

An Argument for Substantial Form

Steven Baldner
St. Francis Xavier University

I provide an argument, based on Thomistic principles, for substantial form, understood as the single principle of substantial actuality for any natural substance. To make this argument, I distinguish between substance and accident, between the natural and the artificial, and between ontological and methodological reduction. I respond to two objections to the Thomistic doctrine of substantial form raised by Benjamin Hill: I explain how it is possible for Thomas to account for the presence of elements in compounds and also to account for the fact of natural instances that fail to realize the full reality of the substantial form (“monsters”).

I begin by offering my sincere gratitude and appreciation for the excellent paper we have heard from Professor Hill.¹ I am going to attempt to argue against some of the conclusions reached by Prof. Hill, but I do so with humility, for, however much I might be convinced of the truth of Thomistic monism, I am even more certain of my own inadequacy to the task of competing with the metaphysical analysis we have already seen. My goal here is not so much to give you better arguments, for I don't think that I can, as to give you some reason to try to find better arguments yourselves. And perhaps you will do just that in the question period. I shall attempt to do two things in this paper: first, to give an argument for substantial form and second to give replies to some of the objections raised so well by Prof. Hill.

Before I talk about the problem of substantial form, I want to explain certain underlying principles in my analysis. First, I recognize that philosophical concepts are more fundamental and more general than the conclusions or discoveries in modern science. The philosopher's principles and concepts provide a *general* way of understanding the world; the natural scientist will tell us in ever more wonderful detail about how the world is to be understood *specifically*. Thus, to take certain obvious examples, we now know much, much more about living systems than Aristotle or Aquinas would have thought we could know, with results in medicine and agriculture that are astounding, but the modern biologist cannot tell you *qua* biologist what life is. Or, what we know today about the atomic and subatomic structure of matter has allowed us, for good or for ill, to unleash forces that the ancients and mediaevals could never have imagined, but we do not, for all of that wonderful accomplishment, know anything more about matter in its most basic sense—the “prime matter” of which Aristotle spoke so insightfully. My assumption here is that both philosophy and science provide knowledge about the same world, but philosophy's yield is *general*, whereas science's yield is *specific*.

A second principle is that general knowledge is metaphysically and epistemologically prior to specific knowledge. You must have a general knowledge of the world before you can do more specialized research. If the chemist did not already think in terms of substantial wholes and

¹ All references to Prof. Hill are to Benjamin Hill, “Substantial Forms and the Rise of Modern Science,” presented at the Metaphysics Colloquium, Saint Anselm College, 20 June 2007 and reprinted in this electronic journal.

elemental constituents, he would not attempt something like chemical analysis or synthesis. A philosophical understanding does not arise as a consequence from a scientific investigation of the world; rather, our scientific work is consequent upon our prior philosophical understanding of the world. That is, because we have a certain general understanding of the world, as when we have an understanding of the relation between substances and elements, we are led to conduct experiments to try to understand that relation better; it is not the other way around. Since philosophical knowledge is prior to scientific conclusions, it cannot be negated by what we know in science. The point I am driving at should now be fairly obvious: if there are good philosophical reasons to recognize the reality of substantial form, nothing we learn in the natural sciences will lead us to gainsay that claim. Hence, when we tell the story of the rise of modern science and of the demise of hylomorphism, I want to avoid any *post hoc ergo propter hoc* fallacy. It may well be true that philosophers stopped talking about substantial forms after the rise of seventeenth century science, but there was nothing about the discoveries in the modern era that required them to do so.

