The Philosophy of the Organism: Notes on the Function of Nutrition

Jacques Maritain
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Translator's Introduction

In this introduction, I merely wish to provide a few opening comments concerning this obscure article by Maritain, extracted from a natural philosophy course and published originally in the *Revue thomiste* in 1937.[1] It may seem strange to the reader that *Nova et Vetera* would choose to reproduce an article on the philosophy of nutritive activity, especially given that said article was written over eighty years ago. Is not such a text, at best, a dated product of a by-gone (neo-)Scholastic age? Is it of anything more than passing historical interest?

The reproach is understandable, but the methodology deployed by Maritain in the article prevents the critique from being correct. As the reader will see, in the text presented here, Maritain clearly draws upon the science of his day in considering the phenomena of nutrition and morphogenesis. However, he does not, one could say, phenomenally consider those phenomena. Put in more precise philosophical vocabulary, we may say that the *objective light under which these phenomena are scrutinized* is that of natural philosophy, not the particular empirical sciences in their early-twentieth-century state of development. His interest is with how the phenomena reveal something pertaining to *mobile being as such*. In contrast to the positive scientist, he is

[1] The text used for this translation is taken from Jacques Maritain, "Philosophie de l'organisme: Notes sur la fonction de nutrition," *Oeuvres complètes*, vol. 6 (Fribourg: Éditions universitaires, 1984), 981–1000, and originally appeared under the same title in *Revue thomiste* 43 (1937): 263–75.

here concerned with the very ontological constitution of mobile being. Adopting a device used by F.-X. Maquart,[2] we could say that the concern here is *mobile* ***being*** (or, *sensible* ***being***), accenting the ultimate formal perspective and concern of the philosopher: "being under the conditions of poverty and division which affect it in that universe which is the material universe, *being* viewed *from the outlook of the mystery peculiar to becoming*."[3]

Thus, this brief article provides a kind of "example *in actu exercito*" of how Maritain differentiates, within the first degree of abstraction, an empiriological-scientific investigation from one that is ontological-sapiential.[4] This is not the place to explain, let alone defend, Maritain on this point,[5] and I would be remiss if I did not note that there are weighty voices of dissent against what Maritain claims regarding these matters.[6] Still, despite intra-Thomistic dissent on the matter, I am of the opinion that Maritain's subtle deployment of Cajetan's distinction between the *ratio formalis obiecti ut res* and the *ratio formalis obiecti ut obiectum* provides a capital tool for the analysis of issues surrounding the differentiation of the

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2 F.-X. Maquart, *Elementa philosophiae*, vol. 1 (Paris: Andreas Blot, 1937), 36–37.

3 Jacques Maritain, *The Philosophy of Nature*, trans. Imelda C. Byrne (New York: Philosophical Library, 1951), 120.

4 For interesting recent discussions about the constituting of facts at various levels of abstraction, see: Michael D. Torre, "Yves R. Simon, Disciple of Maritain: The Idea of Fact and the Difference Between Science and Philosophy," in *Facts are Stubborn Things: Thomistic Perspectives in the Philosophies of Nature and Science*, ed. Matthew K. Minerd (Washington, DC: Catholic University of America Press and the American Maritain Association, 2021), 19–39; John C. Cahalan, "Thomism's Conceptual Structure and Modern Science," in Minerd, *Facts are Stubborn Things*, 40–68. For a similarly interesting application of this same noetic discussion, though applied to the distinction between faith and theology, see Michel Labourdette, "La théologie, intelligence de la foi," *Revue thomiste* 46 (1946): 11–12 and 30–34.

5 On this distinction, see Jacques Maritain, *The Degrees of Knowledge*, trans. Gerald Phelan et al. (Notre Dame, IN: University of Notre Dame Press, 2002), 23–72, 215–224, and esp. 145–214; Maritain, *Science and Wisdom*, trans. Bernard Wall (London: Geoffrey Bles, 1944), 34–69; Maritain, *Philosophy of Nature*, 45–60, 73–156. Also, see the essay included in the last volume, Yves R. Simon, "Maritain's Philosophy of Sciences," 157–182. Also see Matthew K. Minerd, "Wisdom Be Attentive: The Noetic Structure of Sapiential Knowledge," *Nova et Vetera* (English) 18, no. 4 (2020): 1134–35.

6 For a recent and insightful article addressing this issue, as regards the critiques registered by the so-called Laval school of Thomism, see John G. Brungardt, "Charles De Koninck and the Sapiential Character of Natural Philosophy," *American Catholic Philosophical Quarterly* 90, no. 1 (2016): 1–24; also see Catherine Peters, "Dianoesis and Perinoesis in the Natural Sciences," in Minerd, *Facts are Stubborn Things*, 69–79.

sciences.[7] The present article is merely offered as a "laboratory" for seeing how that claim plays out.

