. He teaches that there is a natural order of learning. He asks, in *De Moribus Ecclesiae* (c. 2), where, in his argument with the Manichees, he should begin:

Where, then, shall I begin? With authority, or with reasoning? *In the order of nature*, when we learn anything, authority precedes reasoning. For a reason may seem weak, when, after it is given, it requires authority to confirm it. But because the minds of men are obscured by familiarity with darkness, which covers them in the night of sins and evil habits, and cannot perceive in a way suitable to the clearness and purity of reason, there is a most wholesome provision for bringing the dazzled eye into the light of truth under the congenial shade of authority. But since we have to do with people who are perverse in all their thoughts and words and actions, and who insist on nothing more than a beginning with argument, I will, *as a concession to them*, take what I think the wrong method in discussion. (Emphases mine)

Augustine uses this same doctrine in his sermons and letters:

If you cannot understand, believe in order that you may understand. (*Sermo CXVIII*)

What soul hungering for eternity and shocked by the shortness of this present life would resist the splendor and the majesty of the authority of God? (*Epistola CXXXVII*)

While Augustine is in his sermons and epistles speaking about the supernatural truth and God's own authority, what he says about the beginning of intellectual assent is true, as he says, about the whole life of the intellect, especially in the case of fallen man.

Newman is further witness. He says:

I have no intention at all of denying that truth is the real object of our reason, and that, if it does not attain the truth, either the premise or the process is in fault; but I am not speaking of right reason, but reason as it acts in fact and concretely in fallen man and that its tendency is towards a simple unbelief in matters of religion. (*Apologia*, c.5)

He also speaks of the efforts "to withstand and baffle the fierce energy of passion and the all-corroding, all-dissolving skepticism of the intellect in religious inquiries."

If the intellectual custom which surrounds us is good, the intellect has a chance to become directed towards the truth, a chance to lead a properly intellectual life. If however the custom is bad, the intellect will be misdirected from the beginning, and its chance of following the right path is close to non-existent.

As in all things human, much of intellectual custom is not helpful, and some of it destructive. Here is a statement by Eric Voeglin in *The New Science of Politics* which, written years ago, gives us a sense of the custom which surrounds us:

We live in the world of the dialogue, where the recognition of the structure of reality, the cultivation of the virtues of *sophia* and *prudentia*, the discipline of the intellect and the development of theoretical culture and the life of spirit are stigmatized in public as reactionary, while disregard for the structure of reality, ignorance of facts, fallacious misconstruction and falsification of history,

irresponsible opining on the basis of sincere conviction, philosophical illiteracy, spiritual dullness, and agnostic sophistication are considered the virtues of man, and their possession opens the road to public success.

Since custom induces a second nature, the case of the corrupted intellect is all but hopeless. The intellect, once directed against the truth, can, by natural means, hardly ever be salvaged. This need not be because of a closed mind, or bad morals, though they play their part, but because of custom itself, which incapacitates the intellect for the arduous task of pursuing wisdom. All this, the result of our fallen nature, makes a great part of the intellectual life for most of us a matter of appetite. Socrates is surely our friend when he so instructs us in the *Dialogues*.

Since we cannot escape intellectual custom, and since most intellectual customs are at the very least deficient, we are indeed in a precarious position with regard to the intellectual life, and there seems to be no way through our difficulties. (The attempt to doubt everything, so fashionable in our times, is no solution, for then the intellectual life could never begin.)

III

St. Paul admonishes Timothy, a Bishop he himself had consecrated, to “preach the word, be urgent in season and out of season, convince, rebuke, and exhort, be unfailing in patience and in teaching” (II Timothy, 4:2). He admonishes Titus, another Bishop, that the Bishop “... must hold firm to the sure word as taught, so that he may be able to give instruction to those who contradict it” (Titus, 1:9). It is most important, in every case, as St. Paul charges Timothy, to “guard the truth that has been entrusted to you by the Holy Spirit who dwells within us” (II Timothy, 1:14).

The Church has, as part of its mission, the duty to teach,

explain, conserve and defend the Revelation which has been entrusted to it in Scripture and Tradition. Because we to whom that Revelation is offered could never arrive, by reason alone, at the most important truths it teaches, because it is supereminently truthful, and because it does not attempt to defend its truths, it should not be surprising that the content of Divine teaching has been so often the subject of dispute, and that it has been obscured, distorted, and even denied by those who claim to believe it. It must be clarified, "in season and out of season," if it is to be conserved, and the errors which would destroy it must from time to time be exposed and anathematized. So difficult is it to understand *what exactly* God is teaching through His Revelation, so prone is the human intellect to fashion fables in the place of it, so easy is it to misunderstand with the best of faith, and so contrary to it are the customs of the world, that St. Augustine was prompted to say that heresies are good for the Church because they lead to fruitful clarifications, without which the teachings of the faith would most probably become more vague with the passage of time.

The Church teaches us in many ways – through Councils, Definitions, Encyclicals, Apostolic Exhortations and so on. More to our point, her doctrine is further clarified, developed and defended by Sacred Theology. Since, however, theology is the work of human reason, even though illumined by faith, and is as such fallible, the Church, in fulfilling her mission, judges theological doctrines, and guides us here as elsewhere. This very guidance is, in fact, based, as are all the prerogatives of the magisterium, upon the promises of Christ that the Church would never fail in proclaiming the truth, and in helping us to adhere to it.

In so judging theological doctrines, the Church establishes an intellectual custom which is opposed to the fluctuations, weaknesses and perversities of human custom; it is based

upon God's word and the inspiration of the Holy Spirit, and it can never deceive.

In following the teaching of the Church here as elsewhere we are more certain of being in the path of truth than we are of any purely human truth we can ever hold. Remember, in this connection, that what we hold by human faith is less certain than opinion or science, and unsatisfactory so far as the intellect is concerned. It is greatly different with supernatural faith. Though the intellect, as such, is not satisfied even when we hold something by Divine faith, we are, because we rest on God's own intellect, and because we are moved by Him to accept His teaching, more certain here than we are in holding anything by reason alone.

What then, does the Church, to whom He has entrusted His concerns for us, teach concerning theological doctrines?

1. Pope John XXII, speaking about St. Thomas, said before his canonization that "his life was saintly and his doctrine could only be miraculous ... because he enlightened the church more than all the other doctors. By the use of his works a man could profit more in one year than if he studies the doctrine of others for his whole life."

2. St. Pius V declared him a Doctor of the Church, saying he was "the most brilliant light of the Church," whose works are "the most certain rule of Christian doctrine by which he enlightened the Apostolic Church in answering conclusively numberless errors ... which illumination has often been evident in the past and recently stood forth prominently in the decrees of the Council of Trent."

3. Benedict XIII wrote to the Order of Preachers that they should "pursue with energy your Doctor's works, more brilliant than the sun and written without the shadow of error. These works made the Church illustrious with wonderful erudition, since they march ahead and proceed with unimpeded step,

protecting and vindicating by the surest rule of Christian doctrine, the truth of our holy religion.”

4. Leo XIII stated that “this is the greatest glory of Thomas, altogether his own and shared with no other Catholic Doctor, that the Fathers of Trent, in order to proceed in an orderly fashion during the conclave, desired to have opened upon the altar together with the Scriptures and the decrees of the Supreme Pontiffs, the *Summa* of St. Thomas Aquinas whence they could draw counsel, reasons and answers.”

Again from Leo XIII: “This point is vital, that Bishops expend every effort to see that young men destined to be the hope of the Church should be imbued with the holy and heavenly doctrine of the Angelic Doctor. In those places where young men have devoted themselves to the patronage and doctrine of St. Thomas, true wisdom will flourish, drawn as it is from solid principles and explained by reason in an orderly fashion ... Theology proceeding correctly and well according to the plan and method of Aquinas is in accordance with our command. Every day We become more clearly aware how powerfully Sacred Doctrine taught by its master and patron, Thomas, affords the greatest possible utility for both clergy and laity.”

5. St. Pius X said that the chief of Leo’s achievements is his restoration of the doctrine of St. Thomas. For he “restored the Angelic Doctor ... as the leader and master of theology, whose divine genius fashioned weapons marvelously suited to protect the truth and destroy the many errors of the times. Indeed those principles of wisdom, useful for all time, which the holy Doctors passed on to us, have been organized by no one more aptly than by Thomas, and no one has explained them more clearly.” Indeed, Pius said, those who depart from the teaching of St. Thomas “seem to effect ultimately their withdrawal from the Church ... As we have said, one may not desert Aquinas, especially in philosophy and theology, without great harm; following

him is the safest way to the knowledge of divine things ... If the doctrine of any other author or saint has ever been approved at any time by us or our predecessors with singular commendation joined with an invitation and order to propagate and to defend it, it may be easily understood that it was commended only insofar as it agreed with the principles of Aquinas or was in no way opposed to them." Theology professors "should also take particular care that their students develop a deep affection for the *Summa* ... In this way and no other will theology be restored to its pristine dignity, and the proper order and value will be restored to all sacred studies, and the province of the intellect and reason flower again in a second spring."

6. Benedict XV stated that "the eminent commendations of Thomas Aquinas by the Holy See no longer permit a Catholic to doubt that he was divinely raised up that the Church might have a master whose doctrine should be followed in a special way at all times."

7. Pius XI said that "indeed, We so approve of the tributes paid to his almost divine brilliance that we believe Thomas should be called not only Angelic but Common or Universal Doctor of the Church. As innumerable documents of every kind attest, the Church has adopted his doctrine for her own ... It is no wonder that the Church has made this light her own and has adorned herself with it, and has illustrated her immortal doctrine with it ... It is no wonder that all the popes have vied with one another in exalting him, proposing him, inculcating him, as a model, master, doctor, patron and protector of all schools ... Just as it was said of old to the Egyptians in time of famine: 'Go to Joseph' so that they should receive a supply of corn to nourish their bodies, so to those who are now in quest of truth We now say: 'Go to Thomas' that they may ask from him the food of solid doctrine of which he has an abundance to nourish their souls unto eternal life."

Since Sacred Theology uses philosophy as a handmaid, the Church's duty does not end with a judgment upon Theology alone, but extends to philosophy as well.

1. Pius XII said that "... the Angelic Doctor interpreted [Aristotle] in a uniquely brilliant manner. He made that philosophy Christian when he purged it of the errors into which a pagan writer would easily fall; he used those very errors in his exposition and vindication of Catholic truth. Among the important advances which the Church owes to the great Aquinas this certainly should be included that so nicely did he harmonize Christian truth with the enduring peripatetic philosophy that he made Aristotle cease to be an adversary and become, instead, a militant supporter for Christ ... Therefore, those who wish to be true philosophers ... should take the principles and foundations of their doctrine from Thomas Aquinas. To follow his leadership is praiseworthy: on the contrary, to depart foolishly and rashly from the wisdom of the Angelic Doctor is something far from Our mind and fraught with peril ... For those who apply themselves to the teaching and study of Theology and Philosophy should consider it their capital duty, having set aside the findings of a fruitless philosophy, to follow St. Thomas Aquinas and to cherish him as their master and their leader."

2. St. Pius X said that "all who teach philosophy in Catholic schools throughout the world should take care never to depart from the path and method of Aquinas, and to insist upon that procedure more vigorously every day ... We warn teachers to keep this religiously in mind, especially in metaphysics, that to disregard Aquinas cannot be done without suffering great harm."

3. Benedict XV said that "along with our predecessors We are equally persuaded that the only philosophy worth our efforts is that which is according to Christ. Therefore the study of philosophy according to the principles and system of Aquinas must certainly be encouraged so that the explanation and invincible

defense of divinely revealed truth may be as full as human reason can make it.”

These are but a few of the testimonies of the Popes throughout the centuries after the death of St. Thomas, and I could have added the testimony of John Paul II, but that would have entailed repeating almost wholly two separate addresses, one on the Philosophy of Thomas Aquinas to the Angelicum University, the other to the Eighth International Thomistic Congress, wherein the Holy Father repeats for the most part the commendations of his predecessors concerning the doctrine, principles and method of St. Thomas, and emphasizes the importance of adhering to him today for the facing of modern problems both theological and philosophical.

IV

It is, of course, decisive for us to believe, to rest with confidence that we can never be deceived by the teaching Church. Since, however, the supernatural life is based upon the natural, and is never in opposition to it, since grace perfects nature, it would be strange if, believing and practicing our faith, we did not in the course of our lives experience in some sense a ring of truth the more we conform to the norms of the Magisterium. It would be strange, for instance, if, living according to the sexual morality of the Gospel we did not experience, amidst all the attendant difficulties, a sense of joy, a peace of conscience and the inner freedom which results from self-control. The same is true in the intellectual life; it would be strange if, in following the Church's guidance, we did not experience a sense of accomplishment, a sense that we were progressing, a sense that we were, as we go on, more at one with the reality which is the object of our study.

Such is in fact the case with the study of St. Thomas.

To have found a master in the intellectual life is as precious as it is rare; to have been directed to one by the Church is as fortunate as it is precious.

Those who knew him report that St. Thomas himself “no sooner heard [St. Albert] expound every science with such wondrous depth of wisdom, than he rejoiced exceedingly at having quickly found that which he had come to seek, one who offered him so unsparingly the fulfillment of his heart’s desire.” It is said further that, in order to profit from this exceptional opportunity, he “began to be more than ever silent, more than ever assiduous in study and devout in prayer” (James A. Weisheipl, O.P., *Friar Thomas D’Aquino*).

St. Thomas himself gives us an insight into the importance of a good teacher. He shows that something may be in potency in two ways. Air, to take an example, is in potency to be consumed by fire passively; if fire is to spread, fire itself will be the principle agent, extrinsic to the air it consumes. On the other hand, a living thing is in potency to health actively; if there is to be health the living thing itself is the principle agent, and any extrinsic agents, such as the doctor, are secondary agents helping the principle agent achieve its end.