In addition to these basic principles, I make three distinctions that will guide my remarks. First, I distinguish between the substantial and the accidental. I don't want to beg the question and claim that our world is made up of these two kinds of actualities (although, in fact these *are* the two fundamental kinds of being), but I want to make the distinction hypothetically. *If* there are substances and *if* there are accidents, then there is a fundamental difference between the two: substances do not exist or inhere in another substance, but accidents do exist or inhere in another substance. Here, surely, is a logical divide that we cannot avoid. And it is one that corresponds to our experience, but it may be that our experience is somewhat misleading and that, really, the distinction is based on an illusion. However, if the distinction is not illusory, there is an important implication of recognizing the distinction. Since substances are independently existing entities and since accidents are dependently existing entities, it would follow that the principles that explain substance cannot be accidental. Form and matter—if they are to explain substance—must at least be substantial rather than accidental. If we do recognize the reality of substances as distinct from accidents, the principles we use to explain substances cannot be anything accidental. Only a substantial principle could explain the reality of a substance.

Second, I distinguish between the artificial and the natural.² At the simplest level this is a distinction between what has been made by man and what has not: chairs, computers, and automobiles being in the first category and gold, geraniums, and dogs being in the latter. At this obvious level the distinction is clear enough. There are, however, more profound differences, which it will be helpful for us to consider. To help us focus on the difference between the artificial and the natural, it will help to consider the difference between a machine and a natural substance. Any machine, even the simplest, *is* a machine by virtue of a spatial ordering of parts. That is, what makes a machine a machine is the fact that some parts are physically distinguished from others in space and are so ordered as to achieve some human purpose. This is obvious for a

² In this paragraph I follow the distinction made by Richard Connell between the natural and the “artifactual” in *Substance and Modern Science* (Houston: Centre for Thomistic Studies, 1988) pp. 64–73.

fairly complex machine like a bicycle, but it is also true for a simple machine like a knife: the handle must be distinguished from the blade. Obviously, living organisms have a spatial ordering of parts, but that spatial ordering of parts is not what makes them alive. The corpse and the living man have the same spatial ordering of parts, but there is a rather dramatic difference between the two. Secondly, this spatial ordering of parts in a machine is imposed from the outside; it does not spring up from within, as it does in natural substances. All mammals, for example, begin their lives as one cell, but this one cell divides and divides and eventually, as an organism of numerous cells, begins to distinguish itself into different organs. Computers or automobiles, by contrast, must be assembled from the outside. Third, the new structure of a machine does not bring about any new physical properties in the machine. If a machine is composed of metal parts that have certain properties (of density, hardness, malleability, conductivity, etc.) then the assembled machine will also have those exact same properties. Natural substances, however, always exhibit new physical properties. Hydrogen and oxygen are both at room temperature flammable gases; water, which is composed of these two, is a liquid that can be used to extinguish fire. Fourth, a machine does not manifest new powers or energies that are any different from those of the parts out of which it is composed. Machines are essentially passive: outside sources of energy cause parts to move that move other parts, but there is no new power that is proper to or novel in the machine itself. By contrast, living organisms manifest a whole range of powers that cannot in any way be found in the organic elements out of which they are composed: growth, self-repair, reproduction, respiration, self-motion, sensation, and so forth. Fifth, and finally, machines are not properly one thing but are aggregates of the substances out of which they are composed. A natural substance, by contrast, is one thing. I realize that this is a controversial claim in the light of the mechanist and Franciscan pluralist criticisms that might be brought against a Thomistic notion of substance. I cannot *prove* against a mechanist or a pluralist that natural substances are united in ways that machines are not, although I think that the unity of natural substances is rather obvious in our experience. But even if one disputes this, the question of whether natural substances are or are not unified wholes is, like the distinction between the natural and the mechanical, a properly *philosophical* question. We should not look to the specialized sciences to give us an answer to this question.

Now I have spoken at length to illustrate the importance of the second distinction I am trying to make: that between the artificial and the natural. I place some stress on this because, if a mechanistic philosophy or understanding of nature is to be held, we must be clear, I think, about what it is that we mean by a machine. If what I have said about machines is true, is it also true about natural substances? Quickly to recap: machines are spatial structures only, they are constructed from without, they manifest no new physical properties, they manifest no new powers, and they are aggregates. The opposite, I maintain, is true of natural substances on all of these points.