Below, the reader will see how Maritain utilizes scientific observations from thinkers who clearly have a mechanistic bias, all the while putting their data to good Aristotelian use. As he says on several occasions, so long as their explanations stay upon the plane of phenomena, such explanations have their own scientific and explanatory value. That is, such empiriological analysis has its own scientific consistency within a body of demonstration pertaining primarily to the phenomenal order.[8] Of course, a metaphysic is implicit within such empiriological forms of scientific knowledge, and this gives birth to the temptation for the scientist to openly express his or her often-implicit mechanistic biases. Still, as Maritain states in reflecting on the descriptions of life provided by the scientific sources that he cites: "Even if one holds a mechanistic philosophy, the act of describing a vital process requires one to employ a language that is in no way mechanistic." Empiriological analysis hides the true ontological foundations of science, though the true metaphysic remains there in a muted, material manner. They have not formally been subjected to the light of philosophical analysis.

The situation is somewhat akin to the metaphysic that is hidden in the data of common sense. Prior to being scrutinized, common human experience is not sapiential knowledge *in act*. That is, common sense *as such* does not formally attempt to subordinate the knowledge thus attained to first principles (and, above all, to the principle of non-contradiction). However, as the mind's first grasp on human experience of reality, common sense stands in *potency* toward being actualized for philosophical knowledge. It is a *sine qua non* source of such wisdom.[9]

Be that as it may, Maritain's distinction between ontological analysis and empiriological analysis remains controversial. Hence, I hope that the

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7 See Maritain, *Philosophy of Nature*, 138–40.

8 Again, the reader should consult the texts cited above in note 4.

9 This was the long-held position of Maritain's great master, Réginald Garrigou-Lagrange, whose *Sens commun* is dedicated to a long study of this theme. While I am of the opinion that one must push the analysis back even further (for common sense is a mixture of speculative, technical, moral, and logical notions), Fr. Garrigou-Lagrange's work remains a Thomistic classic. Indeed, late in his life, Maritain commended it highly. See Réginald Garrigou-Lagrange, *Thomistic Common Sense: The Philosophy of Being and the Development of Doctrine*, trans. Matthew K. Minerd (Steubenville, OH: Emmaus Academic, 2021). For Maritain's remarks, see Jacques Maritain, *The Peasant of the Garonne: An Old Layman Questions Himself about the Present Time*, trans. Michael Cuddihy and Elizabeth Hughes (New York: Holt, Rinehart, and Winston, 1968), 136n7.

opponents of this outlook will find interest in another thematic point in this article, one of greater interest for all Thomistic camps. Implicitly, the article helps to provide an example of how natural philosophy engages the philosopher in participatively metaphysical[10] reflections that lead the philosopher along the first steps toward fully metaphysical speculation. Thomists are not Wolffians, so natural philosophy is the necessary first sapiential stage needed for developing a sane metaphysics.[11] It is in natural philosophy that we first encounter the four causes, act and potency, and immanent action, and only by a kind of "second step" do we then form the analogical notions pertaining to metaphysical insight.[12] Thus, in his comments on the "ontological self-extension" that occurs in the vegetative processes of nutrition and morphogenesis, Maritain reflects on vital assimilation, which provides the first analogate (*quoad nos*) for our analogical awareness of vital assimilation more broadly. Such natural-philosophical reflections pave the way for further reflection on the nature of knowledge, as well as the very nature of life, an analogous notion that stretches upward

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10 On this point, which must not at all be confused with a kind of "covert Wolffianism," see Maritain, *Degrees*, 189–190; Maritain, *Philosophy of Nature*, 155–56; see also Jacques Maritain, "No Knowledge Without Intuitivity," in *Untrammeled Approaches* trans. Bernard Doering, (Notre Dame, IN: University of Notre Dame, 1997), 338.

11 In addition to Maritain's remarks throughout the texts cited above, also see Réginald Garrigou-Lagrange, *The Order of Things: The Realism of the Principle of Finality*, trans. Matthew K. Minerd (Steubenville, OH: Emmaus Academic, 2020), 225–50.

12 Early in his career, Yves Simon strongly cautioned against referring to vegetative activity as immanent activity (despite the fact that many Thomists have done so). He comments that vegetative activity, like the agent intellect's production of the intelligible *species*, is primarily the production of a terminus, not a qualitative enrichment. However, this observation seems problematic, for the agent intellect's activity, while indeed playing a very important role in the *virtually productive* activity involved in intellection, nonetheless has its entire *raison d'être* in its subordination to the *formally immanent* activity of intellection. Neither abstraction, nor the possible intellect's own speaking of the internal word (always under the illumination of the agent intellect), are ultimately dissociable from their role as providing the presupposed supports for the act of intellection, which itself is indeed a *formally immanent* activity. (Note that Simon does clearly affirm this important Thomist point concerning the relationship between virtual and formal productivity in intellection.) I would argue that something similar, though at an analogically lower level, is operative in vegetative action as well, calling for a softening of an observation like that made by Simon. This is, however, the subject of a much longer discussion. For Simon's remark, see Yves R. Simon, *An Introduction to Metaphysics of Knowledge*, trans. Vukan Kuic and Richard J. Thompson (New York: Fordham University Press, 1990), 83n46.

to God, who is indeed Life—and that, supremely, *Life Itself, Eternally and Essentially*.

