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When is the human soul infused?

One of the relatively few fundamental areas within Thomistic philosophy where modern scholastics differ from St. Thomas as well as among themselves concerns the time at which the rational soul is infused into the human embryo. The "animation question," as it is called, has important implications in several areas: if the human soul is truly infused a considerable time after fertilization, as Aristotle, Thomas, and other "mediate" animists claim, infants who die before this infusion would not be truly human beings and as such neither immortal nor in need of baptism. Furthermore, a prevalent but likely unsound ethical opinion maintains that if such retarded animation could be proven to be the actual fact, abortion would be licit during the period before the rational soul's infusion because such abortion would not be homicide.¹

The historical ramifications of the animation problem are also interesting because they touch on some aspects of the relations between philosophy and science. The major premise of both positions explicates the commensurative relations between form and matter; this is, then, a philosophical principle as valid today as when it was first defined. The minor premise in both positions attempts to state exactly when the embryological matter is truly human; accordingly, this premise, unlike the major, depends on empirical evidence and consequently might need alteration as our biological research advances. It becomes theoretically possible, then, that Aristotle and St. Thomas may have erred in their philosophical conclusion about the time of the soul's infusion, not because of philosophical error but because of inadequate scientific evidence.

The animation discussion is not about the essential nature of man, a subject independent of the methodology of the natural sciences, but rather about an accidental issue concerning the temporal origin of his nature. Such a discussion illustrates how philosophy is independent of science in its fundamental conclusions but how it can profit from scientific particulars on occasion. Our purpose here will be to review the historical development of the animation problem and to suggest what appears to be a suasive argument for immediate infusion based on recent (1961) discoveries in the genetic structure of the human zygote.

1. This opinion has been expressed to the author by several doctors, among them Catholic professors at Catholic medical schools. Such action may perhaps not be truly homicide but it seems nonetheless seriously immoral because of the intrinsic human finality of the zygote.

Some scholastic philosophers and theologians insist that it is simply impossible to determine exactly when rational animation occurs.¹ This belief, however, has deterred few prophets in either camp from stating their positions with dogmatic certainty. "We regard as certain the theory of the succession of embryonic forms before rational animation," states one mediate animist.² A proponent of immediate infusion of the soul states that his position is *omnino certa*.³ Immediate animists claim on their side a long line of Catholic doctors, theologians, and philosophers for whom immediate infusion is the "commonly accepted doctrine."⁴ Mediate animists claim in their defense a long philosophical tradition embracing both Aristotle and St. Thomas⁵ and an argument, in their view, "more in conformity with metaphysical principles and empirical facts."⁶ Immediate animationists maintain their theory is more consistent with the Church's teaching on baptism and abortion, whereas mediate animists claim to be more consistent with modern embryology.⁷ The chasm yawning between these two positions has at times become sharp and deep :

We are not exaggerating in the least when we regard the fact that this theory [immediate animation] should still find defenders long after experimental basis on which it was thought to be founded has been definitely shown to be false as one of the most shameful things in the history of thought.⁸

St. Thomas was clear and careful in outlining the nature and role of the human soul. The soul is "actus primus corporis physici organici, potentia vitam habentis," a definition he took from Aristotle.⁹ It is the form of an organized body : "anima est actus primus corporis physici organici."¹⁰ For St. Thomas the soul is formal, final, and efficient cause of its matter,¹¹ though modern Thomists agree it is only

1. George Peter KLUBERTANZ, S.J., *The Philosophy of Human Nature* (New York, Appleton-Century-Crofts, Inc., 1953), p.312.

2. E. C. MESSENGER, *Evolution and Theology* (London, Burns, Oates, & Washburne, Ltd., 1931), p.88. Dr. Messenger is an ardent advocate of mediate animation in this and his other works.

3. CAPELLO, *De Sacramentis*, I, no.168, c.747.

4. *America* magazine, echoing the common assumption, June 9, 1923.