My third distinction is a distinction between the ontological and the methodological. It is one thing to give an account of real being; it is quite another thing to give an account that satisfies methodological requirements. Francesco Ayala and others have helpfully distinguished

between ontological and methodological reductionism,³ and I think that something like that distinction is needed in our discussion. If there is merit in my first assumption, that philosophical knowledge is general whereas scientific knowledge is specific, then it might be reasonable to expect that a specific and detailed analysis could profitably leave out of account certain realities that must be included when one is giving a general account. Contemporary empirical sciences, which are very highly specialized, regularly leave out of consideration—and rightly—any consideration of general philosophical categories. Their methods require a prescinding from the general. In so doing, they tend to view nature in a reductionist and mechanist way. There is nothing wrong with such a focusing of attention. The only mistake, I would claim, would be that of supposing that reductionism or mechanism is a *complete* account of nature. Obviously, it is helpful to reduce the study of biological organs to a kind of mechanistic account: the heart really is like a pump. The mistake, I would argue, would be to conclude that what we know of the parts applies without qualification to what we know of the wholes. Mechanism may give a true account of most biological phenomena, but it does not for all of that necessarily give a true philosophical account of natural reality in its fullness.

I shall now offer what I intend to be an Aristotelian or Thomistic argument for substantial form. It should be realized at the outset that principles cannot be demonstrated, and the reality and unicity of substantial form is a principle of Thomistic natural philosophy. The arguments that I will give, therefore, will be dialectical. The principal difficulty, it seems to me, in understanding substantial form comes not from understanding form itself but from understanding matter. That is, in order to recognize the reality of substantial form, we must first recognize the true nature of matter. The arguments for substantial form look like this.

1. If substantial change is real, then it can only take place because matter is fundamentally indeterminate (i.e., it must be pure potentiality or “prime matter” in Aristotle’s and Thomas’ sense). Substantial change is real; therefore, matter is fundamentally indeterminate.
2. If matter is fundamentally indeterminate, then some principle must account for its being determined or structured. But matter is fundamentally indeterminate (from the preceding argument). Therefore, some principle must account for its being determined (this principle is substantial form).

Let us consider the first argument.

I claim that if substantial change is something that really occurs in our world, then matter at its root is not any identifiable thing or substance but is a purely undifferentiated potency. Why do I say this? Well, clearly when substantial change occurs a new substance comes into being, but it does not come into being *ex nihilo*. I do think that we must accept the Eleatic dictum: *ex*

³ F.J. Ayala, “The Concept of Biological Progress” in F.J. Ayala & T. Dobzhansky, eds., *Studies in the Philosophy of Biology: Reductionism and Related Problems* (New York: MacMillan, 1974) pp. 329–354.

nihilo nihil fit. To say this another way, clearly there is a before and an after in substantial change: something old is replaced by something new. But there must be something that underlies the change, something that is in some sense continuous from the old to the new. There must be a substrate in substantial change.

The question then is, what is the nature of this substrate? There are only two possibilities: either the substrate is something determinate or it is something indeterminate. When I distinguished between substances and accidents, I pointed out that substances cannot be dependent upon accidents. This means that the material substrate of substantial change cannot be something accidental. If the substrate is determinate, then, it must be an actual, identifiable substance. But if the substrate of substantial change is an actual substance, then the resultant substance must be an aggregate of some sort. And here, again, we have only two possibilities. Either the aggregate is accidentally united, which is the position of the 17th century mechanists (I take it from Prof. Hill) who deny the distinction between substance and accident. Or the aggregate is substantially united, which is the position of the Franciscan pluralists. If we do accept the Franciscan pluralist position, then we have accepted substantial form, for if the position is successful it does uphold the existence of substantial form.⁴ The mechanists' position, however, cannot be accepted, if we recognize the reality of substantial change. I think that Prof. Hill has drawn the correct conclusion: if we accept the mechanist explanation of natural things, then we cannot accept either the idea of substantial change or the distinction between substance and accident.