Thus, the article presented here offers something akin to an extended reflection by Maritain on a "natural mystery," namely the transition from brute matter to life. When the crystal grows, we are faced only with a phenomenon of the same being integrated into the same: a quantitative extension of the same formal capacities. In the case of nutrition and, more brilliantly still, in morphogenesis, we are faced with a higher organism integrating a lower being into the ontological structure of the higher one. Here, in the activity of life, we touch upon the first analogical fringes of a *simpliciter simplex* perfection, concerning which I will allow Father Réginald Garrigou-Lagrange to pronounce the final words:

> When we raise our view from brute matter to plant life, we find that there is a superior sort of obscurity involved in defining *life*, for life as such is an *absolute perfection* (*simpliciter simplex*) attributable, analogically and in its proper sense, to God, angel, man, animal, and plant. Life is not a genus but, instead, is above every genus. It is an analogue, something difficulty to define, for this definition must be able to be applied *in its proper sense* proportionally to God, who is Life Itself, and to a blade of grass, which properly speaking is something living.[13]

The Philosophy of the Organism: Notes on the Function of Nutrition[14]

In this lecture, we are concerned with the third great and fundamental fact of organic life, namely, the living thing's characteristic property of

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13 Réginald Garrigou-Lagrange, *The Sense of Mystery: Clarity and Obscurity in the Intellectual Life*, trans. Matthew K. Minerd (Steubenville, OH: Emmaus Academic, 2017), 113–14. Regarding the content of Maritain's lecture, I would also recommend that the reader consider a parallel reading of the recent work by Ambrose Little, O.P., "Are You What You Eat or Something More?," *American Catholic Philosophical Quarterly* 92, no. 1 (2018): 1–20. Also see Leon Kass, *The Hungry Soul: Eating and the Perfecting of Our Nature* (Chicago: University of Chicago Press, 1999), 17–56. I would like to thank Jack Cahalan and David Capan for looking over this article and providing helpful editorial feedback. Likewise, I owe Brett Kendall a debt of gratitude for his careful and always excellent copy editing.

14 These pages are the stenography of a lesson taken from a course on the philosophy of the organism. The style has all the defects of unaltered transcribed oral explications. Please excuse these defects, which it was impossible to correct without rewriting the whole piece. (Note by Maritain.)

self-movement. Hitherto [in earlier lectures], we examined this fundamental fact only in an external manner. Now, I would like to reflect more deeply upon it and to attempt to analyze vegetative activity in its essential functions, in order to see if we here find, in the course of analyzing such functions, the notion of self-movement.

You likely know that biologists recognize three orders of phenomena as bearing witness to vegetative life: assimilation, morphogenesis, and reproduction.

Today, we will occupy ourselves with the first great function, namely the general function of nutrition, which the ancients, understandably, held to be the fundamental and basic function of vegetative life. The living organism appropriates to itself the properties of surrounding materials, as well as the latter's physicochemical energies. Now, this appropriation takes place in a wholly bodily manner, that is, by fashioning into the living thing's own substance the very substance where these energies are found. It is here that we find the first degree of appropriation or of vital assimilation, one that is still wholly bodily. Higher on the ontological scale, we will once more find a case of assimilation; however, on this new level, it will be a question of cognitive assimilation through sensation or intellection. In these latter two cases, one and the same form is involved, though now dematerialized. In knowledge, the same object's form will be assimilated by the subject, though in a completely different manner.[15]

At the vegetative degree of life, we are in the presence of perpetual transformations of substances. Modern science designates such transformations by means of the term "metabolism." As the scientists tell us, they are at one and the same time ectropic and entropic, assimilative and disassimilative, nutritive and respirative, and so forth. From this perspective, the physiologist [Ewald] Hering wrote that, physiologically speaking,

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15 [Trans. note: Namely, in an intentional or objective manner. On this point, see Austin Woodbury, *Natural Philosophy* (The John N. Deely and Anthony F. Russell Collection, St. Vincent College Library, Latrobe, PA), no. 630 (p. 500, slightly altered): "Knowledge is to be defined as 'having something in oneself formally and not materially,' meaning both 'according to its form' and 'after the manner of form,' that is, *not subjectively*, and therefore, neither physically, nor compositively but, rather, objectively and therefore supra-physically, incompositively, and 'not materially,' or immaterially. Thus, it may be said that to know is to communicate immaterially in the very form of something, namely, of the known. Accordingly, knowledge may equivalently be defined, 'Having [a] form in oneself immaterially or objectively.'" Also, see Réginald Garrigou-Lagrange, "*Cognoscens quodammodo fit vel est aliud a se* (On the Nature of Knowledge as Union with the Other as Other)," *Philosophizing in Faith: Essays on the Beginning and End of Wisdom*, ed. and trans. Matthew K. Minerd (Providence, RI: Cluny Media, 2019), 63–78.]

the essential characteristic by which the living substance differs from the non-living substance consists in its organic exchanges. That is, it differs in the chemical processes that take place within the substance in question, processes whose effects are twofold. On the one hand, there is the formation of the materials that the substance gets rid of as something that is foreign to it, these materials being either accumulated in its immediate environment, or cast off into the current of its humoral system. On the other hand (and always as part of the same processes), the living substance simultaneously absorbs nutritive materials, assimilates them, and makes an integral part of itself from them.