5. H. M. HERING, O.P., "De Tempore Animationis foetus Humani," *Angelicum*, Vol.XXVIII, (1951), p.18.

6. MESSENGER, *op. cit.*, p.82.

7. Canon de DORLODOT, *Darwinism & Catholic Thought* (London, 1932) p.107.

8. *Ibid.*

9. *De Anima*, II, c.1, 412 a 28.

10. *In II De Anima*, lect.1, n.233.

11. *In II De Anima*, lect.7, n.318.

a formal cause because it does not directly guide the embryonic cells toward becoming human but acts in the body by information, i. e., by self-communicating itself to matter which is already rightly disposed.¹ Since every substantial form is in determinate matter, it follows that the soul becomes instantaneously present to a body which has been specified by material dispositions commensurate to the specificity of the form. As the ultimate principle of vital operations, the soul is responsible for the conditioning of matter required for the exercise of those operations. Thomas accordingly calls the soul *first* act to distinguish it from those operative potencies which are naturally interrupted. From the diversity of vital operations, Thomas concluded that the embryological material must be equipped with an organic diversity capable of performing these diverse operations at the time when the soul is infused.² Since the soul is the principle of vital operations and also of the perfections required in matter for the exercise of these operations, the matter, at the time of infusion, must contain precisely those perfections which are required for the exercise of those operations. "Et quia omnis forma est in determinata materia, sequitur quod sit forma talis corporis."³

St. Thomas saw that the soul, being spiritual and unlike other forms, could not be educed from matter. When the fertilized egg gives rise to the material dispositions requiring the presence of the soul, God creates and infuses it. Infusion occurs when the matter is "human." "Haec enim anima est commensurata huic corpori et non illi, illa autem alii, et sic de omnibus."⁴

These requirements equivalently mean that the soul is infused at the moment when the matter is specifically human — which, of course, is the point disputed by the immediate and mediate positions. Believing with Aristotle and Avicenna that no such specificity could exist in the apparently non-living, homogeneous menstrual blood of the early fertilized egg, Thomas concluded that the human soul was infused when this required specificity first existed, a stage he estimated as well past fertilization : 40 days in the male, 80 in the female embryo. He therefore concluded that the intellectualive soul was created by God "in fine generationis humanae, . . . corruptis formis inferioribus praeexistentibus."⁵

1. Cf. for example KLUBERTANZ, *op. cit.*, p. 312, for a discussion of the soul's mode of activity.

2. "Et dicitur corpus organicum, quod habet diversitatem organorum. Diversitas autem organorum necessaria est in corpore suscipiente vitam propter diversas operationes animae." *In II De Anima*, lect.1, n.230.

3. *In II De Anima*, lect.1, n.223.

4. *Cont. Gent.*, II, c.81.

5. *Ia*, q.118, a.2.

Aristotle, Thomas, and Avicenna lacked modern technological devices necessary to uncover evidences of human specificity in embryos. In human development, Thomas understandably saw fit to postulate this succession of forms, believing with good reason that the embryo is first homogeneous, then blocked out in the rough, then differentiated progressively as living, vegetative, sentient, and finally rational — an account of embryology which, save for the belief in homogeneity, closely parallels the accounts of eminent embryologists today.¹ Thomas postulates a miraculous exception to account for the presence of Christ's soul immediately at conception, for he is unwilling to let the convenience of a theological necessity in Christ's case dictate an identical position for all other men, especially when his scientific evidence apparently indicated otherwise.

