

BP. JÓZEF WRÓBEL SCJ

HUMAN CONCEPTION AND THE STATUS OF SINGLE-CELLED HUMAN ZYGOTE FROM THE PERSPECTIVE OF CATHOLIC BIOETHICS

Abstract. In the discussions on the status of human zygote, the issue of its animation appears only occasionally. Current teaching of the Magisterium of the Church on the beginning of human life emphasises the fact that life of a new human being begins with the conception. The moment when single 2n diploid cell called zygote comes into being is very often considered as a start of a new human life. According to embryology, this takes place 12 to 24 hours after fertilization. The discoveries in epigenetics allow to claim the human character of a zygote is then defined. From the moment of conception, that is when the head of spermatozoon combines with oocyte cytoplasm and two pronuclei come into existence (the nuclei of both male and female gametes), the processes related to a new human life begin.

Key words: human conception; zygote status; epigenetics.

In numerous documents on the sanctity of human life, the Magisterium of the Church demands respect for human life “from the first moment of its existence.” At other times, the Magisterium uses the words: “from the moment of conception.”¹ Emphasis on the term “conception” and not “insemination” implies a personalistic context. Thus, more emphasis is put on the reference to the beginning of life of a particular person, and not only an indication of

Bp. dr hab. JÓZEF WRÓBEL, prof. KUL—head of the Department of Theological Bioethics at the Institute of Moral Theology, Catholic University of Lublin; mailing address: ul. S. Kard. Wyszyńskiego 2, 20–105 Lublin.

¹ JOHN PAUL II. Encyclical *Evangelium vitae* (Rome 1995), No. 60. See also: CONGREGATION FOR THE DOCTRINE OF THE FAITH. Declaration on Procured Abortion *Quaestio de abortu procurato* (Rome, 1974), No. 12; CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction on Respect for Human Life in Its Origin and on the Dignity of Procreation Replies to Certain Questions of the Day *Donum vitae* (Rome 1987), No I, 1; CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction on Certain Bioethical Questions *Dignitas personae* (Rome 2008), No 4.

a particular biological process, typical of animal and plant world. Nevertheless, the biological dimension of this process is not indifferent. Since man is a spiritual and corporeal being, this specifically “human” biology communicates his presence, especially when still not revealed in the realm of the spirit.² Thorough knowledge of the processes connected with biological beginning of a particular person’s life reveals a significant problem, namely, when his or her conception takes place. Discoveries in epigenetics greatly contribute to the knowledge when it exactly happens. They have also important (bio)ethical implications.

1. DISCUSSION ON THE PROBLEM OF THE BEGINNING OF HUMAN LIFE

The fundamental problem concerning the beginning of human life is connected with the knowledge of relevant biological processes and their philosophical interpretation. In historically remote approaches (beside minor exceptions), the crucial meaning in determining this moment was assigned to the moment of animation and the accompanying division into non–animated and animated fetus. This distinction was present not only in Church teaching, but also in secular law. Frequently, it was based on reasons resulting from medical knowledge at the time (e.g. the first movement of the fetus in mother’s womb) and referred to the teachings (though not exclusively) of St. Augustine, *Decretum Gratiani*, and St. Thomas Aquinas.³

For contemporary reflection this stance rather belongs to the past and is treated as a historical curiosity, though in some modern approaches there is an alternative for spiritual animation (pouring spiritual soul) in the form of “dynamic animation” connected with the beginning of movements made by human fetus.⁴ Also, there rarely appear statements of secular bioethicists who, referring perversely to the Christian tradition that propagates successive animation, suggest non–human character of human embryo in the first

² J. WRÓBEL, “Godność poczętego życia ludzkiego,” *Homo Dei* 2–3 (1992): 45–46.

³ M. MACHINEK, *Spór o status ludzkiego embrionu* (Olsztyn: UWM, 2007) passim; E. SCHOCKENHOFF, *Etyka życia. Postawy i nowe wyzwania* (Opole: Wydział Teologiczny Uniwersytetu Opolskiego, 2014), 468.

⁴ K. SZEWCZYK, *Bioetyka*. Vol. 1: *Medycyna na granicach życia* (Warszawa: Wydawnictwo Naukowe PWN, 2009), 239–240.

period of its development. Such a position opens the way for the acceptance of abortion, eugenics or the use of embryos in biomedical experiments.