Such is the empiriological description that the scientist can propose to us concerning this range of phenomena. Thus, on the one hand, this metabolism bears witness to the incessant production of wastes, a production that is even more important in animals than in plants, that is, a destruction of materials, whether of materials that are exploited or those of the organic substance itself (a destruction that above all takes place because of the organism's respiration, which destroys the endothermic composites of matter so as to produce the heat needed for life). On the other hand, it also bears witness to the simultaneous construction of new substances from a heterogenous mélange of inorganic substances: hydrates from carbon, fats, lipids, albuminoid substances, and so forth.

Thus, the organism fabricates three principal kinds of materials.

First, there are the materials for exploitation, that is, the materials necessary for the production of its internal work. Thus, in particular, the green plant assimilates carbonic acid and produces starches, thanks to chlorophyll, which enables it to transform light energy into chemical energy. Thus, the green plant appears to be charged with an important task within the universe: the preparation of organic substances from mineral substances. Indeed, from this perspective, we can say that animals are dependent upon plants, so that, in the final analysis, all the energy placed in play in the nutritive process of the living world derives from the plant world and from the sun.

Second, and of greater interest to us here, is the fact that the organism produces the materials for construction. It does this for two reasons: (1) so that it may replace those materials that are destroyed during the phase of dissimilation; (2) so that it may construct the organism itself, on the basis of its egg, given each organism develops itself and constructs itself, an activity which presupposes significant substantial growth, all beginning with the fertilized or activated egg.

Finally, and thirdly, the organism also produces a third category of substances, which we come to know as organic catalysts, or ferments,

which are also called enzymes. They are, as it were, the tools, the intrinsically non-living chemical instruments which are used by the living being. The formation and excretion of these ferments are produced from the protoplasm, in conformity with the necessities of the given moment.

Here, allow two remarks in particular. The first: all of the nutritional activity, admittedly just described rather summarily, ultimately depends upon morphogenesis. As Hans André has observed, in the process of assimilation, chemical transformations appear as being ruled by invisible directives, so that the material exchanges appear to be *subordinated* to the requirements of the construction of the form. In this, we encounter an idea to which we will need to return, namely that of the existence of functions and complexes that are subordinated to one another.[16]

In sociology, we can ask whether the economic order ought to be superordinate in relation to the political order, or vice versa. In other words, which of these two orders stands above to the other? Now, in biology, we see that nutrition (the economic order of organic life) is subordinated to morphogenesis. In other words, the latter stands above assimilation, with nutrition being at once the absolutely fundamental function of the living organism and, nonetheless, its lowliest function as well.

Our second remark—and here we arrive at our main subject in this lecture—concerns the organism's fabrication, not of the materials for exploitation, but of the very materials for construction. Here, we must note that we are witness to the veritable *production* of a substance that is new in relation to the food, though nonetheless produced from this very food. What is quite remarkable, indeed something that should astonish us greatly, if we were not so accustomed to experiencing this phenomenon, is the fact that this new substance is *the same* as that of the living thing. Therefore, quite precisely speaking, we find ourselves faced with the *production* of a new *part* of the *same* substance, that is, with what the Scholastics call the conversion of the food received into the very substance of that which is fed, into the substance of the living subject, *conversio alimenti intussuscepti in sustantiam aliti*. On this point, Aristotle had a very important formula that anticipated many of the discoveries of modern science. You can find it in *De anima* 2.4, where he says that the food is subject to that which is fed and not that which is fed to the food, just as the architect is not the patient in relation to the matter, but the latter in relation to him: "Further, food is acted upon by what is nourished by it, not the other way around, as timber is worked by a carpenter and not conversely; there is a change in

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16 [Trans. note: Although this is somewhat treated in this article, perhaps it was given fuller treatment in the remainder of Maritain's course.]

the carpenter but it is merely a change from not-working to working."[17]

Now, yes, it is quite certain that the foods we take in has some kind of reaction on our bodies. However, what Aristotle means is that the influence of the food on that which is fed falls within the order of material causality, and if, on the contrary, we consider things from the perspective of formal and efficient causality, then we must say that the food is not what acts on that which is fed, but rather that which is fed is what acts on the food. This is so, first, because the living being chooses it, a choice adapted to the maintenance of life in the fed subject, and then because the living being submits it to a whole series of chemical processes, breaking it down through a series of transformations, thereupon reconstructing this substance on a new level. Here we can cite an interesting passage from Georges Bohn in his book *Chemistry and Life*:

> The cell works in stages. Little by little, it breaks down the substance under consideration, transforming the latter into its ultimate products, and it is only when the latter is reduced to its simplest, most indifferent fragments that the work of synthesis begins. Sometimes, moreover, the cell only makes use of the freed energy. However, when the substance introduced is destined to become an integral part of the cell, the latter, after having decomposed the former, then proceeds to its "reconstruction from the bottom up," and the foreign substance is found to have acquired, in its least details, the cell's own structure and character. In all this work of breaking down and subsequent reconstruction, enzymes [*ferments*] play an essential role. On the one hand, they render possible the dislocation of the foreign substance. On the other hand, they "aid" the cell in maintaining its own constitution.
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> Let us pass on to multi-cellular beings, which are more elevated in their organization. Here, we find the division of work. The cells that constitute the walls of the digestive tract are the only ones in contact with the substances that have entered the organism from the outside and that serve to nourish it. Now, even the latter cells do not enter into immediate relations with the substances that will be absorbed. Before penetrating into the intestinal cells, these substances are assailed by the enzymes of the digestive tract and

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17 [Trans. note: Taken from Aristotle, *On the Soul*, trans. J. A. Smith, ed. Jonathan Barnes (Princeton, NJ: Princeton University Press, 1995), 416a35–b2. In the original, Maritain cites the text in Greek. It is here provided in English, with slightly more context.]