The philosophical principles concerning form and matter as outlined by Aristotle and Thomas are valid today. Our knowledge of embryology and biochemistry, however, has increased substantially since medieval times. Biologists themselves are reluctant to discuss philosophical questions dealing with spiritual substances, especially since Driesch over-hastily posited a physical *entelechy* to direct embryological development as an efficient cause. The modern biological approach is to explain development in terms of the known laws of chemistry and physics. Biologists are understandably hesitant to speak of formal causality; most of them are even unwilling to admit in the egg any guiding influence toward its goal. They note that the egg overcomes early disturbances which might deflect it from its course² and some even speak loosely about the embryo's pre-determined end.³ One of the more daring hazards the opinion that a fertilized human egg cleaving in a precise fashion and marching towards its culmination in the adult is "activity which is goal-directed." He hastens to add that "whatever we may think of it in theory, the organism *looks* as if it were going somewhere."⁴ Some biologists will even agree with von Bertalanffy's opinion that the fertilized egg is charged with form as a storage battery is charged with electricity. Under the shadow of ominous vitalism, however, modern-day mechanism permits little such daring.

There is good reason to respect this scientific reserve. Because of the differing methods, scope, and concerns of biology and philosophy, we must not expect biologists themselves to determine when the rational soul is infused. The question in its premise and conclusion

1. Cf. for example R. C. RAVEN, *An Outline of Developmental Physiology* (New York, McGraw-Hill, Inc., 1954), p.34: "Determination advances by degrees... from the more general to the more specific."

2. Joseph NEEDHAM, *Chemical Embryology* (New York, 1931), p.17.

3. *Ibid.*

4. W. SINNOTT, "Biology and Teleology," *Bios*, Vol. XXV, 1, p.38.

is philosophical, and we naturally must expect philosophers rather than empirical scientists to provide whatever philosophical answers are possible.

Before considering the modern embryological evidence for each position, we need to consider the historical development of the two theories of animation to indicate what interpretation each has placed on past embryological evidences.

THE IMMEDIATE ANIMATION THEORY

The theory of immediate animation holds that the rational soul is created and infused by God at the moment of fertilization. It has been suggested by one of its opponents¹ that the origins of immediate animation lie in (1) the decline of scholastic philosophy, (2) the Church's teaching on baptism and abortion, and (3) the biological theory of preformation. Immediate animation does evidence some basis in these first two items, but the greatest original impetus to its popularity appears to have been the biological theory of preformation.

Up to well past the Council of Trent, meager mention was made of the immediate theory of animation, except for Gregory of Nyssa's suggestion in the fourth century of its possibility. The principles and conclusions of Aristotle and Thomas found general acceptance then and well until the seventeenth century, when medical observations suddenly began to undermine the mediate theory with apparent indications that the embryo manifested a specifically human character even before fecundation. The mouthpiece of this assumption was the faculty of medicine of the University of Louvain.² A certain Thomas Fienus published in 1620 an endeavor to prove that the embryo is animated by the rational soul three days after conception. A number of subsequent observations supposedly established that human fetuses expelled four days after conception had well-organized brains, hearts, and livers. In 1661, the papal doctor Paul Zacchias, wary of the difficulties of mediate animation, published his *Questiones medico-legales*, in which he maintained, in view of this "evidence," that God must create and infuse the human soul immediately at fertilization. He was apparently the first to maintain this seriously since Gregory of Nyssa.³

The discovery of the Graafian follicle in 1672 gave more solid basis to this theory. De Graaf considered the follicle which bears his name to be the true mammal ovum. Mistaking the proligerate cumulus as the embryo, De Graaf naturally concluded that the embryo

1. HERING, *op. cit.*, p.28.

2. MESSENGER, *op. cit.*, p.271.

3. *Ibid.*, p.273.

did indeed exist even before fecundation. Embryologists of the day soon were maintaining that the "embryo" in the unfertilized "ovum" possessed miniature human organs, even though the body was not yet living. The natural conclusion was that the sperm's activity consisted in vivifying the pre-formed embryo. On this basis it seemed even more logical to conclude that the human soul was infused at the moment of fertilization.

Preformation was disproved in 1827 with von Baer's discovery of the true ovum and its relatively undifferentiated character. Today we know that the fertilized egg (and unfertilized egg as well) bears no detailed spatial structure responsible for the development of certain locations into definite organs. Both preformation and neo-preformation are in disfavor, and today, while admitting a certain polar and chemical preformation, biologists agree that human development is largely an epigenetic process. The *homonculus* has been dethroned.