It cannot be forgotten, however, that the teaching about fetus animation does not have its most important foundation in the authority of philosophers and their conceptions, but in the truth of faith invariably preached by the Church instructed by the Scripture: “The Church teaches that every spiritual soul is created immediately by God—it is not ‘produced’ by the parents—and also that it is immortal.”⁵ Recognizing this fact as the axiom of faith, the Church does not speak at the same time about the moment of pouring soul into the developing corporeal structure because “presence of a spiritual soul cannot be ascertained by empirical data”⁶ and, moreover, “the Magisterium has not expressly committed itself to an affirmation of a philosophical nature.”⁷ Thus, the Church does not declare herself for any position regarding animation. In addition, defining the moment of animation goes beyond the capabilities of sciences for “it is not up to biological sciences to make a definitive judgment on questions which are properly philosophical and moral such as the moment when a human person is constituted.”⁸

The practical meaning of the dogma indicating each individual creation of the soul by God is explained synthetically by *The Catechism of the Catholic Church*: “Being in the image of God the human individual possesses the dignity of a person, who is not just something, but someone” (No. 357), and then “[t]he human body shares in the dignity of ‘the image of God’: it is a human body precisely because it is animated by a spiritual soul” (No. 364).

The problem of humanising human zygote is presented by some of contemporary authors in a similar way. A good example here can be German ethician and theologian from Tübingen, Dietmar Mieth. While it is true that he indicates the connection of St. Thomas to Aristotle’s concept of animation, at the same time he proves that it was not Aquinas’ intention to distin-

⁵ *Catechism of the Catholic Church* (ROME 1992), No. 366; see also: PIUS XII. Encyclical *Humani generis* (Rome 1950); *Breviarium fidei. Wybór doktrynalnych wypowiedzi Kościoła*, ed. S. Głowa SJ, I. Bieda SJ (Poznań: Księgarnia św. Wojciecha, 1997), 190, No. V, 38.

⁶ JOHN PAUL II. Encyclical *Evangelium vitae* (Rome 1995), No. 60.

⁷ CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction *Donum vitae*, No I, 1. It is worth adding that no philosophical system, even Thomistic one, unequivocally suggests the moment of animation, and to the point that while some Thomists present arguments for direct animation, others in turn are for successive (see: J. WRÓBEL, “Kiedy ciało może przyjąć duszę,” *W drodze* 199 (1990), 3: 19–29; J. WRÓBEL, “Godność poczętego życia ludzkiego,” *Homo Dei* 2–3 (1992): 37–44; T. ŚLIPKO, *Granice życia. Dylematy współczesnej bioetyki* (Kraków: WAM, 1994), 107–122.

⁸ CONGREGATION FOR THE DOCTRINE OF THE FAITH. Declaration *Quaestio de abortu procurato*, No. 13.

guish stages of humanising human embryo in its development. Mieth bases his conviction on the assumption that Aquinas did not know the course of the biological process of conception or the development of a human being. Consequently, his teaching about animation does not assume a two-stage development of the embryo, but indicates that every man owes his life to the Divine act of creation.⁹

Another German theologian and moralist from Freiburg im Breisgau, Eberhard Schockenhoff, who is well-known in Poland, also presents his stance. He reminds us that the distinction between animated and non-animated embryo, once present in Church law, was rejected by successive Popes, including Sixtus V (1585–1590), Gregory XIV (1590–1591), Innocent XI (1676–1689), or Pius IX (1846–1878). At the same time, Schockenhoff analyzes the problem of the beginning of human life, referring to the achievements of ‘humanistic biology’. He emphasises the fact that subsequent discoveries in the field of human biology increasingly undermine the position of the advocates of successive animation. Most important assumptions in this matter result from the achievements of genetics published in 1953 by James D. Watson and Francis H. Crick.¹⁰ They allow to state that human zygote from the very beginning has a complete adequate genetic information that decides about its individual development and specific features.