> decomposed into their simplest and most-indifferent constituents. Thus, destruction always comes first. The alimentary substances begin by being deprived of the characteristics that are particular to them and that distinguish them, both chemically and physically, from the intestinal cell, and it is only at this moment that the latter takes them up so as to rebuild them following plans that are new and proper to them.[18]

Even if one holds a mechanistic philosophy, the act of describing a vital process requires one to employ a language that is in no way mechanistic. Food substances, thus taken up by the cells of the intestinal walls, are delivered to the organism's circulation, to its chyme and blood, and will be assimilated by other parts of the whole organism.

Thus, we can see, in striking fashion, the activity exercised by a living body on the very food by which it nourishes itself. It breaks it down, destroys it, and then reconstructs it. However, when it does this, it does so on a new level, refashioning this food in order to restore itself. As we have indicated, all of these activities are a series of chemical processes, but note well that they are ruled in dependence on the functions of the living being. You see here the essential difference between the way that a crystal grows and the way that the living cell nourishes itself. In the former case, you have a simple aggregation or juxtaposition of parts, following a continuous progression. In the formation of crystals, you assist the reciprocal attraction of molecules, which move themselves in the liquid of the solution only when the latter reaches a certain degree of saturation so as simply to superimpose one group upon another. Crystal formation simply involves a process of depositing, whereas assimilation consists in radically different processes. Assimilation is an active process, first, of breaking down and, then, of synthesis and reconstruction.

In this regard, the biologist Arthur Thomson has written: "Organic growth occurs at the expense of different materials. We can even speak in a radically different manner of the materials from which the substance composes itself in view of growth. It implies an active assimilation rather than a passive juxtaposition, as occurs in the case of crystal growth."[19] In order to contrast these two kinds of growth, it is often said that life involves a process of intussusception, which is contrasted to the juxtaposition of particles upon other preexisting layers that takes place in the

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18 Georges Bohn and Anna Drzewina, *La Chimie et la Vie* (Paris: Flammarion, 1925), 71–72.

19 See Eugenio Rigano, *Qu'est-ce que la vie?* [Paris, Alcan, 1926], 10–11.

case of crystals. The word in question, "intussusception," designates the fact that the particles resulting from the transformation of the food are transported into the very interior of the microstructure of the living being. It is true that this is an important difference, but it does not say enough. This word does not characterize the proper mystery of assimilation, for the outcome of all the work that I have just described is the ontological extension of the *very substance* of the living thing, which is, as we saw in an earlier lecture, a single, individual substance. (As soon as we recall the fact that a living being is a single individual substance, and not merely a collection of juxtaposed molecules, then the fact of assimilation no longer has a merely empiriological value but, rather, takes on its full ontological scope.) It is not only a question of new particles actively constructed, under the regulation of the superordinated functions of the living being, coming to penetrate to the interior of the micro-organization of the cell. The biologists' descriptions generally stop here. However, we must add that the particles thus newly and actively formed by the organism are not molecules of individual micelles that would be joined, even by intussusception, to a system of other molecules or individual micelles. These particles become the simple *parts of one and the same individual substance*, of one and the same preexisting ontological individual, and this is what is essential to the notion of assimilation. Thus, we find ourselves faced with a wholly unique form of vital incorporation. The living protoplasm produces a *new part of itself* inside itself, making it come into existence, on the basis of food materials. The most exact word that should be used to characterize this process, a word employed by Fr. Gredt,[20] is the word "aggeneration" (*ad-generatio*): production in existence, the generation of a new substance in relation to the materials from which it arises, a new substance which is joined to a preexisting individual substance as an integral part of the latter.

It is here that we find something absolutely new in comparison with the entire inorganic (or, non-living) world. And it is something that the light of philosophy enables us to see very clearly from the moment that we employ philosophical and ontological terms such as *substance*, *individual*, and *specific difference* so as to interpret the experimental descriptions. (In our earlier lectures, we showed that it is wholly legitimate to use such terms in relation to living organisms.) Philosophy relies on these two previously established facts: the specific difference between substances, between the food substance and the living subject substance; the individual and

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[20] [Trans. note: See Joseph Gredt, *Elementa philosophae aristotelico-thomisticae*, 13th ed., ed. Eucharius Zenzen, vol. 1 (Barcelona: Herder, 1961), nos. 442–47 (pp. 370–72).]

substantial unity of the living organism. Thus, we must conclude that the process of assimilation, such as it is described by scientists, is precisely what we have said it is: aggeneration, the production in existence of a new substance that is a part of the preexisting substance of the living organism, ontologically extending itself.

And what is remarkable, methodologically speaking, is that, if we do not appeal to this philosophical elaboration of properly ontological concepts, the same material details, made up of scientific facts and information, will remain under our eyes without taking on the ontological meaning just discussed.