It is because this erroneous preformation theory gave historical impetus to the theory of immediate animation that Canon Dorlodot condemns adherence to that theory as "one of the most shameful things in the history of thought."¹ This criticism, however, seems severe and biased. Immediate animation no longer rests on preformation theories but on more solid metaphysical and empirical grounds. Immediate animists find their first recourse in the philosophical rigors of Occam's razor. Since rational life is the term of vegetative and animal forms and can itself embrace the functions of these lower forms, there is no need, they claim, to postulate specifically vegetative and sensitive forms in man prior to the advent of his human soul. This argument, then, is based on the metaphysical principle that *entia non sunt multiplicanda sine necessitate*.²

Since mediate animists often counter this argument with an assertion of just such a necessity for multiplication of forms, supporters of the immediate theory find recourse to a second argument based on the fact that the fertilized ovum is naturally destined to evolve and terminate in a human being. This pre-determination, though only dispositive, is nonetheless evidence of a definite and specific intrinsic finality. Since the *finis* of the egg is the complete human adult, what vital principle can determine the development to this *finis*, supporters ask, except a corresponding form, namely, the human soul?³

1. DORLODOT, *op. cit.*, p.107.

2. Those dissatisfied with immediate animation regularly dispose of this argument by insisting that there is a necessity to multiply forms because of the disproportion between form and matter in the early embryo.

3. This popular argument suggests that the soul may exercise some efficient causality upon the body's development, a view which does not appear consistent with the causality usually attributed to a substantial form.

These arguments have their suasive aspects, but neither is apodictic, and both fail to indicate whether the prime requirement for the soul—specifically human structure—is present or not. Before looking further at the immediate theory, we will review the historical genesis of its opposing view.

THE MEDIATE ANIMATION THEORY

Although mediate animation has returned to the philosophical and theological spotlight mainly in this century,¹ due partially to the concern to find escapes for the problems of population and thalidomide babies, the theory was common to philosophical and theological discussions of the past. The question of the time of rational animation was actually treated as early as the time of Aristotle, who discusses this and related topics in *De Generatione Animalium*. He holds that intellection is non-material, and, consequently, that the soul, as first act of a physically-organized body, cannot be educed from the embryological matter but must be imposed from without. The time of infusion is well after fertilization: 20 days in the male, 40 in the female. To the Stagirite's mind, the semen was the residue of digestion, homogeneous, and contributive of a mere efficient motion for initiation of embryological development. The ovum was homogeneous menstrual blood, completely passive, dependent for initial development upon the efficiency of the sperm. The resultant fertilized ovum, to Aristotle's mind, was itself initially non-living and homogeneous. Once stimulated by the sperm, it formed only slowly into an heterogeneous living thing which, in turn, became a *human* being only after passing through intermediate stages of vegetative and sentient forms.

The theory of mediate animation expounded by Aristotle was widely held in various forms by early and medieval Christian philosophers, the more notable being Cassiodorus, Anselm, Peter Lombard, Alexander of Hales, Albert the Great, and St. Bonaventure. It is clearly espoused by St. Thomas,² who follows Avicenna's biology and holds, with Aristotle, that the early zygote is non-living and homogeneous.

1. For some recent articles, cf. especially the *Irish Ecclesiastical Record* (1932), the *American Ecclesiastical Review* (1914), *Angelicum* (1951, 1952), as well as text books of Catholic medical ethics and scholastic philosophy published in the last thirty years. Messenger's work cited above gives one of the better reviews of the controversy. This interest took on a new form in the face of Catholic opposition to birth control, abortion, etc., because some thinkers, seeking an escape from such problems, maintained that an embryo was not a human being until nearly birth and that during the preceding period, the usual laws of human morality did not bind.