The Magisterium of the Church also refers to the above success of genetics in the stance on the subject of the beginning of human life, omitting the issues related to the moment of animation. The Congregation for the Doctrine of the Faith already in 1974 taught, referring to the discoveries made by geneticists, that “from the first instant, there is established the program of what this living being will be: a man, this individual man with his characteristic aspects already well determined. Right from fertilization is begun the adventure of a human life, and each of its capacities requires time—a rather lengthy time—to find its place and to be in a position to act.”¹¹

⁹ D. MIETH, “Konfessionelle Identität in der biomedizinischen Debatte? Relecture der Be-seelungstheorie bei Thomas von Aquin,” *Ökumenische Rundschau* 51 (2002): 326.

¹⁰ J.D. WATSON, F. CRICK, “Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid,” *Nature* 171 (1953): 737–738.

¹¹ CONGREGATION FOR THE DOCTRINE OF THE FAITH. Declaration *Quaestio de abortu procurato*, No. 13.

2. WHEN DOES CONCEPTION TAKE PLACE?

As already indicated, the Church regularly reminds that human life begins at the moment of conception. In the light of embryology, the question remains, which moment should be considered as conception: is it the penetration of a haploid sperm cell into the cytoplasm of a haploid egg cell (ovum), or the “constitution” of a diploid cell nucleus of a new being that contains individual genetic information? In the analyzes carried out, these two moments cannot be treated arbitrarily or interchangeably. They also cannot be identified with each other, for there are 12 to 24 hours between the conception and the formation of a diploid nucleus of the zygote.¹² Embryologists describe this process in the following way: “As a result of conception two haploid sets of chromosomes (chromatids) engage in the creation of pronuclei. This process takes about 5 hours. [...] Pronuclei begin the synthesis of the DNA, and after the replication of the DNA, they move from the peripheral region to the centre of the ovum. About 20 hours after conception, chromosome condensation takes place. Pronuclei move closer together and form a zygotic nucleus. [...] After the membranes dissolve, chromosomes mix in the metaphase of mitosis. [...] Their ‘age’ is assessed for 12–24 hours.”¹³

Eberhard Schockenhoff, who is one of the few who thoroughly analyze the problem in question, provides arguments that allow both options, i.e. the penetration of the sperm into oocyte and the constitution of integrated genetic information in the nucleus of the single-celled zygote, as the beginning of human life. First possibility is indicated by the fact that already at the pronuclei stage all elements of new man’s genotype are present. What is more, it is known today that two pronuclei do not blend together to give rise to an integral genotype, but only their membranes dissolve.¹⁴ At the same time, Schockenhoff states that “the embryo does not develop to be human being but from the very beginning it [develops] as a man.”¹⁵ The scholar’s sensitivity to the precision of the used terms is not without significance. He emphasizes that the term “fertilized egg cell” cannot be considered correct.

¹² L. SPEROFF, M.A. FRITZ, *Kliniczna endokrynologia ginekologiczna i niepłodność* (Warszawa: Medi-Page, 2007), 277: “The activity of the human embryo genome begins early. The synthesis of DNA can be detected already 9–10 hours after insemination.”

¹³ H. BARTEL, *Embriologia* (Warszawa: Wydawnictwo Lekarskie PZWL, 2007), 84–85.

¹⁴ E. SCHOCKENHOFF, *Etyka życia*, 471–472; H. BARTEL, *Embriologia*, 85.

¹⁵ E. SCHOCKENHOFF, *Etyka życia*, 473.

After conception, the oocyte is no longer an egg cell, it is a zygote, though a single-celled one.¹⁶

On the other hand, Schockenhoff also presents reasons suggesting that only the moment of constitution of a diploid nucleus can be considered the moment of conception. He states that “presence of gametes in the right place is not enough to verify a substantial unity of a living being.” What is necessary is “unity of form and spontaneous development,” which is not the case before the unity of aggregation (“unitas aggregationis”) as a unity of form in the strict sense that determines the beginning of spontaneous development. The discussed author states that from the biological point of view, conception cannot refer to the period of time when two haploid pronuclei are together in the cytoplasm of zygote formed through fertilisation of an egg cell, but do not constitute unity in the strict sense yet. He also quotes opinions of Evangelical theologian, Wilfried Härle, who states: “It is only from the short section of the process in which the sperm cell and egg cell genome combine into new, independent genome which is able to live [...] that it is sensible to talk about the beginning of man—not earlier, but also not later.”¹⁷