The intellect is in potency to science, and its potency is active. Just as a living thing, becoming sick, can become healthy by nature or by the help of secondary agents, so the intellect can learn through discovery or, most likely, with the help of a teacher. Where there is a teacher, the intellect of the learner is always the principle cause of learning; the teacher is never more than a secondary cause. Just as the doctor must follow the order of nature if he expects to heal, so the teacher must, says St. Thomas, follow the order the intellect would follow without him if it could. This means that the teacher must follow the order of discovery, the order which is natural to the intellect, if he is to teach. If he does not follow the order imposed by the object of study, he becomes

a cause of the corruption of the learner's mind, even though he says what is true.

This can be seen, says St. Thomas, by reflecting upon the means the human teacher must use as he teaches. Unlike God who can illumine the intellect from within, or an angel who can order the imagination from within, the human teacher uses words as signs, which are proposed to the learner from *without*. The order in the words of the teacher is a sign of the order of his concepts. The more orderly the words, the more orderly the concepts. The learner hears the words of the teacher, and they lead to images in his imagination; the more orderly are those words, the more orderly are the images; the more orderly the images the more orderly the concepts in his intellect, which are abstracted from the images.

So weak is the human intellect – unlike the body, which does not need the doctor for the most part – that, as St. Thomas says, *the words of the teacher are more proportioned to the intellect than things themselves*. Since we learn through the use of images, and words can bring about an ordering of those images, the great teacher, through the excellence of his words, orders well the images in our imagination, and through them our minds, with the result that we can be led to understand the realities signified by the words. *The more we apply ourselves to the words, and hence the concepts of the master, the more will we grasp reality*. And since, as learners, we are ignorant, and since truth is difficult to obtain, we must have faith enough in the teacher to stay with his words, through them to grasp his thought, and through that thought become one with the objects themselves. We can see from the very nature of teaching and learning that without faith learning becomes almost impossible; no faith, no light!

St. Thomas proves to be the master who, without peer, can order our minds, so that we ordinary mortals can in our limited way come to see some of the truths we first accepted from him

on faith, truths we would never have seen without that faith in the master.

It is then most important that here, as elsewhere, we obey the Church; if we do we shall experience some of what she teaches about St. Thomas, and we shall see for ourselves more about reality than ever we would had we studied without him.

V

Our Lord has not left us bereft of an intellectual custom. If we think according to it we will likely progress towards a greater and greater grasp of the truth, and we may if we persist become one of those relatively few who actually begin to live the intellectual life. If, on the other hand, we knowingly reject the guidance of the Church, we, Catholics, who have been graced with so many gifts, will be worse than those who have never been given them, and who wander about without ever finding the right path. If we refuse to accept St. Thomas as our master, knowing full well what the Church has constantly taught concerning him, that rejection will most likely throw us back upon the weak and fallible customs of our own milieu; it could then be said of us that “it would have been better for them never to have known the way of righteousness than after knowing it to turn back from the holy commandment delivered to them. It has happened to them according to the true Proverb, The dog turns back to his own vomit, and the sow is washed only to wallow in the mire” (2 Peter 2:21-22).

FAITH SEEKING UNDERSTANDING

John W. Neumayr

Prologue

“Wisdom sent her maids to invite to the tower” (Prov 9:3). “Wisdom” signifies the Divine Science and “her maids” is understood to be the human sciences which Sacred Doctrine calls from their merely temporal value to the higher service of supernatural knowledge. This same idea is captured in the notion that the Catholic intellectual tradition had its origin in Jerusalem and Athens. Jerusalem signals faith and Athens reason. St. Anselm spoke of this same coalition in the eleventh century as “faith seeking understanding.” From the start teaching, preaching, and schools of Christian formation existed, and the Doctors of the Church brought the human arts and sciences into Catholic theology. The universities of Oxford, Cambridge, Paris, Salamanca, and the like, had their origins as places of theological study gathering the arts and sciences as “handmaidens” to “Wisdom.” The fullness and proper order of studies reached its pinnacle in the *Summa Theologiae* of St. Thomas Aquinas.

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The following are a few reflections on this masterpiece of “faith seeking understanding.”

The Church and Divine Science

St. Augustine, in his tract *On Christian Doctrine*, remarks that the deeper study of the Faith begins with a careful reading of the Scriptures. An informed acquaintance with the word of God is a starting point for supernatural wisdom. But, as necessary as it is to be steeped in the Scriptures, such learning is not precisely where “faith seeking understanding” begins. To elevate this understanding to the level of science, more is required. Here, the Church comes into play. Without the Magisterium, founded upon the Apostles, Sacred Doctrine as a science would not come to be. As Aristotle observes in the *Physics*, “We think we know a thing when we know it in its principles, elements, and causes.” Such knowledge is necessary for science. Divine Science as well will involve its own principles, if we seek “understanding” of that which we hold in this life by “faith.”

The essential primacy of the Church and its relation to Scripture is brought out in the third article of the *Oath Against Modernism* issued by Pope Pius X. We read: “I believe with equally firm faith that the Church, the guardian and teacher of the revealed word, was *personally* instituted by the real and historical Christ when He lived among us, and that the Church was built upon Peter, Prince of the apostolic hierarchy, and his successors for the duration of time.” Several points stand out here. One is that the Church is the “guardian and teacher of the revealed word” and this will have a direct bearing on “faith seeking understanding,” which I mean to take up next. Another point, of passing interest, is that the Church is founded upon the living Christ and not on a Christ we merely read about – as would be the position of the *sola scriptura* argument. In fact the

Church existed and was thriving before the Gospels and Epistles were written and we can see this in Luke's remarks to Theophilus in Luke's Gospel.

Faith Seeking Understanding

St. Thomas will speak of Divine Wisdom as "the science of God and the blessed." This has its ambiguity. One might think St. Thomas is designating the subjects of this science. Indeed it is about God and all creation as it relates to Him; but that is not Thomas's meaning. He means rather that Divine Wisdom is the knowledge that God has of Himself and all else and in which the blessed in heaven share. The blessed are elevated above the light of human reason to participate in the Divine Light. "In Thy light we shall see light" says the Psalm. The natural theology we know in this life does not rise above the human mode of conceiving. In heaven where we are taken up into God's life, we will "know as we are known." Yet in this life through revelation we can participate in the Divine intelligence, but unlike the blessed we cannot, short of the experience of ecstasy, rise above the use of human concepts. Still we do not bring Divine Wisdom down to the level of natural theology. Recognizing that the mode in which we attain to this Wisdom remains merely human, St. Thomas will speak about our earthly participation in "the science of God and the blessed" as a subalternate version of God's supernatural wisdom.

St. Thomas explains what he means by a "subalternate science" illustrating it with the cases of the sciences of optics and music, pointing out how these sciences take their principles from the "higher sciences" of geometry for optics and arithmetic for music. Geometry and arithmetic, however, have as their principles that which can be known by the natural light of reason without deriving these principles from any higher science.

Sacred Doctrine, on the other hand, is “subalternate” because it proceeds from principles properly known only in “the science of God and the blessed.” And this supernatural wisdom is altogether beyond the “natural light of the intellect.” Unlike optics and music the “higher Divine Science” cannot at all be comprehended by man in this life – whereas the students of optics and music can in fact go to the “higher sciences,” geometry and arithmetic, and comprehend them in their ultimate principles. So it must be that the proper principles of Sacred Doctrine are known only by faith – and are in themselves beyond our comprehension. “We see now as in a mirror darkly,” but then (in beatitude) face to face with God. Since Sacred Doctrine belongs *per se* to God (and the blessed in their beatific vision), Sacred Doctrine is for us *per se* under the formality of “revealed” knowledge. It cannot be, no matter how hard we try to reduce it to our natural concepts, a mere natural science.

How, then, do we in this life come into possession of the principles borrowed from God’s own wisdom so as to share, even now, in “the science of God and the blessed”? It is the office of the Church to set out for us “the Articles of Faith,” and these Articles are the principles of Sacred Doctrine as we may attain it in this life.

The Old Law was a figure of the New Law, a prefiguration of the reality of Christ and His Church. The charism of the Apostles was to set out the teachings of Christ correctly and unerringly. This gift to the Apostles was unique to them as the original Magisterium – their successors, though guided by the Holy Spirit, do not fully enjoy this charism. These teachings, of course, are the Articles of Faith set out in the Creed. Not every Article is mentioned in the Creeds we recite, but rather the most central to the faith. The Articles, however, are the immediate principles of Sacred Doctrine, and thus stand as the formal beginning of “faith seeking understanding.”

We might note in the Creed that some of the Articles are actually knowable by reason. Even in the opening of the Apostles' Creed, when we say "I believe in God the Father almighty ..." we assent to the assertion that "God exists" and this is knowable, as St. Paul says, from the visible things around us. But in the full sentence we also assent to "the Father" who is a person in God distinct from the Son and Holy Spirit. This is to assent to a Trinity altogether beyond our comprehension. Clearly, we cannot believe in the Trinity unless we first believe in God's existence. Now some can see by reason the truth of God's existence, called a preamble to the Mysteries; yet it is only with time and effort. Most believers will hold the truth of the preambles along with the Mysteries by faith.

Faith, it should be emphasized, is not opinion, though like it. Both lack strict demonstrative reason. But faith, as St. Augustine speaks of it, is "thinking with assent." "Thinking" because no necessary demonstration has been attained yet, nonetheless, the believer "assents" to the divine truth through his will being moved to compose the subject and predicate in the Article by the gift of grace. Mere opinion, on the other hand, is thinking without assent because reason is still uneasy about the contradictory of the opinion.

When "faith seeking understanding" turns to the Articles, it is not primarily concerned with the meaning of the Articles. It is mainly for the Magisterium to spell out what is to be believed. The theologian is more concerned with an account of the truth of the Articles. With the preambles he is able to show by natural reason that, say, God exists, that He is almighty, infinite, omnipotent, and the like, so that reason cannot think otherwise. With the Mysteries, say, the Article that asserts God to be three persons in one divine nature, theology cannot prove this to reason, but it can argue from one Article of Faith, such as that in God there are processions, to the conclusion that distinct relations

exist in God, and these relations are divine persons. This, however, is not a strict demonstration to natural reason itself, but beginning with the Article of Faith regarding the processions in God, theology can rigorously infer the persons – yet the argument is certain only to faith. Though reason cannot demonstrate the Mysteries, it can show that no rationally compelling argument can be raised against what in reality is true. Such arguments are either only probable or sophistical.

Theology: Natural and Supernatural

The *Summa Theologiae* blends two ways of theology. One is seen in the light of human reason. We call it Natural Theology. Man's natural gift of reason, which can grasp the natures of the things of the world around us, can find the principles and definitions of these sensible things and can reason to their first efficient cause, God. This is, of course, not to see God face to face but only to infer the existence of God as the uncaused cause of the *visibilia*. The other theology, the Supernatural Divine Science, "the Science of God and the Blessed," is seen only through the eyes of faith. We come to know this higher theology through the light of God's revelation. In the sphere of natural knowledge the argument from authority is the weakest of arguments. To the contrary, in Sacred Doctrine, the testimony of divine authority is the strongest of arguments – even more certain for the believer than the strictest demonstration. Through God's grace, those who have "eyes to see and ears to hear" assent to the Articles of Faith as the principles of Sacred Doctrine. And, as noted, here is where "faith seeking understanding" begins.

The Articles of Faith, especially those of the Mysteries, are beyond the creature's comprehension, such that the believer's hold on the "knowledge of God and the Blessed" has need of Natural Theology. When the Church asserts that God is three

persons in one divine nature, the believer has no concept of God nor of divine persons nor of the divine nature as these are in themselves – as God and the blessed know them. Hence, the believer must turn to those natural concepts from which he reasons to the divine realities. Now in this life we know God through causality, eminence, and negation. That is, we know God as the cause of creation and as cause pre-eminent to His effects and, consequently, we must remove all limitation to form a concept suitable to the divine being. For this reason, all names we say of creatures and God are never said univocally, only analogically. The upshot is that Sacred Doctrine must turn to Natural Theology as an indispensable aid. The blend of the two theologies is, as it were, natural to Sacred Doctrine and “faith seeking understanding.”

For all the blending of the two theologies in Sacred Doctrine, the two are distinct, not only in their principles, but even in the order in the development of each. Natural Theology has its beginning in the *visibilia* and reaches God at the end of its *cursus*. Sacred Doctrine, to the contrary, begins with God and proceeds to the creation that flows from Him. This is the order of knowledge that belongs to “God and the blessed.” Thus, it is also the order that belongs to the subalternate science of Sacred Doctrine.

If Natural Theology is brought to the aid of Sacred Doctrine to help the understanding of the preambles, say the Article regarding God’s existence, and it proves to reason God must exist, that Article would cease to be held in faith because faith is *per se* of the unseen. It has been asked whether a believer who comes to see the demonstrative truth of the Article loses the merit of faith. Would such a believer now be subject to the rebuke of Doubting Thomas who refused to believe in the resurrection of Christ without proof? St. Thomas Aquinas, however, points out that St. Anselm, who believed God existed with the

strongest conviction, did not cease to believe but only sought to draw nearer to God in seeking the most compelling proof of God's existence. He would retain the merits of faith though faith itself would cease. This brings out a vital contrast between Anselm and Thomas the Apostle. Anselm's motive was a case of "faith seeking understanding" while the Apostle's case was that of understanding seeking faith. On top of that, Anselm would gain the merits of charity, which exceed the merits of faith. Left to itself, a rational proof would not be meritorious, but when used to elevate the heart and mind to God, it gains the merits of charity. The proper and proportional motive for Natural Theology is wonder. Philosophy begins with wonder, Aristotle says. Natural Theology is a part of metaphysics, which is the highest part of philosophy. Men's minds are naturally proportioned to a knowledge of sensible natures. Such knowledge is part of the perfection of man. To know supernatural essences is beyond our natural powers. Even with the grace of faith, the "living God" is beyond our knowing in His essence. Hence faith will cease with the knowledge of the "living God" face to face. So too, hope will give way to possession in beatitude. But charity will remain. Now we love the "living God" in desire. In heaven that same love becomes joy. In "faith seeking understanding" the motive is not wonder as if we can reach over "the knowledge of God and the blessed" here below, but a desire to draw ever nearer to our Creator, Lord and Savior. The motive of Sacred Doctrine is divine charity.