2. In various places, more notably: *In II Sent.*, d.18, q.2, a.3; *De Pot.*, q.3, a.9; *Cont. Gent.*, I, 2, c.87-89; *Ia*, q.118-119.

The arguments supporting mediate animation as propounded by Thomas were accepted throughout the middle ages. They are taken for granted by the Council of Trent with, however, no implication of being *de fide*. Sixtus V and Gregory XIV both held the theory and, following the teaching of contemporary philosophy, they pronounced excommunication on all who aborted a *foetus animatus* or an *inanimatus* (anything under three months), with more stringent punishment for aborting the former.¹

Up to this time, immediate animation had received scant attention. At the dawn of the seventeenth century there occurred the chain of mistaken "preformation" observations explained above which nurtured the view of immediate temporal infusion of the rational soul.

Mediate animists list several embryological phenomena in support of their position, one of the more popular of which is parthenogenesis. They interpret this phenomenon to indicate that there is no difference between a non-fertilized and a fertilized human egg, an assertion surprisingly common in their camp.² In virtue of this assumption, mediate animists have argued that if such organization in a fertilized egg is sufficient for the rational soul, every non-fertilized egg would be equally well-disposed for the rational soul and therefore actually informed by it. The absurdity of this conclusion demands, to their minds, that the rational soul be infused only some time after fertilization. This argument, however, is deficient in both parts. The possibility of human parthenogenesis is currently a matter of doubt, since it has been successful in no animals higher than rabbits and turkeys. According to one medical professor,³ parthenogenic cleavage is possible at the dyad stage but subsequent growth is disorganized and does not result in a recognizable nor viable human organism. Medical text books are also highly skeptical about the possibility of human parthenogenesis.⁴ At any rate, the current doubtful status of human parthenogenesis cannot be used to build a convincing argument. Furthermore, the statement that a fertilized

1. SIXTUS V, *Constitutio Effraenatum* (Oct.29, 1588); GREGORY XIV, *Constitutio Sedes Apostolica* (May 31, 1591).

2. "Respectu futuri organismi, ovulum foecundatum ab ovulo non foecundato non differt." M. HUDECZEK, "De tempore Animationis Foetus Humani secundum embryologiam hodiernam," *Angelicum*, Vol.XXIX, (1952), p.165. Before fertilization, in the dyad stage of maturation, the non-fertilized human egg has 46 chromosomes, as does the fertilized egg; the difference is that in the fertilized egg, 23 chromosomes are from the female and 23 from the male.

3. Dr. John LOVE, M.D., Ph.D., Resident Surgeon, Walter Reed Army Hospital, Washington D.C., in a letter to the author, 11/22/61.

4. Cf. Hamilton, Boyd, Mossman, Pincus among the medical embryologists who deny the possibility of human parthenogenesis. For a scholastic consideration also denying the possibility of human parthenogenesis, cf. M. M. HUDECZEK, O.P., "De Paritate sexuum et de parthenogenesi humana sub aspectu biologico," *Angelicum*, Vol. XXXVIII, (1961), pp.73-88.

egg in no way differs from a non-fertilized egg is biologically inaccurate. The difference is minute but of great importance : a fertilized egg has the full complement of 46 chromosomes, 23 from the male and 23 from the female, a total twice that of the mature non-fertilized egg.

The incidence of identical twins has also been a popular recourse of mediate animists. Identical twins spring from one ovum fecundated by one sperm, and the ensuing zygote for some unknown reason splits into two distinct entities. This permanent cleavage occurs in early stages of development. Since it is metaphysically impossible for one soul to undergo the trauma of division, a second soul must be introduced by supporters of immediate animation. But in this event, there is no possible way of determining what material part of the divided germen is commensurately predisposed to receive the original soul and what part is to receive the newly-created one.