Does it mean that sciences studying human being are not able to work out a strong position in this matter? Schockenhoff himself, despite presenting arguments for both options, is not entirely sure, however, which moment should be considered the decisive one. Admittedly, he notices: “Conception is a radical new beginning through which something that was not there before is created through unification of the egg cell to constitute individual life of a new man.”¹⁸ At the same time, he emphasizes that “quality leap of becoming a man lies at the beginning of the entire embryonic development process.”¹⁹ However, the context of this sentence seems to suggest that the author does not think about the moment male gamete penetrates the oocyte, but about the formation of a diploid nucleus of the first cell of the zygote. He states: “With the constitution of the genome a step is made towards a new man. From that moment the embryo is defined specifically both as species (man) and individual organism (a particular man) [...]. By means of a new

¹⁶ Ibidem.

¹⁷ W. HÄRLE, W., “Menschenwürde—konkret und grundsätzlich,” *Menschsein in Beziehungen. Studien zur Rechtfertigungslehre und Anthropologie* (Tübingen, 2005) 393; qtd in E. SCHOCKENHOFF, *Etyka życia*, 472.

¹⁸ E. SCHOCKENHOFF, *Etyka życia*, 473.

¹⁹ Ibidem.

combination of an individual genome that arises from maternal and paternal elements [...] a new human comes into being in a magnificent way.”²⁰

Lack of unambiguity in determining the moment when the zygote gains human status is not indifferent from the bioethical point of view. Conviction that we can speak of human life only when the diploid nucleus of the zygote is formed, in practice, may lead to the conclusion that its destruction in the first hours after insemination, for example in the process of *in vitro* or in various experiments, is not the same as the destruction of the life of a particular human being. In other words, it is not immoral.

Ethical reflection and the teaching of the Magisterium of the Church do not permit such simplification. Even the classical scholars of Thomistic thought who are in favour of successive animation, think that human zygote contains internal forces that enable it to comprehensive psychophysical development. From the very beginning, it has purposefulness present in it, which orients it towards a person it will become in the further developmental process, and towards supernatural goal. Thus, human zygote falls into the category subjected to moral evaluation and deserves respect due to man.²¹

As already noticed, the teaching of the Church is unambiguous in this matter. She underlines the inviolability of human life from the moment of conception. She also clearly indicates that human embryo in the preimplantation period demands respect. The Church also definitely condemns, among others, eugenic embryo selection in the *in vitro* procedure, destruction or freezing of surplus embryos, and “embryo reductions.”²² However, this teaching also demands an explanation which moment is considered by the Church to be the moment of conception. In the Instruction on respect for human life in its origin and the dignity of procreation, *Donum vitae*, one can see some ambiguity. On the one hand, it treats about the moment of oocyte fertilisation as the beginning of life of a new human being. On the other hand, this beginning is connected with the formation of a zygote, which described as “the cell produced when the nuclei of the two gametes have fused.”²³ In this case, the beginning of human life seems to be connected only with the moment of the formation of a diploid nucleus of a single-celled zygote.

²⁰ Ibidem.

²¹ T. ŚLIPKO, *Granice życia*, 122–123; R. OTOWICZ, *Etyka życia. Bioetyczny i teologiczny kontekst problematyki życia poczętego* (Kraków: WAM, 1998), 154–155.

²² CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction *Dignitas personae*, No. 21

²³ CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction *Donum vitae*, No. I, 1.

From the moral point of view, this ambiguity is overcome not only by reference to “the probability of person’s existence” from the first moment male gamete penetrates the egg cell,²⁴ but also by comprehensive analysis of the teaching of the Church. She regularly points to the moment of egg cell insemination and at the same time refers to the achievements of modern genetics.²⁵

3. CONTRIBUTION OF EPIGENETICS TO RESOLVING THE PROBLEM

What does embryology, enhanced with the achievements of modern genetics, contribute to the discussed problem? In a very narrow context, creation of man takes place already by the very fact of gamete fusion. This applies, above all, to the sex of a new man: whether it will be a girl or a boy (depending on the “sex” of male cell, i.e. whether has an X or Y chromosome). Full definition of man on the genetic level begins gradually in a very short period of time: from the moment the sperm cell penetrates the egg cell. The impulses directed at the development of a zygote are triggered within a few minutes. Then, particular processes start, which aim at shaping two active haploid pronuclei with specific character. Within few hours, the process of preparing the oocyte nucleus is complete. Also, the sperm cell that has remained passive activates due to biochemical and structural changes, and it becomes an active male pronucleus.²⁶