This is why we can make use of experimental testimony offered by mechanist or monist scientists in order to establish [ontological] facts that prove something wholly opposed to mechanism and monism, though on the condition that these facts are understood philosophically. Thus, Jacques Loeb wrote that:

> The essential difference separating living matter from non-living matter consists in the fact that the living cell synthesizes its complex specific materials from simple, indifferent or non-specific composites, which it borrows from the surrounding environment, whereas the crystal only adds one set of molecules to the other molecules that it finds in its super-saturated solution. This synthetic power of transforming little "building blocks" into complex composites, specific for each organism, constitutes the "secret of life," or rather, one of the secrets thereof.[21]

Only, if you do not analyze this fact in light of certain philosophical concepts can you believe that, one day or another, you will be able to resolve this secret of life into mechanistic terms. By contrast, if you first cast a philosophical light on these matters, you will understand that it necessarily belongs to another order.

Le Dantec, a great theorist of materialism, likewise states that assimilation is the fundamental characteristic that essentially distinguishes living organisms from non-living beings. However, as we said above, as soon as we recall the fact that a living body is a single, individual substance, and not only a collection of juxtaposed molecules, then the fact of assimilation takes on a value that is not only experimental and empiriological but, beyond that, one that is ontological. Now, we must attend the school of the philosophers if we wish to hear tell of this ontological value. It is an exam-

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[21] See Rigano, *Qu'est-ce que la vie?*, 11.

ple of what we said [above]: the experimental fact must be placed under the light of philosophy so as to yield its philosophical value. You must have formed the philosophical notion of *individual substance*, *unum per se*, which presupposes the notions of *essence*, *existence*, and *unity*, and if you do not hold all these philosophical notions in mind, you will not extract from the fact of assimilation the intelligible content we are discussing now. The proof of this is that Le Dantec constantly insisted that assimilation is the distinctive mark of the living organism. He affirmed the very thing that is the proper character of the living organism in opposition to non-living matter is assimilation, even though he interpreted this only as marking out a difference on one and the same level. To his eyes, the living organism was perfectly reducible to a constellation of physiochemical factors. The difference remained wholly within the domain of chemistry. He had discovered this fact in the experimental order; however, he had illuminated with the light of empirical knowledge or of a materialistic philosophy, thus preventing him from extracting from this fact the intelligible philosophical content contained therein. For him, it was a purely descriptive characteristic that did not imply an essential ontological difference. All he noted was one chemical behavior in relation to another, equally chemical behavior. In the same way, we can distinguish an organic composite (e.g., cellulose) from a mineral composite.

Loeb recognized that "the constant synthesis of specific materials from simple composites having a non-specific character constitutes the principal characteristic by which living matter differs from non-living matter."[22] He says (using a curiously equivocal formula) that living organisms can be defined as chemical machines that compose themselves principally from colloidal materials and that possess the property of preserving and reproducing themselves by their own means.

By expressing himself in this way, Loeb believed that he had reduced everything to physicochemical processes. By declaring that this chemical machine has the property of preserving and reproducing itself through its own means, he has said nothing. He has simply posed the question.

But, if we admit that the chemical machine in question is an individual substance (which, if one reasons things through correctly, will need to be declared to be endowed with an immanent activity, precisely on account of which it preserves and reproduces itself by its own means), then this formula becomes perfectly acceptable. However, in such a case, we will have given it an ontological meaning that was precisely precluded by its author's own original thought.

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22 Rigano, *Qu'est-ce que la vie?*, 12.

Let us note again that, in the inorganic world, new substances are formed by the transitive action of bodies interacting with each other. Similarly, in the case of nutrition and assimilation, we indeed have a case of the living substance exercising a transitive action on the food, doing so by means of ferments or of enzymes. However, the terminus of this action is what we just called aggeneration, the ontological extension, the self-production of the living substance itself, which from the food in question brings into existence a part of itself that did not exist. Clearly, it is a process of activity of self upon self, passing by transitive activity exercised on the food, thus returning back to the subject, bringing into existence a new part of its own, individual substance. We can say that nutrition is the self-productive function of the living substance. Here indeed is the immanent action which we have spoken of as being an ontological characteristic of life.

As I recalled [in an earlier lecture], Heidenhain proposed the theory of protomeres, in which he saw the minimal particles of micro-organization. He thought that these protomeres, by being increased through substantial self-production, would rhythmically divide themselves in accord with the so-called nucleo-plasmic relation. (The mass of the nucleus over the mass of the protoplasm is a constant).

We will return to this latter point as regards morphogenesis. Each of the smallest particles of the microstructure of the living being would thus increase by self-division.

Whatever the case may be, you see that, once the foods have been introduced within the cell, we must distinguish, within the cell itself: (1) a potential complex, the non-living food matter having been prepared, with everything ready to be assimilated; (2) an actual complex which actualizes and determines the former by transforming it into the same substance as the living being, an assimilating complex. In this way, the metabolic process has the property (which has no analogue in natural inorganic processes, setting aside the case of what can be made by way of human art) of maintaining itself in a state of stationary equilibrium or of tending to get itself back into this state.[23] Here, we have a secondary characteristic that derives from this immanent, much more characteristic, activity. Now, this characteristic of stationary equilibrium is much less profound and typical than the immanent activity just spoken of, for it can be artificially imitated. Rigano himself notes this point when he writes:

> Certainly, the steam engine that puts into motion the machine tools of a workshop is a mechanical system in a state of dynamic,

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23 Rigano, *Qu'est-ce que la vie?*, 13.