The Relation of Natural Theology to Sacred Doctrine

Harkening back to the first sentence in the Prologue of this article, we recall how "Wisdom sent her maids to invite to the tower" (Prov 9:3). "Wisdom," the queen of the sciences, is Sacred Doctrine, and she judges and uses the other sciences and

arts as “handmaidens.” Natural Theology is the queen’s most useful servant, but nonetheless a “handmaiden.”

The human arts and sciences come to the aid of Sacred Doctrine in various ways. Logic, the universal instrument of all thought, must be a “handmaiden” to Sacred Doctrine. Because Supernatural Theology is a subalternate science and in the human mode of thought, the theologian must employ the tools of reasoning: that is, definition, division, demonstration and all that goes into them for sound reasoning. But other sciences like Natural Theology enter into the reckonings of Sacred Doctrine. I will not attempt to spell out the “handmaidens” in this essay – except to remark later in the Epilogue how the makeup of modern liberal education has greatly obscured its usefulness for Sacred Wisdom.

Acquired and Mystical Theology

All theology is by way of the Spirit. This is so whether it be the way of Scriptural study or the ways of prayer, meditation, contemplation, mystical theology as we would find it in St. John of the Cross and St. Teresa of Avila or in the tracts of St. Athanasius, St. John Damascene, St. Augustine, St. Anselm, and the like. It reaches its highest form, perhaps, in the *Summa* of St. Thomas Aquinas for it takes on the way of sacred *science*. Of these several modes, the relations between the *Summa* and Scripture, and the comparison of the *Summa* and mystical theology deserve comment.

The Scriptures are thought to contain the whole of Sacred Doctrine – at least implicitly. But the Old Law relates to the New Law as prefiguration to the prefigured reality. The New fulfills the Old as our Lord said of Himself. Also, the whole of the Scriptures pertain to the Incarnation, according to St. Thomas Aquinas. The Old is explained in the New – and this by Christ

and His Church. “*Multifariam et multis modis olim Deus locutus patribus in prophetis, in novissimis his diebus locutus est nobis in Filio*” (Heb 1:1). The Articles of Faith are drawn immediately from the Church of Christ and His Apostles – the “Apostolic” Church. Go forth, Our Lord said to the Apostles, “teaching all that I have taught you” (*cf.* Mt 28:19). “I will go to the Father and He will send another Paraclete to remind you of all that I have said to you” (Jn 14:16). Our Lord spoke to the masses in parables which are metaphors. In this way the teaching in the parables bore a likeness to the Old Testament as a prefiguration of the New Testament and needed the New to fulfill it. The parables too needed to be unfolded, insofar as they, being in the form of metaphors, are merely “unlike likenesses” of the truth. Providence stirred the Apostles to regularly ask Christ to explain the parables in “open” language, that is, in proper or literal speech. Proper speech explains metaphorical speech and not *vice versa*. And, the Apostles were to be the first Magisterium of the Church whose office is to define and defend the revealed doctrine. It is one thing to teach in parables so that all who have “eyes to see” and “ears to hear” may be drawn to Christianity. It is another thing to state exactly what is taught and preserve it for all time against the “gates of Hell.”

If “faith seeking understanding” is finally a case of the lover seeking the divine, the beloved, and if the union comes through the truth that sets men free because our wills most freely choose the supreme good who is the living God, will not this union, even in this life, reach its greatest fulfillment in ecstasy? This is the experience that St. Paul speaks of having in his epistle (2 Cor 12:2) where he was taken up into the third heaven and saw what was unfit for man to see – that is, what is beyond any human power of knowing. He acknowledges that it was by a light beyond the light of reason for he was not even aware of whether he was in his body or not. The light of human reason,

called the agent intellect, *per se* makes use of phantasms which are taken from sense apprehensions and thus require a body. It was by the divine light that he saw God. Such is a pure gift from God; it cannot be acquired by any human effort no matter how greatly desired.

Sacred Doctrine, as in the *Summa Theologiae*, is on the other hand acquired by human effort. With the gift of faith, the believer can with time and effort come to “understand” the faith he was freely given and, having attained it in some measure, he can teach this understanding to others. If this is taught with the purest of motives, it is a spiritual work of mercy – “informing the ignorant.” The gift of ecstasy as such is purely personal and cannot be given by one man to another. St. John of the Cross and St. Teresa of Avila can speak to us about preparing the soul for this divine gift, but it remains altogether up to God to give or not to give. In the course of preparation for a mystical experience every impediment to reception of it is to be removed; and this would include even the concepts through which we would possess Sacred Doctrine. Does this put acquired theology at odds with the mystical?

John of the Cross and Teresa, in fact, had the greatest regard for St. Thomas Aquinas and the *Summa*. They saw that acquired theology could not only be shared with others, but also contribute to spiritual growth in a way that the mystical cannot. St. Teresa had for a spiritual director a Dominican priest named Bañez. He was a somewhat more worldly man than was the saintly John of the Cross, but a genuine master of Thomism. When St. Teresa was asked why she turned to Bañez for spiritual counsel rather than to her dear friend and associate, St. John of the Cross, she replied that “for a spiritual director it is better to go to a learned man than a holy one.” The reason being, it would seem, that he who knows the nature of the virtues and their properties is better able to point out the direction to perfection.

Conclusion

Reflecting back on the significance of *Apostolic* in the Creed, one can see that the Magisterium had the role in Sacred Doctrine similar to Euclid's role in Mathematics. Well before the *Elements* was composed, many mathematical demonstrations had been found. The first principles, however, were either absent or only imperfectly formulated, or the order of progress in the science was defective. In a similar way, the numerous tracts in Christian doctrine had been imperfectly ordered until the Doctors of the Church were able to resolve them back into the first principles of Divine Science: The Articles of Faith set forth fundamentally by the Apostolic Magisterium. In the *Summa Theologiae* of St. Thomas Aquinas, the quest of faith for understanding reaches its loftiest state. The parts of the science rooted in the Articles of Faith are drawn out in their most essential and proper order.

Epilogue

The focus in the above discussion was primarily on the *terminus ad quem* of "faith seeking understanding," that is, on Sacred Doctrine itself. But the *terminus a quo*, namely the "handmaidens," deserve mention. Before the Enlightenment, the universities of the West had an elaborated *ratio studiorum* – an orderly sequence of studies leading to Wisdom herself. St. Thomas spoke of these as the little streams to be followed leading to the great sea of Wisdom. In the modern era, this core of studies has come apart; theology herself is cast off and the arts and sciences have gone in their independent ways – little conscious of each other or of the whole. This appears to be the case even in liberal education. The humanities, those subjects that stress human values and express the spirit of man, have largely supplanted the classic liberal arts and sciences. With this

John W. Neumayr

fragmentation, it is near impossible to find a unified account of modern higher education. Likewise, an account of what a Catholic liberal education is, is hard to say. To say it is Catholic because its students are Catholic, or that it includes in its program the Bible or the great works of Catholic thinkers, would hardly be enough to give an organic unity to the program of studies. Some say there could be no such formal unity because many of its parts are not uniquely Catholic. There is no Catholic mathematics, or Catholic logic, or Catholic physics, and the like. Many of the parts of the traditional liberal curriculum originated in pagan times. We have Plato and Aristotle to thank for much of the core of classical learning, the program thought most suitable for the free man insofar as he is free. Is there then such a thing as Catholic higher education? Something beyond Catechesis? The mission statement of Thomas Aquinas College, however, is entitled “A Proposal for the Fulfillment of *Catholic* Liberal Education.”

This would call for another discussion.

LIBERAL EDUCATION AND CITIZENSHIP

Peter L. DeLuca III

Introduction

As you know, this first lecture of the year is devoted to some aspect of liberal education. I have decided to try tonight to address not a part of liberal education, but its end or purpose. I do realize that in doing this I will be going over well trodden ground. The freshmen have just been discussing essays on the subject by Fr. McGovern and Mr. Berquist. And President Dillon and the good Bishop spoke about this subject on Monday. So I ask you to bear with me if I go over ground with which you are already familiar in the hope that I can bring out some less familiar aspects of the subject.

Part I: Education for Freedom

The word “education” signifies preparation, by means of teaching, for some kind of activity or life, as when one prepares to be a doctor by acquiring knowledge of the medical art. From its name, then, liberal education will be the teaching of the free man or simply education for freedom. Indeed, in the history of

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civilization, liberal education has been the education of the free men of the state. It follows that a good answer to our opening question is that the end of liberal education is freedom. And that answer will not be wrong—but we will need to examine the notion of the free man if we are to make clear what kind of knowledge will make us free.

What knowledge is needed for freedom or for the life of a free man? Gorgias, in Plato's dialogue which bears his name, argues that the art he teaches, the art of rhetoric, will make his students free because it enables them to get whatever they want.¹ But when Socrates examines this art, it turns out to be not an art but a knack, a kind of flattery by means of which one can persuade people who don't know.

Finally Callicles, one of Gorgias' disciples, says that Gorgias, and all men, really believe that if a man is to be truly free, and not a slave, he must:

“... allow his desires to become as mighty as may be and never repress them. When his passions have come to full maturity, he must be able to serve them through his courage and intelligence and gratify every fleeting desire as it comes into his heart.”²

Socrates, on the other hand, argues that whenever we act, we do so for the good. So if we are wrong about what is truly good, we fail to get what we ultimately want and are therefore not free.³ No matter how persuasive a man may be, or how strong he is, he is helpless unless he knows what is truly good. And, of course, Our Lord says something similar; “you will know the truth, and the truth will make you free.”⁴

¹Plato, *Gorgias*, 452.

²Plato 492.

³Plato 468.

⁴John 8:32.

We need, then, a better understanding of the free man. Let us seek it through consideration of his opposite, the slave. The slave is described by Aristotle as “not his own but another’s man,”⁵ and as “a living possession.”⁶ He is compared to the domestic animal and said to be “a living tool.”⁷ The slave as such “has no part in happiness.” The free man then, in contrast to the slave, is the man who exists for his own sake, who is his own man. He is capable of happiness and seeks that as his greatest good. To be free, then, one must know what human happiness is and how to reach it. Education for freedom, then, must be education for happiness.

Part II: Happiness

But what is happiness and how do we achieve it? That is the question with which Aristotle is primarily concerned in the *Nicomachean Ethics* and in the *Politics*. In the first book of the *Ethics* he nominally defines happiness as “activity of soul according to perfect virtue.”⁸ Clearly, this is totally opposed to the view of Callicles, for whom happiness is the satisfaction of unbridled appetites for the pleasures of the table and the couch. Aristotle reaches this definition by first noticing that “happiness” is the word men use for the highest good achievable by action: the one to which all their actions are ordered. But, as we see from the words of our friend Callicles, men disagree about what that good is.

Aristotle says then that, for all things which have a function or an activity, the “good” or the “well” of that thing lies in

⁵Aristotle, *Politics*, trans. Richard McKeon (New York: Random House, 1941), 1254a15.

⁶*Politics* 1253b31.

⁷Aristotle, *Ethics*, trans. Richard McKeon (New York: Random House, 1941), 1161b4.

⁸*Ethics* 1102a5.

performing this activity or function well. For example, the good of the flute player is to play the flute well. He says, therefore, that if we can determine the function proper to man, we will know what happiness or human good is.

Since man is a living being, perhaps “life” is his proper activity. But this seems too broad because we share life even with plants. And the life of sensation we have in common with the beasts. He thus narrows down his subject to the “life of the rational part” of the human soul. The function or proper activity of man as man then must be the life of reason. The good life, then, or happiness will be a life lived well according to reason or activity of soul according to virtue.

But this definition needs elucidation. What does it mean to live well the life of reason? We are seeking the excellence of soul rather than of body so he points out the existence of two parts of the soul, the rational and the irrational. The irrational he divides into the vegetative and the appetitive. The activities of the vegetative part of the soul, like digestion, are involuntary and do not share in a rational principle. The appetitive, in a sense, does share in it. Unlike the beasts, with which we share this part of the soul, we can choose to satisfy our appetites or not to do so. Though not rational itself, the appetitive part is capable of listening to reason. In a sense, then, it is rational and, in a sense, irrational, and the tension between these alternatives is a phenomenon with which we are all familiar and upon which St. Paul himself remarks. So the rational part too is twofold, the part which has reason and the part which is able to listen to reason. Human virtue or excellence, then, will be excellence of the rational parts. The excellence of the appetitive part is moral virtue and that of the part which itself has reason is intellectual virtue.⁹

In Book II Aristotle defines moral virtue as “the habit of

⁹*Ethics* 1103a.

choosing the mean with respect to us as that mean is determined by reason and understood by a prudent man.”¹⁰ He spends the next three and a half books elaborating this definition but for our purpose here it is sufficient to see that the definition of moral virtue includes, as a measure, reason or prudence.