The most important discoveries in the source and the course of this process were made by specialists in the most recent field of genetics called epigenetics. They describe (within the discussed issue) control principles at the genetic level by means of processes taking place in the oocyte after its insemination. In the light of epigenetics, not only the genes of the nucleus, even supplemented by mitochondrial genes, perform the decisive function in shaping the genotype of the new person and incline his or her life. In the

²⁴ “[T]he mere probability that a human person is involved would suffice to justify an absolutely clear prohibition of any intervention aimed at killing a human embryo” (JOHN PAUL II. Encyclical *Evangelium vitae*, No. 60).

²⁵ “[Modern genetic science] has demonstrated that from the first instant there is established the programme of what this living being will be: a person, this individual person with his characteristic aspects already well determined.” (JOHN PAUL II. Encyclical *Evangelium vitae*, No. 60).

²⁶ PONTIFICIA ACADEMIA PRO VITA. *Lembrione umano nella fase del preimpianto. Aspetti scientifici e considerazioni bioetiche* (Città del Vaticano: Libreria Editrice Vaticana, 2006), 14–16, 19.

discussed subject matter, the entirety of genes can be compared to “hardware.” “Software,” on the other hand, is formed by the chromatin structure which is the carrier of epigenetic heredity based on DNA methylation and different chromatin molecular changes. They decide which genes are active (gene expression), and when are inactive.²⁷ In other words, it is not only the gene pool of the nucleus in a unicellular zygote that determines genetically a particular person who is conceived, but also an epigenetic program which controls genes and initiates life processes of a new being in the inseminated egg cell. Epigenetic information together with the genes is the “the program of what this living being will be: a person, this individual person.” A single-celled zygote (similarly to cells of an adult person) has a certain pool of genes, which not necessarily must be all active at a given moment and have decisive meaning for determining the characteristic features of a person (e.g. the differences between identical twins). This epigenetic heredity is active all the time and transmitted from the moment the sperm cell enters the oocyte and the pronucleus is formed.²⁸ Thus, human specificity of the zygote is defined and processes relevant for new life begin already at the time of conception, i.e. from the moment two haploid and sexually determined pools of genes appear in the cytoplasm.

Research into the latest genetics (epigenetics) has provided numerous examples of such interaction at the level of genetic information. One of the forms of such gene control is, for example, genomic imprinting also referred to as imprinted genes, found in mammals, including human being. Genomic imprinting reveals its significance, for instance, in the case of manipulating reproduction, in the attempts of reproductive mammal cloning, and also in trisomic or disomic people who in certain cases have copies of chromosomes from the same parent.

²⁷ J.R. DANIELS, V. BOLTON, M. MONK, “Imprinted Expression of SNRPN in Human Preimplantation Embryos,” *The American Journal of Human Genetics* 63 (1998): 1009–1014; P. SPORK, *Drugi kod. Epigenetyka, czyli jak możemy sterować własnymi genotypami* (Warszawa: W.A.B., 2011); W.W. GIBBS, “Genom ukryty poza DNA,” *Świat Nauki* 1 (2004): 58–65.

²⁸ W. SIKORA, “Dziedziczenie epigenetyczne,” Zakład Biofizyki Obliczeniowej i Bioinformatyki. Wydział Biochemii, Biofizyki i Biotechnologii. Uniwersytet Jagielloński. [Http://bioinfo.mol.uj.edu.pl/articles/Sikora05](http://bioinfo.mol.uj.edu.pl/articles/Sikora05) (access 28.10.2014); see: M. ŁUKASIK, J. KARMALSKA, M.M. SZUTOWSKI, J. ŁUKASZKIEWICZ, “Wpływ metylacji DNA na funkcjonowanie genomu,” *Biuletyn Wydziału Farmaceutycznego Warszawskiego Uniwersytetu Medycznego* 2 (2009): 13–18. [Http://biuletyn.farmacji.wum.edu.pl/0902Lukasik/Lukasik.html](http://biuletyn.farmacji.wum.edu.pl/0902Lukasik/Lukasik.html) (access 15.05.2017); T. KOHDA, F. ISHINO, “Embryo Manipulation Via Assisted Reproductive Technology and Epigenetic Asymmetry in Mammalian Early Development,” *Philosophical Transactions of the Royal Society B: Biological Sciences* 368.1609 (2012). [Http://rstb.royalsocietypublishing.org/content/368/1609/20120353](http://rstb.royalsocietypublishing.org/content/368/1609/20120353) (access 13.05.2017).