Hence, if we do accept the reality of substantial change, and if we do not accept the Franciscan pluralist position, we must accept the claim that matter at its most basic is prime matter or pure potency. But let us go at this in another way. I said before that matter must be either determinate or indeterminate. If it is determinate, it must be something that we can in principle identify.⁵ If we can identify it, then it would presumably be (in our current terms) a subatomic particle. But if that particle is the primary instance of matter, then it must be ungenerable and indestructible, for otherwise there would have to be some prior material substrate out of which it could be generated. Such an atomic unit, however, is implausible on two counts. First, to suppose such a thing is to suppose the existence of a natural thing that is fundamentally unnatural, for all natural things are liable to generation and destruction.⁶ Second,

⁴ But can the Franciscan pluralist position be accepted? I don't think we can, if we accept the idea that natural substances are, as I indicated in the beginning, unified wholes. In the human case, I think that the Franciscan tendency was always toward some sort of Cartesian dualism, and I think that Cartesian dualism is false. I cannot demonstrate the falsity of dualism, but I think that it is obviously false to claim that the relation of me to my body is something like the relation of me to my automobile. And I do think that the pluralist position tends to imply this sort of dualism in human nature.

⁵ This, by the way, is one of the difficulties with the pluralist position. A pluralist would have to maintain that matter is something determinate, because it is something made actual by substantial form, and if this is so, then it must be something that in principle we could discover or verify empirically. But I don't think that anyone would say that, for example, the Bonaventuran notion of matter is something that scientists will one day discover. Thomistic prime matter, by contrast, is something that, as Aristotle says, we reason to by analogy.

⁶ William A. Wallace has argued that, at the most basic level, the particles of contemporary physics are *transient* realities: *The Modeling of Nature* (Washington, DC: The Catholic University of America Press, 1996) pp. 53–58.

the supposition of such a particle seems to go counter to what we are told by contemporary science, according to which all particles are liable to generation and destruction. In fact, there seems to be recognition in contemporary physics of something like prime matter, for at bottom matter is now understood by physicists to be a matrix of mass-energy.⁷ Neither mass nor energy is prime matter, but the fact that matter in its most basic form is seen as a kind of potency for either mass or energy is an indication, I think, of the potency that is matter.

If it is true that matter is an indeterminate potency, then the second argument must be made. If matter is fundamentally indeterminate, then some principle whereby it is determined and structured must be found. Structured matter is not an explanation; it is, in fact, a thing to be explained. If matter has no structure, then the fact that we always find it structured is something that requires an explanation. The explanation, of course, is form. That is, form is the explanation of what Prof. Hill has called the problem of subduction—it is not the explanation for the problem of eduction. If it were the case that matter is inherently structured, and this seems to be the position of the mechanists, then it would be reasonable to say that structured matter in some new structure is what accounts for any new reality. In that view of matter, structure itself could play the role of form. But, again, we can only accept that view of matter if we reject substantial change and the distinction between substance and accident.

If we do accept the distinction between substance and accident, and if we grant, as I have argued we should, that the principles of substance cannot be accidents, then we have a reason to see why structure cannot be a surrogate for substantial form. What characterizes any structure and any change in structure is always something accidental: a change, for example, in spatial relationships. But if substances cannot be dependent upon accidents, then no substance could be a substance because of some accidental determination. Structure itself could not make a substance to be a substance, for it is itself fundamentally constituted by accidental relationships.

I hope that I have just given you a dialectical argument for the reality of substantial form. But what, really, am I arguing for? Fundamentally this: that natural, substantial wholes are always realities that are not reducible to the material constituents of those wholes. Mechanists sometimes claim that there is something “mysterious” or “spooky” about substantial form—as though we have to bend the knee and talk in reverentially hushed voices whenever the word is mentioned—but, really, form just means “actuality”. It is just a way of saying that some new actuality, radically different from what it was made out of, has come into being. And surely there is nothing mysterious or spooky about that: it is an obvious fact that compounds are radically different from their elements, that living plants are radically different from organic compounds, that sensate animals are radically different from other living things, and that the reasoning and joking animal is very different again from all other animals. This is not mysterious or spooky, it is an obvious fact that we live with all of the time. The word “form” is just a philosophical way