At the beginning of Book VI, Aristotle returns to the divisions of the soul and says that the part of the soul which has a rational principle is also twofold.¹¹ He divides it according to the twofold character of the objects of knowledge: variable things and invariable things. These two corresponding parts are the practical intellect and the speculative intellect. He asks then, what is the excellence or virtue of each of these two parts of the soul.¹²

The practical intellect, whose object is variable things, is principally concerned with action and production, with prudence and art, because both things done and things made are of the variable. He says that action and production are different.¹³ Prudence is “a reasoned and true state of capacity to act with regard to human good.” Art is “a reasoned and true state of capacity to make.”¹⁴ But prudence is itself an excellence while there can be an excellence of art.¹⁵ Prudence then, is the virtue of the rational part which deals with the variable. It is prudence which measures the habits of the appetitive part of the irrational soul and it is these that make our actions good. Prudence is the virtue of the rational part to which the irrational part is able to listen. Political prudence, which is concerned with the good of the highest human community, is the highest form of prudence.

¹⁰*Ethics* 1107a2.

¹¹*Ethics* 1139a.

¹²*Ethics* 1139a10.

¹³*Ethics* 1140a.

¹⁴*Ethics* 1140b20.

¹⁵*Ethics* 1140b25.

With prudence is given the perfection of all the moral virtues, so the prudent man is the man of perfect moral virtue. The active life of political prudence, which aims at the good of all the citizens, seems to be one candidate for the virtue whose activity is happiness. And indeed the great statesman and lawgiver has ever been honored and loved among men. Such a man is often accorded the title “father of his country.” Cicero, in fact, appears to consider the life of the statesman preferable to that of the philosopher.¹⁶

Aristotle finds the chief virtue of the speculative intellect, which grasps the truth about things which are invariable, to be wisdom and defines it as scientific knowledge “of the things that are highest by nature.”¹⁷ About scientific knowledge, he says:

We all suppose that what we know is not even capable of being otherwise; of things capable of being otherwise we do not know, when they have passed outside our observation, whether they exist or not. Therefore, the object of scientific knowledge is of necessity. Therefore, it is eternal; for things that are of necessity in the unqualified sense are all eternal; and things that are eternal are ungenerated and imperishable.¹⁸

The highest of the unchangeable and eternal things is God himself. Since He is also the greatest being and the most real thing, He is the most knowable in Himself. The knowing power is perfected, then, by knowing God. For Aristotle, the activity of wisdom, which is the contemplation of God, is the very best activity because the knowing power in some way takes on the form of the thing known. And so the eye, when it sees, has within it the form of the thing seen. So the intellect, in knowing

¹⁶Cicero, *The Offices*, Bk II Ch. 1.

¹⁷*Ethics* 1141b4.

¹⁸*Ethics* 1139b19.

God, even in the limited way we can in this life, becomes, in some way, divine.

Speaking about the activity of the intellectual virtue of wisdom in the tenth book of the *Ethics*, Aristotle says:

...the activity of reason, which is contemplative, seems both to be superior in serious worth and to aim at no end beyond itself, and to have its pleasure proper to itself; and the self-sufficiency, leisureliness, unweariedness and all the other attributes ascribed to the supremely happy man are evidently those connected with this activity. It follows that this will be the complete happiness for man, if it be allowed a complete term of life.¹⁹

And so, liberal education will be a preparation for a life of happiness, a life of contemplation of God and Divine things in so far as they can be known by our natural reason. In describing this life, Aristotle says:

But such a life would be too high for man; for it is not in so far as he is man that he will live so, but in so far as something divine is present in him; and by so much as this is superior to our composite nature is its activity superior to that which is the exercise of the other kind of virtue. If reason is divine, then, in comparison with man, the life according to it is divine in comparison with human life. But we must not follow those who advise us, being men, to think of human things, and being mortal, of mortal things, but must, so far as we can, make ourselves immortal and strain every nerve to live in accordance with the best thing in us; for even if it be small in bulk, much more does it in power and worth surpass everything.²⁰

¹⁹*Ethics* 1177b18-1177b25.

²⁰*Ethics* 1177b25-1178a.

The life of contemplation is, for Aristotle, true human happiness and he who can devote his life to it is truly happy. To live this life he must acquire speculative wisdom and studies ordered to this will therefore always be the primary part of liberal education rightly understood.

Part III: Liberal Education and Citizenship

For Aristotle, however, man is by nature a political animal.²¹ This means that he has a nature such that only within the city or “polis,” the highest human community which exists for the sake of the good life, can he achieve happiness. One reason is that moral virtues, without which no one can be happy, are habits. And we can only form good habits if we are brought up under good laws. So, contrary to the popular notion of our own time, Aristotle thinks that it is possible to legislate morality. In fact, he thinks that doing so is the principal business of the legislator.

Another requirement for the life of true happiness is leisure. By leisure, I do not mean recreation. Recreation is the time we spend resting and refreshing ourselves that we may be able to work. Recreation is for the sake of work, while work is for the sake of leisure. When we occupy ourselves with business, we either do things which are wholly for the sake of some other good, such as making money, or which are good for their own sake and yet are done also for the sake of something else, such as brave or just acts. Such acts are liberal, in so far as they are done for their own sake and because they are noble. But leisure time is the time we spend in doing things worthwhile and good only for their own sake and in themselves. Therefore the city must be prosperous enough to afford the citizens the opportunity of leisure. For the study and contemplation of truth are leisurely activities.

²¹*Politics* 1253a.

The good life also requires peace. The citizens must be protected from injustice either from within or from without the city. This requires force which can only be exerted properly by the united armed might of a courageous citizenry.

For there to be such a state, it must be governed by citizens possessed of political prudence and defended by men of valor. And these activities too, in so far as they are the excellent activities of rational parts of the soul, are human and constitute a kind of happiness, but one secondary and inferior to the life of contemplation and existing for its sake.²²

The activity of political prudence or moral virtue falls away from the true notion of happiness for, while brave acts or prudent laws are good and noble in themselves, they are also ordered to other goods. War is for the sake of peace and law for the sake of virtue and justice. And although such acts involve knowledge, it is not the knowledge of the eternal and unchanging things and therefore does not perfect the intellect of the knower simply by being acquired.

The citizen then does not find his true happiness in war or in political life but in leisurely contemplation. But he will also have a duty to defend his city and to govern it according to reason. This tension in the life of the citizen was reflected, not only in the writings of Cicero, but first in Plato's *Republic*, where the philosophers are kings. Socrates takes note of the reluctance of the philosophers, who have climbed out of the dark cave of the world of becoming into the clear upper light of the world of being, to descend again into that cave and devote themselves to the affairs of ruling. And so, he makes a law requiring them to take their turn at rule.²³

Liberal education, then, was originally conceived as the

²²*Ethics* 1178a9.

²³Plato, *Republic*, 519d.

education of the citizens. Educating the citizens was the business and responsibility of the state. That education aimed above all at true happiness. It was to prepare the citizens of the ideal state to live the full life of free men: a life of moral and intellectual virtue, a noble life, a life lived for its own sake, and a happy life.

IV: Liberal Education and Christianity

But we are Christians, living in the Christian era. What relevance does this pagan ideal have for us? With regard to the nature of human happiness, Christianity teaches that true happiness is to be found in the next life. This happiness, like that described by Aristotle, consists in knowledge of God. But it will be a far more perfect knowledge. We believe we shall see God “as He is.” We shall see Him “face to face” rather than “through a glass, darkly,” contemplating His glory as we are united with Him for all eternity.²⁴

In view of this, some would argue that the pagan ideal of liberal education is vain and useless and that we ought rather to devote ourselves to prayer and works of mercy so as to have a chance to someday share in that heavenly happiness. Are they correct? Certainly Christ Himself spent much of His public life feeding the hungry and curing the sick and this is ever the work of His followers. But His words to Martha telling her that “Mary has chosen the better part,”²⁵ give us pause. God is the best and therefore the most lovable being. To know Him is to love Him and Charity is, first and foremost, the love of God. Love of neighbor springs from that. And therefore, even though it may only be possible “through a glass darkly,” knowing God, even in this life, is good.

²⁴I Cor. 13:12.

²⁵Luke 10:42.

Catholic liberal education therefore crowns liberal education with the Science of Sacred Doctrine. To the study of God and Divine things as they can be known by reasoning from ordinary experience, it adds the study of the truth about God and Divine things as reason can know it from what God has revealed about Himself through Scripture and Sacred Tradition. This makes possible, even in this life, a Christian contemplation which is worthwhile in itself and is the highest form of happiness possible in this life—absent some direct and personal revelation by God. This is the activity in which the Christian engages for its own sake. And this is the activity for which Christian liberal education is chiefly a preparation.

And just as the Greek ideal of happiness included a responsibility for the good of the community, and just as Greek liberal education was a preparation also for such activity, so the Christian ideal includes a care for the good of our fellow wayfarers in this vale of tears and Christian liberal education is a preparation also for a life of Christian Charity.

Thus we conclude that there is a Christian liberal education. It prepares each human being for true freedom, for happiness, for the contemplation of God. And in this respect the Christian has a huge advantage. He can know much more about God.

Part V: Catholic Liberal Education and Citizenship in Modern America

How does the liberally educated Catholic of today pursue happiness? Can he live the life of contemplation? What about one's duty to the state? The ideal cities of Plato and Aristotle consist of no more than a few thousand citizens. And even so, Aristotle says of his that it is "an aspiration only." Even the Athens and Sparta of Aristotle's time, for which such ideals might have

more relevance, have vanished. What relevance can such an ideal have for the citizens of a modern commercial republic with a population of more than 300 million?

Aristotle himself points out that there are few if any existing states, even in his time, whose legislators have a proper care for the education of citizens. He gives the following account of why we should nevertheless learn the art of legislation:

Now it is best that there should be a public and proper care for such matters; but if they are neglected by the community, it would seem right for each man to help his children and friends towards virtue, and that they should have the power, or at least the will, to do so.²⁶

And throughout the *Politics* he asks if the good man and the good citizen are the same, concluding finally that they are not, except in the perfect state, which is, as noted above, “an aspiration only.” So Aristotle himself is very aware that the ideal of human happiness, of human freedom, is unlikely to be achieved perfectly, at least in this life.

Our forefathers were aware that founding a republic on such a large scale even as existed in the 13 colonies would have been unthinkable to Plato and Aristotle. But they tried to deal with that problem by fashioning a representative government. And, imperfect as the result may be, we do seem to have the possibility here of some modicum of a good life. Certainly our government too seems to have little care for the moral formation of the citizens. But so far it still gives us the freedom to ourselves help our family and friends become good. And the United States provides wealth enough for the average man to have leisure for contemplation: an achievement otherwise unknown in human history.

²⁶*Ethics* 1180a29.

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And so, we should never abandon our country to the disciples of Callicles. It affords us and our children a significant chance at what happiness there is in this life and we depend upon it for peace. For all these reasons, we ought to take seriously those parts of the College's curriculum which prepare us for political life and be prepared to serve our country in whatever way we can.

ARISTOTLE AND GALILEO RECONCILED

Ronald J. Richard

Preface

Over 45 years ago Dr. Donald F. Scholz introduced me to the problem discussed in this paper. He was truly my first philosophy teacher and my dear friend. He also introduced me to Thomas Aquinas College, and thereby to Dr. McArthur. I can never adequately repay him for all the good he has done for me, but as partial repayment, I dedicate this article to him.

Introduction

Aristotle states in *Physics*, VIII, 8:

For if H be borne to D and in turn, being turned back, be borne downward, that to which, the extreme D, was used as an end and as a beginning, one point as two; therefore, of necessity it stands still. (262b23)¹

In simple terms, what this passage seems to be saying is that if a body be thrown upward, then when it reaches the top

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¹All translations are by the author.

of its motion it must stop and be at rest for some time before it starts falling downward. How long it stays at rest is not stated.

Galileo has Sagredo say in the Third Day of *Discorsi e Dimostrazioni Matematiche Intorno a Due Nuove Scienze*:

Therefore, let us consider that while a heavy body is going upward, the power impressed upon it by the projector is continually diminishing, and that this power drives it upward as long as it remains greater than the contrary heaviness; and when these are equal, the movable ceases rising anymore and passes through the state of rest.²

In simple terms, what this passage seems to be saying is that if a body be projected upward, then when it reaches the top of its motion it does not stop for some time, but immediately begins to fall, having merely passed through the state of rest.

So, these two passages appear to be diametrically opposed: Aristotle says that the body stops for some time at the zenith while Galileo says that it does not. The question is, are they actually opposed? If not, how are they to be reconciled?

Aristotle

In order to understand fully what the quoted passage from *Physics* means, we must see how it fits into the context of Chapter 8 of Book VIII. Aristotle begins the chapter by saying:

Let us now say that it is possible for some [motion] to be infinite [i.e., unending], one, and continuous, and that it is in a circle. ... It is clear then that the thing borne on a straight and finite line is not borne continuously; for it turns back, and what turns back on a straight line moves with contrary motions. For the contraries according to

²*Opere di Galileo Galilei*, Florence, 1811, Vol. VIII, p. 254.

place are upward, downward, also forward, backward, and leftward, rightward. (261b27–36)

First, is it in fact true that a “thing borne on a straight and finite line” must turn back? Not necessarily. Consider a body moving uniformly along a straight line AB from A to B with such a speed, V, that it takes a unit of time to traverse the whole length. Let us designate this time by T. Next consider another body moving along the same line, but now with continuously decreasing speed. This body would take more than a unit of time to traverse the whole length. How much time it would take depends on the exact way in which the speed was decreasing. In fact, the deceleration could occur in such a way that the body could not traverse the whole length in any finite time, no matter how great. Let us see how this could occur.