In the first case, if experimental manipulation on the zygote removes one of the pronuclei and replaces it with a new pronucleus of “the opposite sex” (for example, if the pronucleus from the egg cell is left in the newly formed zygote and pronucleus from the sperm cell is replaced with another pronucleus from an egg cell), then such an embryo or fetus will die *in utero* as a result of serious developmental defects. This suggests that genomes of parental gametes are epigenetically marked before they fuse, and thus—in the problem analyzed in this article—a new person is fully “described” already from the moment the sperm cell penetrates the egg cell and the pronuclei are formed. This law of nature prevents parthenogenesis in mammals (also in the case of humans) and hinders reproductive cloning, which usually leads to numerous errors so that the embryo/fetus either dies quickly or child is born with different (epi)genetic defects.²⁹

A similar problem occurs in the case of an embryo with the trisomy defect mentioned above. It has one chromosome from one parent and two duplicated chromosomes (as a result of an error) from the second parent. If, at one point, such embryo loses its single chromosome from one parent, the remaining two chromosomes will be from the other parent this same sex. In this case, the both imprinted genes (being silent) present on these chromosomes cannot take part during expression of certain genes or if the both being active from the second parent’s chromosome (second sex) may show extra expression. And in this case, in the process of further development there will appear severe genetic defects, despite the fact that the number of chromosomes in the cells of the new being (person) will be adequate.³⁰

Analogous pathologies appear in the processes of determining sex of a new person. According to classical genetics, human sex is defined at the moment of conception through configuration of sex chromosomes: in the case of a pair of XY chromosomes a child will be a male, and in the case of a pair of XX chromosomes a child will be a female. The genes normally present on these chromosomes begin to perform their role in the third week of pregnancy when the genitourinary system starts to form.³¹ Around this time, there is also a differentiation of primary gamete cells that underlie the gonads. In studies carried out on mice, it was also discovered that blastomeres, i.e. cells resulting from the division of the zygote and forming the

²⁹ W. SIKORA, “Dziedziczenie epigenetyczne.”

³⁰ Ibidem.

³¹ H. BARTEL, *Embriologia*, 328.

morula, are differentiated into somatic and sex cells.³² More recent studies have allowed us to get to know the process of shaping human sex even better and deeper. In their light, sexual differentiation takes place at the stage of conception “through numerous parallel signaling routes initially determining the sex belonging to elements named recently sexome.”³³ The unbalanced number of X and Y chromosomes in the zygote is more frequent formed after the penetration of the sperm head into the egg cell during *in vitro* methods in comparison to natural procreation and different pathology concerning health and sex status of existence of such form of chromosomal aneuploidy are observed in such cases.”³⁴

Another testimony of the presented role and meaning of epigenetic information and the moment of its activation in the process of fertilization is constituted by the consequences of artificial insemination sequences used in the *in vitro* method. In such a procedure, the disruption of epigenetic gene control occurs more often than in natural procreation, which is the result of the artificiality of the environment in which the procedure is carried out. These errors result in more frequent pathological conditions in children who have been conceived by means of *in vitro* than in naturally born children.³⁵

It is also worth adding (as an important reflection pointing to the role of epigenetic information, although going beyond the scope of these analyzes) that some processes which define the biological specificity of a human being at the genetic level do not end at the moment considered as the moment of the constitution of genotype, but they still take place during the early embryonic life. This applies, for example, to the process involved in inactivating the big part of the entire X chromosome of a female sex embryo with the aim of levelling the expression of genes on sex chromosomes. In up to fifty divisions of embryonic cells, before its implantation in the uterus, both X chromosomes are still active. Only at this stage one of them is randomly inactivated.³⁶ This process is extremely important for the development of a female embryo. It is determined by the differences between the X and Y

³² Ibidem, 342.