⁷ There are many expressions of this idea. Here is one from an eminent contemporary physicist. “From $E=mc^2$, we know that mass and energy are interchangeable; like dollars and euros, they are convertible currencies (but unlike monetary currencies, they have a fixed exchange rate, given by the speed of light times itself, c^2).” Brian Greene, *The Fabric of the Cosmos: Space, Time, and the Texture of Reality* (New York: Vintage, 2004) p. 354.

of designating this. One could say simply that the substantial form of hydrogen just is hydrogen, that the substantial form of water just is water, that the substantial form of a geranium is a geranium, and so on. This, as you will recognize is the Scholastic way of using “form” to mean the “form of the whole”—it applies to the whole substance. But, occasionally, as when we are trying to argue about these things philosophically, we need to consider the form of the part, that is, form as opposed to matter—and then we are using the term in a properly philosophical way that the scientist does not need at all. It is, however, most helpful for us to realize that the form of the part always indicates that the whole is greater than its constituents or that the form *transcends* the matter. This *transcendence* is true at every level—compounds over elements, living over non-living, sensation over non-sensation, rational over non-rational—except that the sort of transcendence gets bigger as we go up the scale. But again, I do not think that this is more than can be dreamed of in our philosophy, unless our philosophy cannot allow that human animals, for example, can think. My thinking is not a material process, but it belongs very much to me, and I am a bodily animal. I don’t think that this is at all mysterious or spooky, unless one insists on a reductionist’s canon for what is metaphysically acceptable. Like Aristotle, however, I think that the physical or the natural is not reductively mechanical: but that is not at all mysterious or spooky.

I have argued for substantial form. Now I wish to turn my attention to two potent objections to hylomorphic doctrine that have been forcefully made by Prof. Hill. First, I should like to consider the third objection he raised, that concerning the presence of elements in compounds or “mixtions”. Prof. Hill rightly raises this objection as one of the fundamental objections to hylomorphic doctrine. Aristotle said enigmatically that elements are that from which a thing is primarily composed, that they remain in the compound substance, and that they are indivisible in species.⁸ The difficulty with this understanding of elements seems to be apparent right away, as Prof. Hill has pointed out. If the elements really do remain in the compound substances of which they are the elements, then it seems that the resultant compound is not really some new substance but is merely an aggregate of the substances out of which it is made. On the other hand, if we say that the elements are simply destroyed, then it seems that we are not really talking about elements in Aristotle’s sense that in some way really do remain in their compounds. Or, one might say that the elements remain in compounds but do so in some diminished or remiss state. To say this, however, is to say that a substantial form could be more or less what it is, but in fact substantial forms do not admit of degrees in that manner. If the substantial form is present, then the substance is actually existent; if the substantial form is absent, then the substance is non-existent. There is no middle ground here: either the substance exists or it does not exist.

I shall try to explain the position of Thomas Aquinas on this problem, but I would like first to comment on Thomas’ rejection of this third possibility, for the rejection is revelatory of

⁸ *Metaphysics* 5.3 (1014a27). Aristotle’s fuller discussions of elements can be found in *De generatione et corruptione* 2.1–8 (328b26–335a23) and in *De caelo* 3.3–8 (302a10–313b24).

Thomas' thinking and helps to clarify his position.⁹ On this third possibility, Thomas was aware of two positions, both of which he rejected. One position is that of Avicenna, which, in fact, was also the position of Thomas' teacher, St. Albertus Magnus. According to Avicenna, and to Albert,¹⁰ we explain the existence of elements in compounds by distinguishing between the *first* and *second* being of the elements. The first being is the being identified with the substance or the essence of the element. Second being is that of the properties or attributes of the elements. The Avicennian/Albertinian position would be that elements are substantially present in compounds (present according to their first being), but that the qualities or properties of the element do not exist as such in the compound. Thus, there is no "more or less" of the elements, for they either are or are not in the compound. But there is a "more or less" of the secondary being, that is, of the powers or qualities of the element.