Nonetheless, some believe that it is relatively easy to explain the origin of this second soul. The individual rational soul, assuming it to be present from the first, remains in one of the separated parts, though it is not possible to determine in which. When the other part of the egg is fully separated from information by the first soul, a new soul is created and infused instantaneously for this second twin. There is no disproportion between form and matter in either case, because the division of the embryo into two parts implies that each part is equally formed and equally able to develop into a human person.¹ It appears, then, that the argument from didymology is no absolute indication that the rational soul cannot be infused at the moment of fertilization.

Mediate animists draw a further argument from the fact of human monsters. By what right, they ask, do we assume that everything issuing from the womb is human? Only that which issues from the womb is human, they claim, when it displays the biological organization ordinarily associated with the human person, i. e., such a disposition of matter as to be suitable to the reception of the rational soul. The incidence of monsters suggests that the soul is "held back" until normal organizational development is assured. When such development is not forthcoming, the soul is simply not created, and the organism is animated by a vegetative or sentient form proportionate to its powers. This argument is a variation of that used by those who propose death for thalidomide babies under the grounds that such babies are not "human."²

1. "The division depends on the possession first, of the necessary materials and, second, of sufficient plasticity or regulative capacity to build from them a whole." E. B. WILSON, *The Cell in Development and Heredity*, (1932), p.1082.

2. The original argument is Messenger's main proposition for mediate animation, *op. cit.*, p.175. If the soul comes as late as the third month following fertilization, as

This, of course, is an argument from convenience, and it can give only an answer which is convenient rather than certain. Human monsters are an admitted fact, and it is difficult if not impossible to draw the line between those which are truly human and those which are not. Nonetheless, the normal pattern for the human womb, in view of its general and consistent pattern and operation, is to produce human beings. We must assume, then, unless definite proof to the contrary can be provided, that a foetus issuing from the human womb after pregnancy is human. Furthermore, the absence of rational activity in human monsters does not indicate the absence of rational nature. We can never say with absolute certainty that this or that monster is definitely not human simply on the grounds that it exhibits extreme malfunction of physical or mental processus. There is no denying, however, that it is a convenient thought to have God hold the soul back until the possibility and actuality of monstrosity are avoided. The argument from monsters does not, however, go much beyond this convenience.

Mediate animists place their strongest argument on St. Thomas' definition of the soul. The soul as substantial form is the term, not the principle, of generation; therefore, it comes to matter only when it is completely formed, i. e., possessed of organs "capable of a high degree of sensitive life."¹ Since the embryo is not preformed in detail but develops gradually by an epigenetic process through various stages of lower phylogeny and reaches term about the end of the third month following fecundation, it is only then that the human soul can be infused into the body.

The syllogism underlying this argument is a rigid interpretation of Thomas' definition of the soul. The argument is based on the assumption that the presence of the rational soul depends on the ability to exercise rational operations, which, of course, demands well-developed organs. If mediate animists were to continue along this logical vein, however, it seems they would have to conclude that the human soul cannot be infused until the time of birth or perhaps even as late as the age of reason — which does not appear likely. No one denies that the human being undergoes a gradual evolution of rational powers and exercise, but it is questionable whether this evolution of rational powers demands a parallel evolution of the rational nature underlying these powers.

Nonetheless, if the human soul truly (1) requires the body to be complete in the parts necessary for sensitive life, and (2) comes

Dr. Messenger insists, some believe that in cases such as thalidomide infants, the soul is held off even longer, perhaps until shortly before birth. Such a belief cannot be given scientific basis as yet.

1. "It is only when the matter is completely disposed, namely, when the human body is complete in all its parts, that the form is introduced." William REANY, *The Creation of the Human Soul* (New York, Benzinger Bros., 1932), p.173.

at the term of epigenetic development, then the validity of the theory of mediate animation is undeniable.

TWO SUGGESTED SOLUTIONS

Two areas of thought present themselves as cogent arguments for immediate animation, the first being largely philosophical and the second, and perhaps stronger, argument based on recent genetic discoveries.