³³ A.P. ARNOLD, A.J. LUSIS, *Understanding the Sexome: Measuring and Reporting Sex Differences in Gene Systems*. “Endocrinology” 153 (2012): 2551–2555.

³⁴ A.T. MIDRO, “Genetyczne i epigenetyczne uwarunkowania płci człowieka,” *Gender. Spojrzanie z różnych perspektyw*, ed. W. Wieczorek (Wyd. Szkoły Wyższej Przymierza Rodzin, 2015), 86.

³⁵ A.T. MIDRO, H.F. HOSER, “Problemy bioetyczne ingerencji medycznych zaburzających genetyczne i epigenetyczne uwarunkowania rozwoju człowieka,” *Family Forum* 5 (2015): 35–36.

³⁶ A.T. MIDRO, “Genetyczne i epigenetyczne uwarunkowania płci człowieka,” 89; M. ŁUKASIK, J. KARMALSKA, M.M. SZUTOWSKI, J. ŁUKASZKIEWICZ, “Wpływ metylacji DNA,” 13–18.

chromosome. The latter chromosome (Y), determining male sex of the future person is very small and contains some important genes defining sex features. In turn, the X chromosome has some genes corresponding to the genes localized on the Y chromosome, and some genes responsible for other features of human being. Because female person normally has two X chromosomes (XX), then, consistently, expression of certain genes present on them would be twice higher than in males. For such process not to take place, one of the X chromosomes is randomly inactivated and, as a result, males and females have similar expression of such genes. Such inactivation of the X chromosome takes place in every cell of the embryo and it is preserved in the descendant cell cultures. This inactivated chromosome is re-activated in the cell culture of female gametes. Otherwise it would be infertile.³⁷

*

Concluding the above analyzes, it must be said that the real beginning of human being does not take place at the moment of the constitution of a diploid nucleus of a single-cell zygote, that is, at the time when the genetic information reaches the level of the integrated unity in its nucleus. Instead, it takes place the moment a sperm cell body penetrates the oocyte's cytoplasm and two haploid pronuclei are formed in the cytoplasm, for it is the epigenetic information, steering full activity of the genes and initiating the life of a new person, that starts to perform its role from that moment on. This moment should be considered the moment of conception. Consequently, in the documents of the Magisterium of the Church there is the invariably present statement that human life begins with the fusion of gametes and that “[]human life must be respected and protected absolutely from the moment of conception. From the first moment of his existence, a human being must be recognized as having the rights of a person—among which is the inviolable right of every innocent being to life.”³⁸

Translated by Dominika Bugno-Narecka

³⁷ W. SIKORA, “Dziedziczenie epigenetyczne.”

³⁸ *Catechism of the Catholic Church*, No. 2270; see also: CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction *Donum vitae*, No. I, 1.

BIBLIOGRAPHY

I. CHURCH DOCUMENTS

- PIUS XII. Encyclical *Humani generis*. Rome: Libreria Editrice Vaticana, 1950.
- JOHN PAUL II. Encyclical *Evangelium vitae*. Rome: Libreria Editrice Vaticana, 1995.
- CONGREGATION FOR THE DOCTRINE OF THE FAITH. Declaration on Procured Abortion *Quaestio de abortu procurato*. Rome: Libreria Editrice Vaticana, 1974.
- CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction on Respect for Human Life in Its Origin and on the Dignity of Procreation Replies to Certain Questions of the Day *Donum vitae*. Rome: Libreria Editrice Vaticana, 1987.
- CONGREGATION FOR THE DOCTRINE OF THE FAITH. Instruction on Certain Bioethical Questions *Dignitas personae*. Rome: Libreria Editrice Vaticana, 2008.
- Catechism of the Catholic Church*. Rome: Libreria Editrice Vaticana, 1992.
- Breviarium fidei. Wybór doktrynalnych wypowiedzi Kościoła*. Ed. Stanisław Głowa SJ, Ignacy Bieda SJ. Poznań: Księgarnia św. Wojciecha, 1997.
- PONTIFICIA ACADEMIA PRO VITA. *L'embrione umano nella fase del preimpianto. Aspetti scientifici e considerazioni bioetiche*. Città del Vaticano: Libreria Editrice Vaticana, 2006.