Albert provides a gloss on this position that is very interesting.¹¹ He claims that the elements are not substances that exist independently from the compounds in which they exist as elements. They are rather transitory entities; they are, as he says, a *via ad aliud*. They are not the sorts of things that exist as substances on their own but they exist always or mostly as material constituents in compounds. In this, the elements would be like subatomic particles in our cosmology, which normally exist as parts of atomic structures within substances and which only exist independently for very short periods of time under highly artificial conditions. The substantial form of the element would be a sort of hybrid form—something in between a substantial and an accidental form.

Thomas rejects this position, for it gets the relation between substantial form and the properties that arise from substantial form wrong. According to Thomas, if it is true that the substantial form is present, then it must be true that all of the properties that flow from that form are present. If the substantial form of water is present, then all of the properties that belong to water must be present. If Albert's or Avicenna's position were true, it would imply that contradictory qualities could be simultaneously present in a compound and that the compound was really an aggregate and not one substance.

How then does Thomas explain the presence of elements in compounds? Thomas uses the term *in virtute* or *virtualiter* to characterize the presence of elements in compounds.¹² The elements are present by their powers in compounds. What does this mean? I think that Thomas means that the substantial forms of the elements corrupt when elements are made into compounds. When, in Thomas' terms, flesh and blood are made out of water, water actually ceases to exist and part of a human body begins to exist. He does not mean to say that the substantial form remains in any way in the compound. On the other hand, he does mean to say that the power or quality of the element does remain in the compound. But, and this is the crucial

⁹ See my fuller explanation of this: Steven Baldner, "St. Albert the Great and St. Thomas Aquinas on the Presence of Elements in Compounds," *Sapientia* 54 (1999) 41–57.

¹⁰ Albertus Magnus, *De caelo*, lib. 3, tract. 2, c. 8.

¹¹ Albertus Magnus, *De caelo*, lib. 3, tract. 2, c. 1 (ed. Colon. 221:6–13).

¹² *De mixtione elementorum* (ed. Leonine) 156–157: 119–153.

point, the original power or quality of the element comes to exist in some altered way in the compound. Thus water no longer exists in the human body, but blood and flesh are liquid or moist. That is, something of the character of water remains, although the water does not. This character, quality, or power is attributable to the fact that the compound was composed out of the element, but the exact nature of that character or quality is now determined by the new substantial form. Further, it is possible to extract the element from the compound, and when that happens, the element will retain its primitive qualities. So, the fact that some version of the element's qualities is present in the compound is attributable to the element, but the exact qualities will not be present. Substantial form always determines (within a range) the exact qualities that belong to the substance. Elemental qualities exist in a "more or less" state in their compounds, but the elements themselves do not exist in compounds.

I think that a difficulty in understanding Thomas' position on this matter is the fact that we know that many chemical compounds do not manifest any of the "qualities" or "powers" of which Thomas spoke. We know that salt is composed of sodium and chlorine, and we know that none of the qualities (in Thomas' sense of the word) of either sodium or of chlorine are in salt. Modern chemistry does not seem to bear out Thomas' claim. And yet, I think that it might do so, after all. In one important way, we have a much stronger sense of elemental presence in compounds than Thomas did, for we have identified the atomic structures of natural compounds. We know that the bonds formed between atoms are fundamentally based on electrical force and that the possible kinds of bonding are determined by the number of electrons in the outermost shell of the elemental atoms. This ability to form a bond based on electrical force determines what kinds of combinations of atoms are possible and what kinds are not. An elemental atom might lose or gain electrons, in which case its bonding is ionic, or it might share its electrons, in which case its bonding is covalent. This ability to bond or not to bond, and only to bond in certain ways and not in others, is a power that always remains in the element. It determines both how the atom will bond in the compound and how it can be separated through chemical analysis. That power for bonding, I would argue, is a good modern analogue to the mediaeval notion that the qualities or powers of the elements remain in compounds.