In the first place, one might question the validity of the mediate animists' attempt to interpret the Aristotelian-Thomistic definition of the soul as the rigid requirement for the time of the soul's infusion. With the exception of the words *actus primus*, that definition is an operative account of the soul. The soul itself is the first or vivifying, substantial act ; its operations are second acts, and it was from the diversity of these operations that Thomas concluded that the subject of the soul needed a diversity of organs. This diversity was needed not for the presence of the soul but for the operations of rationality. As the principle of vital operations and of the required perfections of matter, the soul certainly demands in the matter precisely those perfections which are required for the exercise of the functions of which it is the vital principle. But the soul itself is first act independently of its operations, which are second acts. In order to account for the required perfections of matter, it does not seem necessary to posit additional substantial forms as preparatives of the matter for the soul. Rather, it would suffice to consider the soul as a causally complex form which itself prepares matter for those operations. Since the human soul as substantial form contains the vegetative and sentient faculties within its own influence, it could by these functions progressively inform the embryo to the operative intellectual stage. It would then be absurd to draw the conclusion, as some have done, that the absence of rational operations indicates the absence of rational nature. The basic question is whether the soul's presence demands organic diversity *fully* or merely *virtually* present with an intrinsic orientation toward becoming actually present as embryological development proceeds. If the latter be the case, as seems possible, the mediate contention demanding organic completion overstates the requirements.

Nonetheless, there will remain those who prefer the tried and true method of ascertaining a nature through its manifested operations. The zygote naturally cannot be expected to act rationally, i. e., do mental gymnastics. Furthermore, the fact that the development of the human embryo recapitulates the structures of lower animals seems to suggest that the human soul is, again, "held off" until the advent of a truly human structure. To answer these objections

and to offer a more convincing basis for immediate infusion a second approach can be suggested. This approach is from a *specific* chemical structure to a *specific* nature and involves the recent information about the structure and functions of genetic DNA (deoxyribose-nucleic-acid) in embryonic development.

Fertilization brings together the full human complement of 23 male and 23 female chromosomes in the nucleus of the zygote. Lined along the chromosome bands are the genes, estimated at some 90,000 in man, whose essential genetic material consists of double helix strands of DNA. DNA itself is a chemical band composed of specific alternating arrangements of four paired nitrogenous bases: adenine, thymine, guanine, and cytosine, commonly designated by their initials. At fertilization, chromosomes are paired by natural attraction according to partner-patterns of A, T, G, and C. In themselves, these four chemicals are not unlike the same chemicals found in subhuman entities, but their paired sequence is such as to produce a specific human protein. The sequence of A, T, G, C is specific to the species in which it is found. (This is why the "creation" of life and even of human beings in test-tubes presents no chemical problem: once the ATGC sequence is fully known, it becomes necessary only to manufacture this sequence; an ultimately successful development, however, also depends on proper chemical resources, proper light, temperature, and environment).

What occurs immediately after fertilization is basically a manifold copying of this basic ATGC pattern of DNA. A special form of RNA (ribose-nucleic-acid) is synthesized from the primer DNA and, in its own structure, represents a one-to-one coding of the information carried by the DNA pattern but involving uracil (U) instead of thymine (T). The proteins which are specifically human derive from this RNA transmission.

In August, 1961, Marshall W. Nirenberg reported how he and J. Heinrich Matthaei discovered that a synthetic RNA molecule made of repeating units of a single base stimulated the formation of a synthetic protein. This work marked the first major step in the coding of embryological development since Watson and Crick first postulated the workings of DNA in 1953.

The significant fact for our concern here is that the human specificity of the adult human being is now directly traceable to the original DNA bearing the ATGC pattern. In all living things, this pattern is an architectural blueprint of the future adult expressed in chemical bonds. An embryologist able to read such a code in an early embryo could predict its normal destination in terms of species and accidental characteristics such as eye color, sex, etc. That such early prediction in human embryos is not actually done today does not negate its eventual possibility — with, however, due regard for moral and mechanical limitations.