First, note that the uniformly moving body would traverse one-half of AB in one-half of the unit of time, i.e., $\frac{1}{2}T$. The decelerating body would thus require a time $>\frac{1}{2}T$ to traverse this distance. Now let us attribute a specific deceleration to the body: let it begin with the speed V and decelerate in such a way that the speed at any point equals the remaining distance. Thus, at the midpoint it would have speed $\frac{1}{2}V$, while three-quarters of the way to the end it would have speed $\frac{1}{4}V$, etc. Since it would pass through the half-way point with speed $\frac{1}{2}V$ and is decelerating, it would take a time $>\frac{1}{2}T$ to reach B. We also note that at the three-quarters point it would again require a time $>\frac{1}{2}T$ to reach B. Indeed, no matter where the body is it would take a time $>\frac{1}{2}T$ to reach B. Thus, it could never reach B. Therefore, a body moving with such a motion could move continuously without turning back.

Why, then, does Aristotle say that “it turns back”? First, his work is a philosophical not a mathematical one. So he is probably only considering bodies moving uniformly. That this

is the case receives support by what he says a little further on: “A sign that the motion from A to B is contrary to the one from B to A is that they cause each other to halt and stop, if they come to be simultaneously” (262a6–8). This would occur only if the opposite motions took place at the same rate. This then is a sign that Aristotle is considering motion in a simple manner.³ Second, Aristotle in the *Physics* is primarily concerned with natural motions. And, since nature usually acts simply, it uses the simplest kind of motion, namely uniform motion.

Aristotle tells us how he is going to show that motion on a straight line cannot be continuous and one at 262a18: “The assurance that it is necessary to come to a stand comes not only from sense but also from argument.” He then proceeds to produce the argument, but never gives any evidence according to sense. What is this evidence? Probably something like the following: If one walks to a place and turns around to go in the opposite direction, he, and we, would see that he would come to a stop at that place. If, on the other hand, he does not turn back, but only proceeds sideways, to turn a corner as we say, he would not have to stop. That this is the kind of sense evidence Aristotle has in mind is supported by what he says at 262a12: “But going to the side is not [contrary] to [going] upward.” But, before proceeding any further in analyzing what Aristotle is saying, we examine what Galileo has to say.

Galileo

Galileo begins his studies of natural local motion by seeing what our senses tell us about it. In particular, he deals with the motion of falling bodies.

³This claim can also be (better) made by examining what Aristotle says at 262b8–17.

What he has to say about local motion is presented in the Third and Fourth Days of the *Discourses*. We limit our consideration to what he says in the Third Day, entitled *On Local Motion*. This part is itself divided into two sections: *On Equable Motion* and *On Naturally Accelerated Motion*. He begins the first section by stating that equable motion is also called uniform motion. We will be concerned only with the second section.

After a brief introductory passage, Galileo states, “And first, it is appropriate to search after and explain the definition that especially agrees with that [motion] which nature utilizes.” A little later he states, “We are confident that this has been found, chiefly guided by the very powerful reason that the properties successively demonstrated by us correspond to, and are seen to be in agreement with, that which physical experiences exhibit to the senses.” He then proceeds to make an argument that natural falling motion is uniformly, i.e., equably, accelerated.

But what about a body that is projected upward? He begins by discussing what happens in the case of a pendulum⁴ that falls through an arc and then rises after reaching the bottom. Galileo has Salviati say that, except for impediments produced by the string and the air, the body would rise to the same height that it began its fall from. Since this is the case no matter the initial height, the rising pendulum must decelerate in exactly the same way that the falling pendulum accelerated. Having reached its highest height, the ball would then fall through the same arc it had risen through and after passing through the bottom would, except for the impediments already mentioned, rise back up to the original height. Galileo later formally argues to essentially the same conclusion in the *Scholium* after *Proposition XXIII*.

⁴See page 167 of *Opere*, which occurs on page 162 of Stillman Drake’s translation.

Experience

What does happen when the ball reaches its greatest height and then falls? Does it hesitate at the top, or does it immediately begin its descent? It will come as no surprise to us that exact measurements indicate that there is no hesitation at all, but the rise is followed immediately by descent. Now Aristotle did not have access to such precise experience, and the eyesight alone is not adequate for determining exactly what happens at the top. So what experience could he have had in mind?

Perhaps it is like what we said earlier: if someone walks to a place and turns around to return on the same path, then he does indeed come to a stop at that place. But, one can in fact return along the same path without stopping by continuing on in a curved line that returns to the path. But, although there is no intervening stop, there is an intervening motion. Thus, in both cases one does not commence the return motion without some intervening time. But this is very limited experience on which to base a judgment in such matters.

There is another kind of experience Aristotle could have been aware of that will eventually help us understand what actually happens. We begin by recalling Sagredo's words cited in the opening section of this paper:

... that while a heavy body is going upward, the power impressed upon it by the projector is continually diminishing, and that this power drives it upward as long as it remains greater than the contrary heaviness.

Consider a tug-of-war in which one side has greater initial strength while the other side has greater endurance. Early on, the rope will move toward the stronger side, but eventually it will start moving the other way. The reversal can take place without any intervening rest because the rope is moving under the

influence of two powers. In such a case, the reversal will occur immediately when one power overcomes the other. Later on in the same passage, Sagredo speaks of holding a body in the hand and then letting it go. Again, the body is affected by two opposing powers, its heaviness tending to move it downward and the force of the hand tending to move it upward. While these balance each other the body remains at rest. But when the hand is taken away the body immediately starts falling.

Continuous

Aristotle states the purpose of Chapter 8 of Book VIII of *Physics* at the beginning of the chapter:

Now let us say that a certain motion can be infinite, being one and continuous, and this is motion in a circle.
(261b27)

Thus, he intends to show that a circular motion can be one and continuous. In order to do this, he must show that a local motion that is one and continuous can be unending. In order for a motion to be continuous no other motion or rest can intervene between parts of it. In order for it to be one, he says it must be in one direction. For he says, “the thing turning back on a straight line is moving according to contrary motions” (261b33). And:

But what ‘one and continuous motion’ is has been determined before, that it is the motion of one thing and in one time and in what is undivided according to species.
(262a1) ... The contraries differ in species, and are not one. (262a6)

The entire passage from 261b30 to 262a12 is spent showing that motions in opposite directions are contraries and so are not one motion. Having established this, Aristotle then proceeds,

at 262a12, to the heart of the argument that motion in a straight line cannot be one and continuous by showing that it cannot be continuous: “It is most apparent, however, that it is impossible that motion on a straight line be continuous.” He then proceeds to conclude that: “So it is necessary that what turns back in a straight line stand” (263a3).

But here Aristotle seems to forget his own doctrine on continuity in Chapter 3 of Book V of *Physics*: “And if [there be] the continuous, there necessarily [is] touching, but if touching, the continuous [is] no longer [necessary]” (227a21). Thus, in the material world two bodies can touch without their being two parts of the same body. They touch because the boundary of one has the same location as the boundary of the other. They are not one because, though their boundaries are in the same location, they remain physically separate by the fact that they get their existences by being the boundaries of different bodies. We can see this also in geometry by considering the boundaries of figures.

In Definition 15 of Book I of *Elements*, Euclid says, “A circle is a plane figure contained by one line ...” In Definition 19 he states, “Rectilinear [literally: straight-lined] figures are those contained by straight [lines] ... , three-sided those by three ... straight [lines].” Thus, a figure can be contained by one curved line or by more than two straight lines.

There can be triangles, and rectilinear figures in general, because the ends of two straight lines can meet at the same location. This can occur because a point does not have any size, and so end points of different lines can co-locate. Consider triangle ABC, where A, B, and C indicate the corners of the triangle. In this case end point B of line AB can have the same location as end point B of line BC. They are distinct in thought by being the end points of different lines. They are labeled by the same letter

in order to indicate that they have the same location. In this case, we say that line AB and line BC are continuous.

A curved and a straight line can also be continuous, for example, the arc of a semi-circle and the tangent at one end of the arc. Now, just as a circular arc and a straight line are different in kind, so also the motions along the arc and along the straight line differ. And just as the arc and the straight line can be continuous, so can the motion along the arc and the motion along the straight line. That is, if a body be moving along the arc it can transition to moving along the straight line without any intervening rest, and *vice versa*. Thus, it is possible for motions different in kind to transition from one to the other without an intervening rest.

As Aristotle says, upward motion and downward motion are contraries, so they differ in kind. But, they also differ in kind because the downward motion is natural while the upward motion is a violent one. So, it does not seem necessary that there be a rest between the upward motion and the downward motion. Thus it seems that Aristotle is wrong, and Galileo is right.

Ambiguity

Perhaps we have been misreading the text of *Physics*, though this might not be our fault, for perhaps the text itself is unclear. In particular, our concern is whether Aristotle's text can be read in a way that would not put it in conflict with Galileo's, and with reality. So we must begin by examining the text more carefully.

Aristotle says, "For if H be borne to D and in turn, being turned back, be borne downward" (262b23) right after a long discussion about motion in one direction. In that discussion he was concerned with the conditions where a motion would be continuous and those where it would not. That he is moving on

to a new situation he shows by writing, “Here then it is not possible to speak in this way about the continuous, but with regard to what is turning back, it is necessary to speak in this way” (262b21).

It thus seems that Aristotle is now going to speak generally about motion along a straight line when the motion turns back to go in the opposite direction. In the second quotation from *Physics* given above, Aristotle says, “What turns back on a straight line moves with contrary motions. For the contraries according to place are upward, downward [κάτω], also forward, backward, and leftward, rightward.” Now, as written, this is not an exhaustive listing of the possibilities for contrary motions. For the second and third pairs have meaning only with reference to oneself. Leaving the specific language aside, however, and considering the physical situation that these three pairs indicate, we see that what they do is illustrate the three possible physical dimensions.

This then raises the question of whether one should take Aristotle literally when he uses any of these terms in Chapter 8. This point is enhanced at 262a12 where he says, “But going sideways is not [contrary] to [going] upward.” Sideways can be said not only with respect to upward and downward, but also with respect to forward and backward. So, once again Aristotle is using specific language to illustrate a general point: if a body is moving along a straight line, then a motion perpendicular to it will not be contrary to the original motion, and will not interfere with it. Galileo, by the way, utilizes this feature when discussing projectile motion in the Fourth Day of *Discorsi*. So we need not take ‘downward’ literally at 262b23.

So it seems there is no necessity to take Aristotle literally in the originally quoted passage when he uses the term ‘downward’. True as this may be, though, it does not seem to solve the problem, because upward and downward themselves are instances

of contrary motions, and what is true of contrary motions in general must be true of all particular ones.

One

As we have seen, Aristotle says that in order for a motion to be infinite, not only must it be continuous but it must also be one. What is required for a motion to be one? Besides the factors listed in Chapter VIII, it must be caused by one mover. For, as Aristotle says in Chapter 3 of Book III of *Physics*: “But the act of the mobile is from the mover; and so the act of both alike is one” (202a17). Since the act of the mobile is the same as the act of the mover, different movers of the same mobile will result in motions that are different. And, as we have already seen, there is no need of a rest between the motions caused by different movers. For the resulting motions could be contiguous. An example of this is the motions of the baton in a relay race. When the baton is passed on it need not stop before moving with the next runner. So the question now is: can a motion that is caused by one mover reverse without a rest between the motions?

The senses appear to tell us that the answer is no. If one walks on a straight path and then returns along the same path, it certainly seems that he has to stop before walking the opposite way. As for vertical motion, if one climbs a ladder it seems that he has to stop before climbing back down.

Walking, and climbing, however, are complicated processes. For when we do so we place one foot down and then keep it in place until the other foot is placed down. The rest of the body, however, seems to be continuously moving. The question, then, is what happens to the body when one is walking forward and then starts walking backward? This is harder to determine experientially.

We, therefore, should examine a simpler situation. Specifically, what happens when an arm is waved from side to side or up and down? Here experience seems to show that there is no need of a stop before the arm returns. So, we seem to have a case of a body moving by a single mover, namely, the owner of the arm, reversing its motion without an intervening rest. But, in this case, is the arm actually moved by one mover for both motions? Or, rather, are not different muscles employed for the two motions? As a clearer example, consider flexing the arm at the elbow. The biceps are used to flex it while the triceps are used to unflex it.

Conclusion

So, is it possible for a single mover to move a body in one direction and then move it in the opposite direction without an intervening rest? We have already answered this question when we stated that it indeed could do so by moving the body with some intervening motion. After reaching his goal, a walker could continue walking in a curved path that eventually became tangent to the original straight path at the end of the original straight path and so he could then be walking in the direction opposite to the original one without stopping.

But, could the mover move the body in the opposite direction immediately upon reaching the goal? This seems to be the question that Aristotle is really addressing in *Physics* VIII.8. He does so first by arguing that for a rectilinear motion that reverses direction there is not one motion because a motion in the opposite direction is not one with the original motion. Then, starting at 262a12, he argues that the motion cannot be continuous because some time must intervene between the original motion and its contrary. But both arguments must assume that there is only one mover of the body, otherwise the motion would not

really be one, in which case there would be no need for the arguments about continuity in *Physics* VIII.8.

If the body has more than one mover, however, no time need intervene between the contrary motions. For Aristotle and Galileo, a body that is projected upward and subsequently falls is moved by two movers: the projector for the upward motion and the body's heaviness for the downward motion. Therefore, Aristotle's and Galileo's doctrines are not opposed, and so their teachings are reconciled.

IS DNA THE SOUL?