In general, I am trying to argue that Thomistic natural philosophy has no difficulty in explaining the elemental presence in compounds. One must say that the substantial form of the element ceases to exist, which is to say that the element no longer exists as such, but one must also say that some residual trace, in the form of a power or ability, does remain in the compound. We must reject—alas!—the simpler chemistry of the four elements, but we do not, for all of that, have to reject the natural philosophy that was developed when such a chemistry was current.

A second objection that Prof. Hill has made to hylomorphic doctrine concerns monsters. The objection concerns the role of substantial form in determining the properties of a substance. In Aristotelian doctrine, an accident may be adventitious in the sense that a substance might possess it or not, and possessing it or not does not change the nature of the substance. The fact that I am now lecturing to you, that I am standing, that I enjoy good health are all accidents of this adventitious sort. They could all change, and they will all change, and yet I remain very

much just the same substance that I was before. Other accidents, however, are considered to be properties: they are the accidental qualities that are determined by the substantial form. Thus, my being rational, able to sense, able to move, and so forth, are accidental properties of me, but they are vastly different from the adventitious sort of accident. In scholastic doctrine, they flow from the substantial form; they are in some way essential to my being the kind of substance I am.

The difficulty concerns these *propria*. What do we say about cases of substances in which these properties are not realized, or not fully realized? A monster could be defined, I suppose, as a substance that has a substantial form but does not realize all of the properties associated with that substantial form. The difficulty is how to explain such cases. In particular, Prof. Hill has raised the objection that, since deficiencies in material and efficient causality will be used to explain the existence of monsters, it would seem that material and efficient causes have frustrated the role of the formal cause. But formal causes should be prior to efficient and material causes, and hence such a frustration of formal causes should not be possible. Prof. Hill distinguishes two different kinds of monsters: heterospecific and homeospecific. Heterospecific monsters are those, like centaurs, that partake of two substantial natures simultaneously. Homeospecific monsters are those, like mentally challenged human beings or Siamese Twins, that are defective members of but one species.

I would offer several comments in response to this sort of objection. First, I would argue that Aristotelian or Thomistic metaphysics need not accommodate heterospecific monsters for the simple reason that they do not exist. Metaphysics in this tradition is supposed to account for the real and the possible, but I would argue that heterospecific substances simply do not exist and that they cannot possibly exist. All substances are, in the end, only of one kind. Mules, of course, are an interesting case, but I do think that they simply are their own odd species, neither horse nor ass. I think that a response need only be made to the homeospecific case.

In the homeospecific cases, we should remember, first of all, that any such case is member of some one species. The mentally challenged or Siamese twins are, we would all agree, fully members of the human species, although not able fully to perform all functions that most adult members of the species can perform. But why is that so problematic? It is certainly true for all of us that we cannot perform all of the proper human functions to full capacity all of the time, and yet we do not suppose that we cease to be members of the species because of these deficiencies. It is true, of course, that some humans cannot perform to any degree some of the proper human functions: a paraplegic cannot move himself and a man in a coma cannot consciously reason. And yet, even in such cases, it seems clear that we still have a living, human substance. Now perhaps such a claim seems only to be an “appeal to our intuitions”. If pushed on this, I would say that whenever, for example, we have a living organism with genetically identifiable human flesh, bones, and organs, we have a human being, no matter how defective, and no matter at what stage of development. I am not here trying to prove the validity of hylomorphism but only to show that the position can consistently meet an objection. I realize that, especially because of controversial problems in contemporary biomedical ethics, many

would deny humanity to the extreme cases I mention. Parenthetically, I think that the very difficulty of such cases shows the importance of maintaining a consistent hylomorphic doctrine.