> stationary equilibrium, that is, a system whose modalities of movement do not change with time. But the technician knows that it took the fantastic discoveries of regulative valves for the pressure in the boiler, of regulators for the centrifugal force so as to regulate the influx of vapor into the distribution box, and of flying weights which by their inertial force equalize the movement impressed on them by the piston before one could realize this stationary state so necessary for the good functioning of the machine tools. Similarly, the water that travels through the channel that brings it to the turbine is in the state of stationary hydrodynamic equilibrium, but this is solely thanks to the appropriate locks that maintain the constancy of its flow. The pressure boiler itself is also in a state of stationary thermodynamic equilibrium, but this is only thanks to the aforementioned safety valves, which precisely maintain the constancy of the pressure. And if the flame of a candle, which many have wished to compare to the torch of life, maintains itself in a state of stationary chemico-dynamic equilibrium, it owes this fact to the wick that was fabricated by man in such a way precisely as to maintain the constancy of the inflow of the melted wax along this wick.[24]

We do not find any example of a similar stationary system in non-living nature. Nonetheless, human art imitates it in the construction of machines.

However, human art will never enable one to bring about the ontological extension of an individual substance, ontologically extending itself by transforming other substances into new parts of itself. No machine can imitate this process. It is here that we find the most profound trait of the assimilative function. Here, indeed, we truly find an essential discriminating characteristic of life. It appears to us as a factual witness to immanent activity. And once again, it has its full meaning only if you regard it not merely as an empiriological fact, but as having an ontological value thanks to the critical preliminary establishment of certain *philosophical facts* (a task that we took up in the first part of this course).

Now, we can verify this conclusion that the living organism is endowed with an immanent activity, an activity of self on self, self-movement, by considering it in comparison with the two other great categories of vegetative phenomena, namely the those that are related to morphogenesis (i.e., growth) and those that are related to reproduction. In what concerns morphogenesis, we are faced with the second great category of facts of the

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[24] Rigano, *Qu'est-ce que la vie?*, 15–16.

vegetative order. Let us note that what modern thinkers call "morphogenesis," the ancients called "growth," ***aúxēsis***. They defined it as that kind of movement by which the living thing passes from a lesser quantity to a greater one, *motus a minore ad majorem quantitatem*. In my opinion, the term "morphogenesis" seems more fitting and more characteristic than does the word "growth," which is related only to the growth of quantity or volume, to size, whereas the very word morphogenesis implies the production and construction of the form.

In any case, note well that the movement of growth spoken of by Aristotle in his theory of four kinds of movement is indeed *par excellence* the movement in question. It is the movement of growth such as you find it in the living being, a movement that is wholly original, the morphogenetic movement following upon nutrition. It is not the simple growth of volume that you can encounter in the inorganic world. You will find interesting remarks on growth in lesson 9 of Saint Thomas's commentary on Aristotle's *De anima* 2.

Before coming to that, I would like to cite for you a passage drawn from the book *La Vie creatrice des formes* by great embryologist Albert Brachet. This passage emphasizes very well the characteristic importance of the morphogenic function. It is at this moment that life begins to manifest itself in all its creative power. The morphogenetic period is that wherein the organism, so to speak, constructs itself from all the pieces, by activating the actions and reactions which have it as their originating source and subject, by allowing all the energies that it contains to blossom forth, by implementing, in view of one and the same end, the matters that come to it from the egg and those that it constantly assimilates to itself through nutrition. The life of an adult being is simple in comparison to that of an embryo at work. The former can strive only to assure the normal functioning of its capacities, to repair what happens to vex the organism, and to regress toward the fatal terminus that is death. It is essentially conservative in nature:

> The life of the seed also assures the functions necessary for its maintenance. It nourishes itself, respires, and so forth. But all this can only enable the accomplishment of its proper task which, far from being conservative, is constructive, under infinite modalities of appearance and of complexity.
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> This takes on a striking image when we think that the central nervous system of the superior animals and of man proceeds entirely from the development, favored by the environment, of the preliminary sketches and localized unformed matter in the cytoplasm of

> the activated egg. Indeed, these sketches are the necessary germ without which none of the brain, which is so extraordinarily consistent, would be formed, nor would any of its intimate structure, which is so infinitely delicate that a century of work has not yet enabled us to know it in its entirety. And what is true of the organ itself is also true of the function that it exercises, for it has no other *raison d'être* than its implementation. However frightfully complex the mental or merely nervous functions may be, they also have their primary origin in the germinal localizations of the egg, and the particular characteristics that they have in each individual will be the blossoming forth of a characteristic of the same order as was possessed by the ovular sketch and that results perhaps simply from a particular ordering of some molecules. Such is the case for all the systems of organs, as for the acquisition of all external forms that life will take on.[25]