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Aristotle begins the *De Anima* with the assumption that all living things must have a soul, meaning by the term nothing more than the principle that distinguishes the living from the non-living. Modern biologists, even those not admitting a real distinction between the living and the non-living, still think that organisms have activities that distinguish them from the inanimate. These activities, such as nutrition, growth, reproduction, sensation, etc., need to be explained. If DNA is the principle that explains all these activities in an organism, it *is* what we call a soul. Biologists might say that if that is what we want to call DNA, that is fine, but now we are only talking about words.

The reluctance of scientists to talk about the soul is understandable. It conjures up images of spirits or ghosts that are supposed to inhabit bodies. Though some scientists claim they have kept their eyes open when dissecting living things, they have never seen a soul leave the body upon death. Even if there were some willingness on the part of biologists to say there might be some vague reason for thinking that humans have souls, why would anyone think that other living things do? The more

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fundamental reason, however, for denying the existence of soul is the denial that there is a real distinction between the living and the non-living. Although living things behave differently than the non-living, nevertheless they think that all the activities of the living can be explained by the powers of inorganic nature, i.e., the laws of chemistry and physics.

If we grant that the living are distinguished from the non-living, at least by their distinctive activities, the question, then, is not *whether* there is a principle that causes this distinction, but rather *what* is it? In what follows I will show that when faced with this question, many biologists claim that it is DNA. I will then consider whether DNA is a sufficient cause by examining what DNA can do and what it cannot do.

The notion that life can be fully explained by the same material elements out of which all things are composed goes back to the first philosophers. In the *De Anima* Aristotle presents the views of his predecessors, most of whom identified the soul with one or more of the elements. The expectation that life will be explained by chemistry has always had its proponents. Theodore Schwann, one of the founders of cell theory, says that he sets out with the supposition that a living thing is not produced by some fundamental power found only in living things, but rather,

...it is developed according to blind laws of necessity, by powers which, like those of inorganic nature, are established by the very existence of matter. As the elementary materials of organic nature are not different from those of the inorganic kingdom, the source of the organic phenomena can only reside in another combination of these materials, whether it be in a peculiar mode of union of the elementary atoms to form atoms of the second order, or in the arrangement of these conglomerate molecules

when forming either the separate morphological elementary parts of organisms, or an entire organism.¹

Of course, when Schwann made this claim he had no idea how this actually is the case, but this is the kind of explanation he was looking for. Now, all would agree that organisms are far too complex to be simply an element or even a second order arrangement of elements, for example some kind of compound having a molecular formula. It seems more reasonable to think of organisms as complex chemical machines where one component moves and directs others. This would be true not only in unicellular organisms but even more so of multi-cellular organisms.

But how do you account for the unity and order of the parts of this chemical machine? In the late nineteenth century biologists began considering the possibility of some sort of complex molecule being the principle of morphogenesis, the process of embryological development. One view was that the fertilized ovum contained a large, extremely complex molecule which gets divided into parts during the process of cell divisions that take place in morphogenesis. Assuming that the parts of this molecule differ in chemical composition, cell differentiation and the subsequent coming to be of the various types of tissues and organs might be explained by the fragments of the original molecule ending up in different cells during cell division. These cells then would differentiate into the various cell types of the body and serve as the basis for forming the organs. This theory has the added advantage of giving some account of the unity

¹From *Mikroskopische untersuchungen uber die ubereinstimmung in der struktur und dem wachstum der tier und pflanzen*, Berlin, 1839; tr. by H. Smith as *Microscopical researches into the structure and growth of animals and plants*, London, 1947. Found in *A Source Book in Animal Biology*, ed. by Thomas Hall, Hafner Publishing Co., New York, 1964.

of the organism by the fact that there is one original molecule that “directs” the development of all the parts. The unity of the organism would be caused by the unity of the initial molecule.

Note that this view takes one side of a debate that had been going on for centuries, namely, whether morphogenesis is metamorphosis or epigenesis. The above view assumes that the parts of the original molecule are predetermined to make certain parts of the body.² On the other hand, those who hold that development takes place by epigenesis think that the parts and even the primordia of the parts are not present at the beginning but come to be part after part in the course of development.

Hans Driesch, in his famous experiments³ with sea urchins, proved that the parts of the ovum are not determined at the beginning of the process of development to becoming a particular body part. If the parts were so determined, then dividing the embryo in half after the first cell division should lead to the production of half an organism. In fact, what Driesch observed was the formation of a whole organism half the normal size. Driesch used these experiments to argue against the chemical theory of morphogenesis and as an argument for vitalism.⁴ In order for a chemical theory to work, the complex molecule in the original cell would also have to be in all the subsequent cells which come about by cell division. This was not the view of those who proposed the chemical theory, so Driesch thought he had struck the chemical theory a fatal blow. The thought never occurred to him that the molecule might be replicated before

²The theory of metamorphosis assumes that all parts of the body are actually present in the original cell, at least in some primordial form.

³Driesch, *Potency of the First Two Cleavage Cells in Echinoderm Development. Experimental Productions of Partial and Double Formations*, 1891-1892.

⁴Driesch, *The Science and Philosophy of the Organism*, Gifford Lectures, 1908; v.1, London: Adam and Charles Black.

cell division so that the resultant cells have the same whole molecule as the original cell.

In 1944 physicist Erwin Schrödinger made a proposal that provided the stimulus for the study of molecular biology which has since become one of the major fields of emphasis in the life sciences. His little book, *What Is Life?*, is considered one of the most influential works of the twentieth century. By the time Schrödinger wrote his book the chromosomes of cells had been discovered and it was known that the chromosomes existed in pairs, one member of which comes from the father and one from the mother. It was also known that these chromosomes are replicated before cell division. So, all the cells of a body have the same set of chromosomes. Schrödinger takes as known that the chromosomes “have control of the observable large-scale features which the organism acquires in the course of its development, they determine important characteristics of its functioning; and in all this very sharp and very strict biological laws are displayed.”⁵ He continues with his own theory:

It is these chromosomes, or probably only an axial skeleton fiber of what we actually see under the microscope as the chromosomes, that contain in some kind of code-script the entire pattern of the individual's future development and of its functioning in the mature state. Every complete set of chromosomes contains the full code; so there are, as a rule, two copies of the latter in the fertilized egg cell, which forms the earliest stage of the future individual.

In calling the structure of the chromosome fibers a code-script we mean that the all-penetrating mind once conceived by Laplace, to which every causal connection lay immediately open, could tell from their structure

⁵Schrödinger, *What is Life?* Cambridge University Press, 2010, p. 21.

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whether the egg would develop, under suitable conditions, into a black cock or into a beetle, a mouse or a woman...

But the term code-script is, of course, too narrow. The chromosomes' structures are at the same time instrumental in bringing about the development they foreshadow. They are law-code and executive power – or, to use another simile, they are the architect's plan and builder's craft – in one.

Schrödinger had no direct evidence for any of this, but to many the theory seemed, not only plausible, but necessarily true. Imagine the satisfaction at the discovery of the DNA molecule and its structure. Scientists learned that DNA (deoxyribonucleic acid) is a double helix with complementary base pairs joining the two strands of the helix. These bases, taken in triplets along one strand, determine the sequence of amino acids used for protein production. The notion of “code-script” was immediately applied as the means by which these triplets were understood, and the triplets themselves were called *codons*. Scientists discovered that the four bases, adenine, thymine, guanine, and cytosine, taken in the various combinations in a codon, correspond to various species of amino acids; they called this the *genetic code*. Now the genetic code is thought to be the same for all organisms. So how is the tremendous diversity of organisms ranging from bacteria to the blue whale explained? The presumption has been that the number, order, and arrangement of the codons on the strands of DNA will explain it all. It does this by determining the production of proteins which are synthesized from the amino acids. Jacques Monod states:

The organism is a self-constructing machine. Its macroscopic structure is not imposed upon it by outside forces. It shapes itself autonomously by dint of constructive

internal interactions. Although our understanding of the mechanisms of development is still more than imperfect, we are now in a position to state that the constructive interactions are microscopic and molecular, and that the molecules involved are essentially if not uniquely proteins. Hence they are proteins which channel the activity of the chemical machine, assure its coherent functioning, and put it together.⁶

According to this view, then, DNA is the ultimate source of proteins, and proteins are not only the structural material out of which the body is made but also the agents by which the machine operates. Hence, DNA is the principle of the living thing and its activities.

If we analyze this view in terms of Aristotle's four genera of causes, matter, form, agent, and end or final cause, DNA would fall under all four. It is a material constituent of nearly every cell in the body. It is an agent insofar as it produces proteins which are themselves agents. Moreover, insofar as we speak of DNA as possessing the blue print, the "architect's plan" for the whole organism, it has the character of exemplar or formal cause. Furthermore, DNA may also be considered a formal cause insofar as its strands contain the genome that is thought to determine the species of the organism. The neo-Darwinian Theory assumes that a species is defined by its genes and that a sufficient change in the genes constitutes a change in the species.⁷ Finally, if we include Richard Dawkins' view that the genes build the bodies of organisms as vehicles for the sake of perpetuating

⁶Jacques Monod, *Chance and Necessity*, Alfred A. Knopf, New York, 1971.

⁷If this sounds confusing, note that one of the major points in Lenny Moss's book, *What Genes Can't Do*, is that biologists have conflated two views of the gene. He calls one the pre-formationist gene, which was first named as being a material principle of heredity; the other is gene as code script, which is a principle of protein production.

themselves, then DNA is also a final cause. If all this is true, then we have found the principle that distinguishes the living from the non-living, and this is what we mean by the soul.

The view that DNA is the first principle of the living is confirmed by the fact that when biologists theorize about the origin of life, they begin by considering how DNA might self-construct or self-assemble and then how the rest of the cell might be assembled around the DNA. Since organisms are considered to be self-constructing and self-replicating chemical machines, it is reasonable to think that the principle of these abilities comes from a molecule that is also self-constructing and self-replicating. This may explain why Schrödinger thought that the underlying principle of the living must be an aperiodic crystal.⁸ It has a complexity commensurate with the complexity of living things, and it is capable of self-assembly. Hence it would be a perfectly adequate principle of life.

What Does DNA Do?

Let us briefly consider what DNA does. How does it operate and what does it produce? Let us begin with the latter. With Schrödinger and Monod modern biologists ultimately want to say that DNA produces the whole organism and all of its activities. No one claims, however, that DNA does this directly; as we will see, DNA does not even produce proteins directly. Can we say that DNA directly produces the amino acids out of which the proteins are composed? In order to answer this question we must consider how DNA operates.

DNA is found in the membrane-bound nucleus of the eukaryotic cell, but protein synthesis takes place in the cytoplasm of the cell. So DNA is not in direct contact with the organelles that produce the proteins. It affects their activities by messengers

⁸A crystalline structure whose unit molecules are not all the same.

that are transported from the nucleus to the cytoplasm. Let us look at some of the details as they are generally understood.

The double helix of DNA is polymer composed of units, or monomers, called nucleotides.⁹ Genes are composed of a series of these nucleotides ranging in number from a few hundred to a few thousand. In order for the information contained in the genes to be made available to the cell, a portion of the helix must be exposed so that an enzyme called RNA polymerase can unzip and bind to one of the strands of the helix. RNA polymerase then synthesizes a complementary strand of *messenger* RNA (ribonucleic acid). This polymer is very similar in form and composition to DNA. Messenger RNA is called complementary because the bases in the nucleotides match up in pairs just as those in the strands of the DNA helix. In DNA, thymine links with adenine, guanine with cytosine. In RNA it is the same except uracil, rather than thymine, links to adenine. The so-called genetic code refers to the sequence of bases as found in messenger RNA. For example, “UUU stands for phenylalanine, UUA for leucine.”¹⁰

Once the messenger RNA has been synthesized it is transported out of the nucleus into the cytoplasm of the cell where it is “embraced by one of the smallest of the cell’s organelles, the ribosomes.”¹¹ Rensberger compares the messenger RNA to a foreman who has read the blueprints to the ribosome, which is the “factory worker who must read the working copy of the plans and assemble the specified product by fastening its components together.”¹² A ribosome attaches to the strand of messenger RNA and moves from codon to codon along the strand. Assembly of a protein occurs with the assistance of another RNA

⁹Each nucleotide is composed of a nitrogenous base, a sugar, such as ribose, and one or more phosphate groups.

¹⁰Franklin Harold, *The Way of the Cell*, Oxford University Press, 2001, p.47.

¹¹Boyce Rensberger, *Life Itself*, Oxford University Press, 1996, p. 99.

¹²*Ibid.*, p.100.

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molecule called *transfer* RNA. This is a much smaller molecule than messenger RNA. It has an anticodon on one end that is able to match with a codon on the messenger RNA that has the proper sequence of complementary bases. The other end of the transfer RNA is attached to an amino acid that is specific to that anticodon. The ribosome attaches the anticodon of the transfer RNA to the complementary codon of the messenger RNA and in this way brings in the appropriate amino acid for that codon. When the next codon is read by the ribosome and a new transfer RNA attaches to the codon on the messenger RNA, the old transfer RNA is dislodged. The amino acid attached to the new transfer RNA binds with the previous amino acid thus forming a chain. This process continues until the whole messenger RNA strand has been read. In order for the protein chain to be functional it must fold up into a three dimensional molecule. The sequence of amino acids is only partly responsible for the exact manner of folding.