I don't think, however, that I have yet quite answered the objection raised by Prof. Hill. The objection is a subtle one concerning the *priority* of formal causality over material and efficient causality. The objection is, if formal substantial causes are really prior, how can mere material and efficient causes frustrate the role of the formal cause? There are, of course, several senses of priority. In the sense of providing the fullest explanation in science, the final cause is really the prior cause to all of the others: it explains why the substance has the form that it has, and what material and efficient causes are required to produce such a form. But from the point of view of the sequence of causes, the material and efficient causes are prior and the final cause is posterior. That having been said, however, it should be realized that nothing about priority in causes takes away from the genuine reality and independence of each kind of cause. The fact that the final cause is prior in causal explanation does not mean that it trumps the independent role of these causes. Hence, final causes can be blocked because of deficiencies in any of the other causes.

It is worth considering the role of chance in Aristotle's doctrine. Aristotle does not see nature as operating in a strictly necessary way, precisely for the reason that material and efficient causes operate independently and can frustrate ends that we might normally expect. Chance is a real, though accidental, cause in Aristotle's physics because all four of the causes, and especially the material and efficient causes, operate in an independent way.

Let me close by commenting on the major shift in methodology that Prof. Hill has identified in the modern rejection of Aristotle. Whereas Aristotle's scientific methodology was "top down", the Seventeenth Century method was "bottom up". "Traditionally, scientific explanations moved from the top—the abstract substantial form—down to the material particular: why x is f is explained by x partaking in F , where F is some form grounding f and conferring f 's being onto objects by virtue of its own exemplification of F . The physicalization of forms, by emphasizing the role matter itself played in the generation of things, placed the explanatory priority on matter instead of form. Thus the door to the bottom-down approaches of reductionism and emergentism were opened." (p. 19)

I think that the problem Prof. Hill is raising here is that of whether Aristotelian philosophy supports an empirical and experimental approach to nature. If one reads the *Posterior Analytics* and the works of Aristotelian science (such as the *Physics*, *De caelo*, and the *De anima*, to name only three major ones), it is certainly the case that Aristotle is concerned in a fundamental way to find the nature of a substance or of some property and to construct demonstrations on the basis of that understood nature. In that sense, Aristotle's method is top-down. But it should also be appreciated that Aristotle, as against his mentor Plato, was the great advocate of the empirical basis of all knowledge. And, in fact, his extensive biological writings (*Historia animalium*, *De partibus animalium*, etc.) are reports on Aristotle's own independent empirical investigations of nature. Aristotle was a great experimentalist. And the role of

empirical investigation has a sure, if not extensive, place in the *Posterior Analytics* (especially in II.19, but elsewhere also). The problem, I think, is not so much with Aristotle as with Aristotelians. Why was it the case that Aristotle's followers so eagerly followed the master's written doctrine but, with almost no exceptions, did not follow his example by doing empirical research? (Albertus Magnus, I must point out, stands as a clear exception to the unfortunate general rule of Aristotelians.) The answer, I think, lies not in Aristotelian philosophy or scientific methodology but in the establishment of long standing academic traditions, which, especially in the middle ages, were decidedly *bookish*. To be an intellectual, including the sort of intellectual who was interested in nature, meant to be a student of books; it did not mean that one went out into nature for the purposes of investigating, experimenting, and recording. Secondly, I don't think that Aristotelians such as Thomas Aquinas thought that there was very much to be learned from the disciplined observation of nature. They simply did not think that nature had very many secrets left to disclose to us. Before the invention of such useful scientific instruments as the telescope and the clock, the ability to probe nature was limited, and the mediaeval scholars thought that you could learn much more from books than from empirical research. They were wrong about the prospects for empirical research, but they were not thereby mistaken in their philosophical principles.

Let me close where I began: by expressing my sincere appreciation for the excellent work that has been done for us by Prof. Hill. I am perhaps less sanguine than he about the philosophical project initiated in the modern era, but I hope only to follow his excellent lead in the exploration with rigor, clarity, and charity of the important problems in natural philosophy that we have been considering.

Thank you for your kind attention.