The entire process of human embryonic development, then, in terms of DNA-RNA, is as follows : the ovum at the moment of fertilization possesses a specific DNA code-pattern and a mechanism for the DNA synthesis of RNA, with the ATGC sequence of DNA determining the identical pattern in RNA. The RNA now transmits the original DNA code to ribosomes in the cytoplasm of the zygote and, with the help of another RNA agent called "transfer RNA," the ribosomes synthesize the amino acids into proteins and in turn into the structures of a recognizable human individual. The design of the DNA gene thus becomes, by a causal and temporal sequence, the reality of the protein and ultimately of the human individual. Proteins are species-specific, with the total complexus of proteins constituting a member of a particular species. But proteins are specific only because, via RNA, they are specified by the specific information embodied in DNA's four-chemical code of ATGC present at the very moment of fertilization.

On the basis of current research in DNA structures, biologists conclude that the all-important directive role of genetic DNA reduces to a single, fundamentally passive function, namely, to allow its specificity to be copied. Genetic DNA accordingly serves as an important original "text" preserved in the "library" of the embryonic nucleus, and available as the authoritative master document from which expendable duplicates (RNA) are prepared and circulated to direct truly human development in various sections of the human zygote.

It is scientifically accurate, then, to say that in normal cases, human specificity in the form of a genetic code destined by an intrinsic, definite structure to form an human adult, is present in the nucleus of the fertilized ovum at the moment of fertilization. In its structure, total complexity, and function, this genetic material is specifically human, i.e., not only destined to result in a normal human being but also directive of human development as *the* ultimate chemical causal agent.

The occasional incidence of human monsters, alleged by mediate animists in defense of their position, results from a DNA structure that is faulty in its code or copied wrongly at some point by either messenger or transfer RNA. Both of these possibilities, though realized often in actuality, are decidedly unnatural and contrary to the normal pattern of the code and of embryonic development. The fact that embryological development is unnatural and aberrant indicates that the basic activities of either or both DNA and RNA were likewise unnaturally structured for normal human development. When such a radically aberrant pattern is present at the moment of fertilization, a decidedly human specificity necessary for the commensurate human soul is absent and, consequently, the human soul could not be infused at fertilization, since the matter, though human in origin and in material, lacks the essential chemical

pattern typical of human embryos. Where this chemical aberrancy can be shown scientifically, a task which to date has not been fully achieved, we could perhaps estimate which "human" monsters were truly not human and not animated by a rational soul. Here, however, our philosophical conclusions must again wait for scientific advancements in determining what particular DNA codes result in definitely non-human or abnormal entities. Such a determination, if ever possible, would rest largely on genetic evidence; rather radical external malformations, such as characterize thalidomide babies, would of themselves be no criterion for judging that a conceptus was truly non-human. Emotional arguments insisting that "such a deformed being could not be human" overlook the fact that human nature basically consists in ability for rational operations and not in any definite physical appearances. That physical deformation often accompanies radical mental retardation is no ground for predicting the latter on the basis of the former.

Genetic DNA might be considered as a strong indication of immediate animation. These chemical patterns perform a unique role in cellular economy which St. Thomas and his contemporaries could not have discovered. As the chief functional unit of genetic material, DNA determines the basic architecture of every cell, the nature and life of all cells, the specific protein syntheses, enzyme formation, self-reproduction, and directly or indirectly, the nature of the developing individual.

It would be interesting to see how Aristotle, Thomas, and Avicenna would react to learning that the egg is not a mass of homogeneous menstrual blood but a precise blueprint of the later human adult. It seems safe to surmise that their preference for postponing the advent of the rational soul derived mainly from their understandably meager knowledge of embryology and genetics. Had they been provided with the discoveries of the past several years, it is not unthinkable that they would have altered their standing on the succession of lower forms and seen good reason to believe that, in normal cases, the substantial form of rationality, the human soul, would be present in the zygote from the very first moment of fertilization.

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