We can now answer the question asked above: does DNA produce the amino acids used for the production of proteins? The answer is no. The amino acids that are brought to the ribosomes by transfer RNA are already present, floating freely in the cytoplasm of the cell. They are bound to the transfer RNA by an enzyme called aminoacyl-tRNA synthetase. Therefore, when it is said that DNA produces proteins, it is only in the sense that it determines the number and the sequence or order of amino acids that the ribosomes put together. Furthermore, in the process described above it is clear that DNA is more passive than active. Rensberger says,

For all their importance, genes are perhaps the most passive parts of the cell. They do not, so far as can be determined, perform any physical activity. They administer their realms with regal aloofness, always staying safely

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inside the nucleus, sequestered from the biochemical hurly-burly just outside. Like a computer program residing passively on a magnetic disk but controlling a vast, automated assembly line, genes simply let their messages be read.¹³

The first part of this quotation raises doubts about whether DNA could be called a first principle in the sense of an agent. Its inactivity does not sound like something characteristic of an architect or a master builder. We will say more about this later. Let us now consider what DNA cannot do.

What DNA Cannot Do

As mentioned above, in order for DNA to do anything, it must be unzipped so that the codons on its strands can be transcribed. There are generally two circumstances under which transcription takes place. The first has already been discussed, i.e., when protein synthesis must take place. The other case is when DNA is replicated before cell division. In the latter case the entire helix is separated into two strands and DNA polymerase produces two new strands using the old ones as templates. The result of this process is a doubling of chromosome pairs so that when cell division takes place the resultant cells will have the proper number of chromosomes. What controls DNA replication and cell division is not well understood. We do know that different types of cells in an adult body replicate at different rates. Cells of the stomach and digestive tract replace themselves in a day or two; muscle cells and neurons, on the other hand, no longer reproduce once the organism is mature. Moreover, it is clear that DNA does not self-replicate because DNA polymerase acts on the double helix to generate the complementary strands.

¹³Ibid., p. 92.

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On the other hand, when transcription of DNA is taking place for protein synthesis, the double helix is not completely unzipped, only a portion of the helix is exposed for transcription. Protein synthesis varies greatly in different kinds of cells and even in the same cells at different times and conditions. This comes about by the cell selecting which genes on the DNA strand to transcribe. What controls this selective transcription? Is it the DNA molecule itself? That seems unlikely given how passive it is. This has been an area of extensive research; Rensberger gives the following summary:

For all their power, genes do not act autonomously. Most exercise their supposed dictatorial role only when switched on by other molecules in the cell – a fact that leads to one of the subtlest but most important points in all of biology. Cell and molecular biologists are proving that human beings are not the products solely of their genes. They are also the products of their environments. For it is the environment – both that of the individual cell and that of the whole person – that determines which of the genes are switched on and when. Some of the molecules that turn genes on, and turn them off, are produced within the same cell. Some, such as certain hormones, come from cells in other parts of the body, slip right through the cell membrane, and head straight into the nucleus to act directly on the DNA. Others from elsewhere in the body act on receptors in the cell membrane, which relay a signal to the DNA. Even environmental influences from a person's surroundings can turn genes on and off. Stress from frightening or difficult circumstances, for example, causes cells in some glands to start manufacturing certain hormones. Mental activity of various kinds can cause brain cells to send signals and sprout new tentacles that make richer contacts with other

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cells. The act of learning can regulate genes in the brain cells, creating more powerful and effective minds.¹⁴

To be switched on and off is not characteristic of a principal agent; the principal agent controls the switches. Here again DNA is essentially passive with regard to gene expression. Controls come not only from within the cell itself but also from the whole organism and from its environment.

Self-Organization

As noted in the introduction, Schrödinger theorized that the aperiodic crystal that is the principle of heredity would also be the principle for the construction of the whole organism. This theory is based on the fact that elements do self-assemble to form molecules. Can the molecules then self-assemble to form cells and cells an organism? Once it was discovered that DNA possessed the code for the production of proteins this hope was given a boost, for proteins not only have chemical properties, they also have physical or mechanical properties. They change shape and in so doing they can move molecules from one place to another. Except for the storage and transmission of genetic information, proteins do almost everything that is done by a cell. Some serve as enzymes to catalyze chemical reactions; some serve as the structural components of the organism. "Some make tracks for the movement of organelles, itself mediated by motor proteins. Proteins act as receptors for signals from within the cell or from the outer world; they transport nutrients, waste products and viruses across membranes. Proteins also commonly modulate the activities of other proteins, or of genes."¹⁵

¹⁴Rensberger, p.92.

¹⁵Harold, p.36.

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It is also known that many of the molecular components of cells can self-assemble. Polymers such as DNA and RNA can form spontaneously under certain conditions if their subunits are present, and this is also true for many proteins. Cell membranes can form spontaneously when phospholipids are present in water.¹⁶ Functional ribosomes can self-assemble under proper conditions from their macromolecular constituents.

Nevertheless, Harold says:

The idea that biological organization is fully determined by molecular structures is popular, seductive, potent, and true up to a point – yet fundamentally wrong. Many scientists cling hopefully to Lederberg’s dictum of thirty years ago: “The point of faith is this: make the macromolecules at the right time and in the right amount, and the organization will take care of itself.” But this faith is too simple to suit modern knowledge. It disregards the fact that the cell as a whole is required to create the proper environment for self-assembly to proceed. Furthermore, both prokaryotic and eukaryotic cells make sure to control self-assembly, so that it takes place only as a part of a larger purpose. Here we stand again on the border that divides biochemistry from cell biology...¹⁷

Harold adds three more reasons the cell cannot self-assemble from pre-existing molecules:

First, some cellular components are not fashioned by self-assembly, particularly the peptidoglycan cell wall which resembles a woven fabric and must be enlarged by cutting and splicing. Second, many membrane proteins are oriented with respect to the membrane and catalyze vectorial reactions; this vector is not specified

¹⁶Ibid., p.55.

¹⁷Ibid., p.56.

in the primary amino acid sequence, but is supplied by the cell. Third, certain processes occur at particular times and places, most notably the formation of a septum at the time of division. Localization on the cellular plane is not in the genes, but in the larger system. Cells do assemble themselves, but in quite another sense of the word: they *grow*.¹⁸

We will come back to this latter point later on. Harold concludes his discussion of self-assembly with the following:

Molecular self-assembly represents an essential principle of biological organization, the first stage on the road from molecules to cells. But molecular self-assembly does not suffice to account for cellular organization, and this failure is highly significant for two reasons. First, it rudely contradicts the unspoken assumption that nothing fundamental is lost when we grind cells into a homogenate, and therefore, that when we know all about the molecular parts we will automatically comprehend how cells are articulated and how they function. Second, the limits of self-assembly bear upon the meaning of the genome. The instructions spelled by the genes are local, not global. But growth and many other operations depend upon energy requiring, directional processes; self-assembly in the cell is directed, in space and time. It follows that only within the context of a particular cell, which supplies the requisite organizing power, is it valid to say that the genome directs the construction and operation of the cell. It is true but misleading to envisage a cell as executing the instructions written down in its genome; better to think of it as a spatially structured self-organizing system made up of gene-specified elements. Briefly, the genes specify *What*; the cell as a whole directs *Where* and *When*; and

¹⁸Ibid., pp.80-81.

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at the end of the day, it is the cell that usually supplies the best answer to the question Why.¹⁹

We are now in position to make a judgment about whether DNA is the principle that distinguishes the living from the non-living. It is not the master builder. With regard to gene expression and protein synthesis, it plays the role of an instrument rather than a first mover. As Rensberger says, it is passive in the acts of transcription both in regard to when and what parts of the DNA are transcribed. It does not seem to have anything to do with the movement of messenger RNA out of the nucleus or with the operation of the ribosomes or transfer RNA. Furthermore, with regards to the constituents and the operations of the cell that depend on being in the right place at the right time, DNA has no control.

Can we say that DNA is the blueprint or essence of the organism? Earlier we suggested that both of these notions come under the notion of formal cause. Normally a blueprint would be an extrinsic formal cause or an exemplar as the form of the building is in the mind of the architect or even in his drawings. This is distinguished from the form that is in the building as its shape. When DNA is called the blueprint, it is because it is said to contain the “information” necessary to build the whole organism.²⁰ This is closer to the notion of form as an intrinsic principle because it is in the organism. In this case it is that which makes the organism to be one kind rather than another. But as Harold

¹⁹Ibid., pp.81-82.

²⁰This assumes that DNA stays the same throughout the life of the organism, which we now know is not necessarily the case. There are organisms that can change their DNA in response to challenging environmental conditions and this is not thought to be by a chance mutation. Moreover, we know that cells have the ability to edit messenger RNA. Therefore DNA cannot be the sole source of information within the organism.

states in the quote above, "...the instructions spelled out by the genes are local, not global." This is true not only in multi-cellular organisms, but also in unicellular ones. Biologists now know that DNA is not the only principle of heredity. In unicellular organisms, for example, the structure and arrangement of the cell is inherited. In some cases, even acquired characteristics can be passed on to subsequent generations. Harold summarizes as follows:

Four decades of research have confirmed and amplified the late Tracy Sonneborn's original insight that new cell structures are ordered and arranged under the influence of pre-existing cell structures. The informational system that directs the assembly of organelles in space and time is complementary to, but separate from, the instructions encoded in the genes. We infer this from the observation that spatial patterns are commonly inherited by pathways that do not involve genes, but turn on the structural organization of the whole cell. We do not yet understand the physical and chemical mechanisms that underlie directed assembly...but it is clear that these fall into two classes: local mechanisms, on the scale of molecules and large complexes, and global ones that extend over the entire cell. The properties of the latter recall what embryologists have traditionally called a field: 'a territory within which developmental decisions are subject to a common set of coordinating influences.'²¹

Note that in this text he is speaking only of unicellular organisms. The notion of morphogenetic fields was first used to account for the coordinated embryologic development of various regions of the bodies of multi-cellular organisms. For example, one field coordinates the development of the parts of a limb.

²¹Ibid., pp.144-145.

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The notion is also extended to fields within fields to account for the coordination of the parts into one whole organism.²² These findings are pushing biologists to look for something other than an aperiodic crystal such as DNA as the principle of life and it is also forcing them to see that life is more than chemical activity. I cite Harold again:

Biochemists and molecular biologists revel in the details of their subject; the key to finding order in the profusion is the concept of *function*. 'Living organisms are composed of lifeless molecules,' the late Albert Lehninger proclaims on the opening page of his classic textbook [*The Principles of Biochemistry*], but those molecules are special. The molecules of life differ from those encountered in the inorganic world, not in their chemical qualities, but in their biological ones: with few exceptions, such as waste products, each performs a job in the service of the organism as a whole. The notion of function is meaningless when applied to the constituents of clay or petroleum, for those molecules are the products of physical and chemical forces alone, but function becomes crucial when we ask why leaves are green and blood is red. Function implies purpose, and therefore, order. 'The molecules of which living things are composed conform to all the familiar laws of chemistry, but they also interact with each other in accord with another set of principles, which we shall refer to collectively as the *molecular logic of the living state*.'²³

Harold makes clear what he is driving at:

I share the commitment to a material conception of life, but that makes it doubly necessary to remember that

²²Webster and Goodwin, *Form and Transformation*, Cambridge University Press, 1996.

²³Harold, p.34.

before the cells were taken apart – as long, indeed, as they were alive – they displayed capacities that go beyond chemistry. Homeostasis, purposeful behavior, reproduction, morphogenesis, and descent with modification are not part of the vocabulary of chemistry but point to higher levels of order. Even as the catalog of small parts approaches completion, the transition from molecular chemistry to the supramolecular order of the cell emerges as a prodigious challenge to the imagination. Make no mistake about it: here we touch, if not the very secret of life, at least an essential stratum of that many-layered mystery. *For life to be convincingly explained in terms of matter and energy, organization is all that stands between a soup of chemicals and a living cell.*²⁴

This is a point that Harold makes throughout his book: order and organization (above the arrangements of atoms) for the sake of some function or purpose is what distinguishes the living from the non-living. Pointing to order as a principle is pointing to something formal rather than material as the principle of the living. Order is something that is in the matter, but not the matter; it is a different kind of principle. If Harold is correct, no material constituent can be a sufficient cause of life. For any material constituent is ordered by the whole rather than being the principle of the order in the whole. He is essentially in agreement with Book I of the *De Anima*, where Aristotle argues that the soul cannot be a material constituent of the body.

The question is then whether order is a sufficient explanation of the living. Harold himself does not think he has gotten to the bottom of what life is. It is noteworthy that this view is very much like another view of soul Aristotle considers in the first book of the *De Anima*, whether the soul is a *harmony*, for it also

²⁴Ibid., p.65 (emphasis is mine).

involves an order and arrangement of parts. The same difficulties can be raised against order as against harmony. Which order? As Harold points out, there are many kinds of order in an organism. Harold speaks of a hierarchy of orders even in unicellular organisms.²⁵ There is order at the level of atoms in molecules, order of the molecules into organelles of a cell, and the order or arrangement of the organelles. Multi-cellular organisms have these and more. If there is a hierarchy of order, then would it not be best to ask whether there is a principle of the order? Here Harold seems torn between two extremes: 1) seeing the higher levels of organization and the attributes that distinguish the living from the non-living, such as purposeful behavior and reproduction, as emergent properties arising from the lower orders, or 2) seeing that the order of the whole organism makes use of the properties of its constituents and gives order to them. He says that, "The organism in its totality is as essential to an explanation of its elements as its elements are to an explanation of the organism."²⁶ Here Harold seems to be left where the best of the pre-Socratics were before Aristotle solved the problem.

²⁵Ibid., p.13. "Many more would agree with Francis Crick that 'the ultimate aim of the modern movement in biology is in fact to explain all of biology in terms of physics and chemistry.' And a few reductionists go still farther, maintaining that the laws and theories formulated in biology should be rephrased as special cases of those propounded in the physical sciences. That the two latter goals are illusory has been amply documented by George Gaylord Simpson, Michael Polanyi, Ernst Mayr, and Alexander Rosenberg. Indeed, even a machine is not explained by mechanical principles alone, for its construction is guided by the designer's purposes which constrain the blind operation of physical laws. In the case of living organisms, it is their *hierarchical organization* and their origin in the interplay of random variation and natural selection that should give pause to any radical reductionist. And it is noteworthy that our unquestioned success in unraveling the molecular mechanics of life have thus far yielded little into the genesis of coherent forms and functions on the scale of cells and organisms." (Emphasis is mine.)