Brachet saw quite clearly what is striking and original in this morphogenic function. Now, in Saint Thomas's comments on the relevant passage in Aristotle, he notes, following Aristotle, that what, from the perspective of assimilation, is called food, serving in the preservation of the organism, is the same thing that also serves in growth and that consequently is employed by morphogenesis. In fact, food is what is in potency to an animated body. Now, an animated body is simultaneously something having a quantity and size, and likewise a determinate supposit and substance. Now, if we consider the living body as a given subject having a volume and dimension, then food, as such, is the material element serving in growth and, *dicitur augmentativum*, is called augmentative, *auxētikón*. However, inasmuch as the living body is a given supposit or a determinate, individual substance, then food properly has the meaning or function of food, for it serves in preserving the substance of the fed thing. This means that, if you consider things from the perspective of material causality, there is not a distinction (other than a rationate one, a *distinctio rationis*) between the materials that concur in nutrition and those that concur in growth.

However, if your perspective no longer is material causality, but instead is formal causality, what is formal in the function, then you will perceive that the growth function is specifically distinct from that the activity of assimilation. Aristotle already had noted that the growth of fire, for example, is unlimited, so long as there is something combustible, whereas

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25 Albert Brachet, *La Vie créatrice des Formes* (Paris: Alcan, 1927), 117–18.

by contrast, in all organic formations of nature, there is a limit and proportion in relation to size and growth. It is this element of limit, of proportion, of form, and of a structural plan that makes for the formal difference of the function considered. Brachet notes it quite exactly in the book that I just cited. He teaches that three notions are joined in the morphology of the living thing: the notion of organization, that of form, and that of specific size. He writes:

> The notion of organization, whatever perspective that is taken when defining it, intrinsically implies another notion, one that itself is also wholly fundamental for the analysis of life, namely, that of form.
>
> If we likewise take into account the fact that in nature each species of being, even the simplest, has, if not its own proper chemical formula, then, at least, a composition and consequently a specific distribution of materials, we will thus arrive at the conclusion that it also has its particular external and internal form. In other words, each one has its own specific morphology.
>
> The added complexity of the organism entails the added complexity of forms, and when, in superior animals, cells group together into organs, the latter have their own proper form and topography. Thus, the whole takes on an external appearance, determined by its content and able to present infinitely varied details.
>
> Therefore, organization and form are two inseparable notions that work together in the midst of their various complexities. They have their origin in life itself, which creates and models them. They are both the expression of its activity.
>
> But, living beings do not have only an organization and a morphology. Another very general and very important characteristic is that they also have a specific size. The power to grow, that is, the power to form more living materials than it destroys, is a commonplace property of everything that lives, but what is particular is that this power is limited. Each animal species has, among the characteristics that distinguish it, a size whose limits hover around a mean that is easy to establish if we consider an adequate number of individuals.[26]

Now, by speaking thus, Brachet, expresses himself, on the experimental

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[26] Brachet, *La Vie*, 8–10: "Obviously, we set aside here the case of certain animals whose growth is indefinite *in appearance*, like certain worms for example, for this is not a question of a true individual growth, but rather of proliferation by budding."

plane, in a wholly Aristotelian manner. Moreover, this phenomenon of having definite organismic limits [*cette limitation*] is a characteristic that is much more susceptible to being sensually experienced in the animal world than in the plant world. We already noted [in an earlier lecture] that an animal is above all a closed form, whereas plants remain open.

In sum, let us say that growth not only involves the material augmentation of volume, but also involves a given form and configuration that is built and determined from within, so that if we were to introduce into the notion of growth this characteristic element—namely, that the form is built up and delimited from within—we could designate growth as being the synthesis or extensive construction of the somatic form of the organism, a construction by which it attains its full existence in grandeur and power.[27]

Thus, it should be immediately clear that, if we define the growth function or morphogenesis in this way—that is, if we define it by self-construction, the self-edification of the form—we are led to the idea of motion of self by self, of activity of self on self, of immanent activity, and at the same time, we define growth in a way that ought to appear unacceptable or scandalous to every mechanistic science. This is why materialist or mechanist biology has a tendency to misunderstand the originality of the function of morphogenesis in relation to nutrition, reducing growth or morphogenesis to nutrition or assimilation, where, at least at first sight, this new kind of activity, this motion of self by self, is less apparent, whereas in morphogenesis, it shines forth much more clearly. N.V

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[27] See Hans André, "La Typologie des plantes," *Cahier de Philosophie de la Nature* 2 (1929): 63: "The organism of the plant is not only specific from the perspective of substance but also is such from the perspective of *dimension* and *figure*. Like *nutrition* (or, the *function productive of the substance*), so too does *growth* (*the function productive of the form*) fall to immanent action in the strict sense of the term. Aristotle characterizes the difference between organic growth and inorganic growth by means of a lovely comparison. 'The growth of fire,' he says, 'is unlimited inasmuch as there is something of the combustible. By contrast, in all the (organic) formations of nature, there exists a limit and a production of size and of growth.' *If we were to introduce into the notion of growth this characteristic element, namely that the form is built up and delimited from within, we could designate growth as being the synthesis or extensive construction of the somatic form of the organism, a construction by which it attains its full existence in grandeur and power.*"