²⁶Ibid., p.94.

At the beginning of Book II of the *De Anima* Aristotle says that we should, "...begin again as if from the beginning, trying to determine what the soul is and what would be the most common account of it" (412a6). He says this after having considered the views of his predecessors in Book I, all of whom proposed principles to explain either self-movement or perception, the two activities of living things that most obviously distinguish them from the non-living. When Aristotle makes his fresh start in Book II, he shifts his consideration from the activities of the living to what it means for something to be alive. It is clear from the divisions he makes to get to the definition of the soul that he is considering life, or to be alive, insofar as it belongs to substance. This fits with the way St. Thomas defines life in the *Summa Theologiae*:

The name is given from a certain external appearance of the thing, namely, self-movement, yet the name is not imposed to signify this, but rather a substance to which self-movement, and to act of itself in any kind of operation, belongs according to its own nature. To live, accordingly, is nothing else than to exist in such a nature.²⁷

Modern biologists have difficulty with the notion of substance. Because biologists think of living things as machines they tend to speak of an organism as a system. Harold, for example, says that "Life designates a quality, or property of certain complex dynamic systems that persist by channeling through themselves streams of matter, energy and information."²⁸ He clearly sees that life is a quality that belongs to a subject that persists through activities that are proper to living things. But is it adequate to say what persists is a system? System denotes an order

²⁷*Prima Pars*, Q.18, art.2, my translation from the Latin.

²⁸Harold, p. 254.

and arrangement of parts. If you change the parts or their order do you have the same system? Do systems grow or do you simply have a new, larger system? The notion of system gives more emphasis to order and arrangement than to something that underlies a change; it is too formal. On the other hand, the very notion of substance is that it stands under or persists through change.

More importantly, a system is not one the way an organism is one. Ordinary experience, especially experience of ourselves, tells us that an organism remains the same being or substance through all life's changes. We think of substance as something that exists of itself; things other than substances exist in it. Quality, for example, does not exist by itself but only in a substance. A system is an order and arrangement of substances. It follows that if an organism is a machine or a system, it is the parts that are the substances, if there are any substances at all. However, if organisms are beings that exist of themselves and underlie change, we must consider them as substances. This is the proper starting point for determining what the soul is.

Aristotle's Definition of Soul

Before examining how Aristotle arrives at his definition of the soul, let us begin by stating his points of agreement with modern biologists. All agree that there must be some principle that distinguishes the living from the non-living. This principle must be the agent cause of the organism's development and its activities. It must determine the species of the organism and, in some way, be in all of the parts. Aristotle would even agree with Richard Dawkins that the body is for the sake of this principle.

Taking as given then that an organism is a substance, Aristotle distinguishes the whole substance from its parts, but taken in a sense different than biologists have considered. Rather

than distinguishing the material constituent parts that make up the whole, Aristotle divides the substance into matter and form or species. In order to understand what Aristotle means by form (*morphe*, in Greek), we must see that the term has more than one meaning, as is clear by the fact that he adds the term “species” to help clarify his meaning as he uses it to explain this composition in living things. Biologists are not strangers to the term *form*. Morphology is part of the study of anatomy. Embryological development is called morphogenesis. They also speak of different *forms* of life. Yet, while some biologists touch on this notion, they seem ignorant of the distinction between matter and form.

The first meaning of the word *morphe* is shape, and this helps us understand how its meaning can be extended. For example, marble together with its shape makes a composite, a statue of Abraham Lincoln. The matter and form are two different kinds of principles. The matter underlies the activity of being shaped and receives the shape. The form comes to be in the matter at the term of the process and makes it to be a statue of this particular person. The meaning of form can be extended to include any notion of order or arrangement of parts. This is why we said earlier that when Harold speaks of order or organization, he is speaking of a formal principle. Thus far the forms are sensible, but the term can be extended to qualities, habits, or anything that is acquired at the term of a change, including a change in substance which terminates in a thing of a certain kind or species. In coming to his definition of the soul Aristotle equates “form” with “actuality.” What is common here is that form or actuality is something in matter but is not the matter itself, and the actuality gives the matter some attribute or character.

Aristotle then says that actuality can be understood in two ways, “the one as science, the other as consideration” (*De Anima*, 412a10). For example, one can possess the science of geometry without actually considering at a given time what he knows.

But by this habit one can freely bring to mind what he knows when he so desires. Aristotle calls the simple possession of the habit “first actuality,” which has potency to a “second actuality,” which in this case would be thinking about geometrical things. Generally speaking, then, first actuality is ordered to second actuality as potency to act.

Having made these distinctions Aristotle quickly comes to his definition of soul by arguing that the soul cannot be a body, since this is what all natural bodies have in common. Living things are bodies of a certain sort, that is, bodies having life. He specifies the meaning of the term ‘life’ by activities such as self-nutrition, growth, etc. Now it is striking that he specifies life by activities rather than pointing to the thing that has life (as he does later when he says, “Living is being” in Ch. 4, 415b13). But this will help us understand his first complete formulation of the definition: “the first actuality of a natural body having life potentially.” A soul, then, is the first actuality, that is, it gives this body the power or ability to perform certain activities, those characteristic of life. These activities are what he is referring to when he says “having life potentially,” because what he means by ‘life’ are these very activities. To put it another way, the soul is the first actuality of a natural body that makes it able to nourish itself and grow, etc.

Aristotle goes on to say that what gives the body the power to perform life’s activities is the fact that the bodies of living things are organized. And by organized, he does not only mean having an order of parts, but having organs or tools for performing the functions needed for life. Hence he gives another formulation of the definition: “the first actuality of a natural organized body” (412b6). Thus the soul is the form or actuality that makes the body organized, and therefore able to act. Isn’t this what

Harold was driving at?²⁹ According to his account there has to be some principle that is a cause of the order and organization of the whole organism.

Note that this definition solves a problem raised by Rensberger when he argues from the inertness of frozen cells to the view that there is nothing more to life than chemistry:

In place of the animating “vital force” of 150 years ago, modern biology confirms the view that all the phenomena that together constitute life can be understood in terms of chemistry and physics. The frozen cells possess the right chemicals in the right combinations and in the right structural arrangements to live. The cold temperatures simply deny the cells the thermal energy needed for the chemical reactions to proceed. Like a car battery in a Minnesota January, the chemistry simply won’t go when it’s too cold. But add a little energy in the form of heat, and *chemistry happens*.³⁰

Here is a case where a living thing has first actuality without second actuality. Aristotle might not have imagined such a case in living things where the two grades of actuality could be so completely separated in a living thing. He would point out to Rensberger that the frozen cells have the right combinations of chemicals in the right structural arrangements to live *because* they have the first grade of actuality. The frozen cell, therefore, has life, but when it is thawed out *living happens*.

Immediately after Aristotle defines the soul, he says that this solves the problem about the relationship between the soul and the body. The soul is not a substance or material constituent in the body as DNA is. Biologists will not be able to separate

²⁹Ibid., p. 113. “If a cell is an orchestra and DNA the score, who or what conducts?”

³⁰Rensberger, p. 21 (emphasis is mine).

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the soul out and put it on a scale. It is related to the matter of the body analogously to the way that order is related to matter. When a molecular biologist puts an organism into a blender to study its chemistry, the order is destroyed; just so, life and its principle are destroyed. To put it more generally then, the soul is related to the matter as its form or actuality.

This actuality makes the organism one thing, because the soul is the actuality of the whole and all of its parts. Rensberger tells us that what distinguishes cancer cells from other cells in the body is that cancer cells are no longer under the control of the organism. They do not act as parts serving the whole; rather they grow and reproduce as if they were parasites in the body. But the parts of the organism, even cells which are capable of living separately from the body, act as parts of one and the same substance; they participate in the one life of the whole organism. So the soul, by being the actuality of the whole and all the parts, is the principle of unity of the organism. DNA, on the other hand, although present in all cells of the body, is not a principle of unity; rather, its activity is regulated by the whole organism.

The soul, according to Aristotle's account, is also the first principle of agency in the organism. Every agent acts in virtue of its form or actuality. Since the soul is the first actuality of the organized body, it is the principle of all the organism's operations.

Finally, Aristotle argues that the soul is also a principle as an end or final cause. For the body is a tool or organ of the soul. Everything the living body does is ordered to maintaining its life. Moreover, the lower activities are ordered to the higher. This is most clear in man, where the lower bodily activities are ordered to perception and knowing, and human knowing is an activity proper to the soul itself.

As we stated at the beginning of this section, there is general agreement about the characteristics of the principle of life. Aristotle's notion of the soul has all of these attributes.

One might, however, make the claim that Aristotle really has not explained anything. To say that the soul is an actuality that makes a thing alive is like saying that Vladimir Horowitz is a great musician because he possesses the form of music or that Grace Kelly is beautiful because of her form, the form of beauty. Well, maybe Grace's beauty does have something to do with her form, but what does Vladimir's musical skill have to do with form? It is true that we can name a principle from the activity it causes without knowing the principle, because we know the activity first. Scientists do this all the time. Notice RNA polymerase could have been named before the molecule was discovered by simply knowing the chemical reaction that it catalyzes. The name does tell us something. We know there is an activity that is the effect of some cause, and the more we know about the activity the more we know about the cause.

Aristotle has more to say about the form of music that Mr. Horowitz possesses. He would call it an art and classify it as an intellectual virtue. Virtues are habits that must be acquired by repeated action. The particular art is defined by what it produces and what instrument it uses. To understand the form or actuality that Horowitz possesses you would have to hear him in concert and see how he performs. You could inquire in detail what exercises he practiced to acquire the art.

What would the scientist want to add to this? Can he point to the art? While Horowitz is in concert, a physiologist could monitor his brain, his sensory and motor neurons, his muscles and bones. He may be able to discover some pattern in all of that information. Would he be able to tell the difference between Horowitz playing the piano and Horowitz typing on his laptop just by that information alone? The pattern would probably be unintelligible without seeing and hearing what Horowitz is doing. Moreover, the pattern would be different for every piece he plays. But this is when Horowitz is in the act of making music.

He still possesses the art when he is not playing. What can a physiologist tell us about this? He can tell us that repeated action has an effect on neural pathways and muscle tone. He may be able to say something about the various ways in which there is memory. But how would he explain the unity of this art? By one art he is able to read and play all sorts of music and even improvise. Is there anything a physiologist can point to and say, "Here it is, here is the art"? Aristotle would say Horowitz's art is in his intellect insofar as he knows certain principles by which he performs, but it is in his whole body insofar as his art involves performance. So, in some way the art is in the whole being of Horowitz. Yet, as unsatisfying as it might be, it is not a sensible form. We know, however, that there is some actuality there that can be acquired by hard work.

Is it unfair to use man as an example? The same difficulties would arise if we considered the instinct of animals. There is nothing sensible we can point to and say, "There is the instinct." We know the instinct by its activity, but we cannot point to the instinct itself. Therefore, the fact that this account of the first principle of life involves something that is not sensible is not a reason for dismissing it. It is clear from the activities of living things that there must be some such actuality we call the soul, however unsatisfying it is that we cannot get our hands on it.

As mentioned before, Harold seems torn between seeing life as a property that emerges out of an arrangement of molecules or something that can only come from the living whole. He argued that life cannot come about simply by self-assembly. But he pointed out that there is another sense of self-assembly that is admissible: growth. Let us add to this: morphogenesis. It is clear in these cases that life is prior to these activities. What is inherited from the parents is not only a structure and arrangement of parts, but life itself, which makes growth and development possible. Hence, the properties of living things do not emerge

out of the elements. Metabolism, homeostasis, morphogenesis, and reproduction are not properties of the elements, and they do not emerge by simply putting them in a particular arrangement. These properties belong to a living organism as a whole, and they have them because of the actuality that makes them organized, giving them the power of performing these activities. The only way elements, compounds, and generally anything non-living become living is by being consumed and assimilated into a living organism.

Schrödinger's theory of life turns out to be untrue. His motivation came from the desire to unify the sciences of physics, chemistry and biology, which desire is understandable and even praiseworthy. Although the majority of biologists were willing to accept his theory as true, the facts have not borne out the theory. Schrödinger assumed that there is no essential difference between the living and the non-living and he ignored the substantial unity of an organism in order to propose his theory. Ordinary experience tells us that these are not the proper starting points for answering the question, What is life? Furthermore, one cannot come to knowledge of what the principle of life is without making a clear distinction between matter and form.

The view of life presented here has implications for the theory of evolution. The neo-Darwinian theory of evolution is predicated on Schrödinger's theory of the aperiodic crystal: mutate genes sufficiently and a new species will be produced. But we have shown that genes are not the principal agents of embryological development, and they do not give the organism life or make it the kind of life it is. The principle of life is a form or actuality that not only gives the substance life but also its species. I have argued more fully elsewhere³¹ that this actuality of the offspring comes by a participation in the life of its parent

³¹Kaiser, *Is Darwinian Evolution Possible?* Aquinas Review, Vol. 13.

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until the offspring separates from the organs of its parent and becomes a distinct substance. This explains the biological law that *like produces like*. Given the modes by which living things are generated, either a parent will produce its like, or, because of a defect, something inferior. This is all that a parent is naturally able to do. Therefore, if evolution has occurred, especially in the cases where a higher form comes from a lower, we must find an agent that can cause the coming to be of a new form or essence, in other words, a new kind of soul.

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