II. LITERATURE

- ARNOLD, Arthur P., LUSIS, Aldons J. "Understanding the Sexome: Measuring and Reporting Sex Differences in Gene Systems." *Endocrinology* 153 (2012): 2551–2555.
- BARTEL, Hieronim. *Embriologia*. Warszawa: Wydawnictwo Lekarskie PZWL, 2007.
- DANIELS, Robert, BOLTON, Virginia, MONK, Marilyn. "Imprinted Expression of SNRPN in Human Preimplantation Embryos." *The American Journal of Human Genetics* 63 (1998): 1009–1014.
- GIBBS, W. Wayt. "Genom ukryty poza DNA." *Świat Nauki* 1 (2004): 58–65.
- HÄRLE, Wilfried. "Menschenwürde—konkret und grundsätzlich." *Menschsein in Beziehungen. Studien zur Rechtfertigungslehre und Anthropologie*. Tübingen, 2005.
- KOHDA, Takashi, ISHINO, Fumitoshi. "Embryo Manipulation Via Assisted Reproductive Technology and Epigenetic Asymmetry in Mammalian Early Development." *Philosophical Transactions of the Royal Society B: Biological Sciences* 368.1609 (2012). <http://rstb.royalsocietypublishing.org/content/368/1609/20120353> (access 13.05.2017).
- ŁUKASIK, Marcin, KARMALSKA, Jolanta, SZUTOWSKI, Mirosław M., ŁUKASZKIEWICZ, Jacek. "Wpływ metylacji DNA na funkcjonowanie genomu." *Biuletyn Wydziału Farmaceutycznego Warszawskiego Uniwersytetu Medycznego* 2 (2009): 13–18. <http://biuletynfarmacji.wum.edu.pl/0902Lukasik/Lukasik.html> (access 15.05.2017).
- MACHINEK, Marian. *Spór o status ludzkiego embrionu*. Olsztyn: Wydawnictwo UWM, 2007.
- MIDRO, Alina T. "Genetyczne i epigenetyczne uwarunkowania płci człowieka." *Gender. Spojrzenie z różnych perspektyw*. Ed. Włodzimierz Wieczorek. Warszawa: Wydawnictwo Szkoły Wyższej Przymierza Rodzin, 2015.
- MIDRO, Alina T., HOSER, Henryk F. "Problemy bioetyczne ingerencji medycznych zaburzających genetyczne i epigenetyczne uwarunkowania rozwoju człowieka." *Family Forum* 5 (2015): 29–42.

- MIETH, Dietmar. "Konfessionelle Identität in der biomedizinischen Debatte? Relecture der Beseelungstheorie bei Thomas von Aquin." *Ökumenische Rundschau* 51 (2002): 315–327.
- OTOWICZ, Ryszard. *Etyka życia. Bioetyczny i teologiczny kontekst problematyki życia poczętego*. Kraków: WAM, 1998.
- SCHOCKENHOFF, Eberhard. *Etyka życia. Postawy i nowe wyzwania*. Opole: Wydział Teologiczny Uniwersytetu Opolskiego, 2014.
- SIKORA, Weronika. "Dziedziczenie epigenetyczne." Zakład Biofizyki Obliczeniowej i Bioinformatyki. Wydział Biochemii, Biofizyki i Biotechnologii. Uniwersytet Jagielloński. [Http://bioinfo.mol.uj.edu.pl/articles/Sikora05](http://bioinfo.mol.uj.edu.pl/articles/Sikora05) (access 28.10.2014).
- SPEROFF, Leon, FRITZ, Marc A. *Kliniczna endokrynologia ginekologiczna i niepłodność*. Warszawa: MediPage, 2007.
- SPORK, Peter. *Drugi kod. Epigenetyka, czyli jak możemy sterować własnymi genotypami*. Warszawa: Wydawnictwo W.A.B., 2011.
- SZEWczyk, Kazimierz. *Bioetyka. T. 1: Medycyna na granicach życia*. Warszawa: Wydawnictwo Naukowe PWN, 2009.
- ŚLIPKO, Tadeusz. *Granice życia. Dylematy współczesnej bioetyki*. Kraków: Wydawnictwo WAM, 1994.
- WATSON, James D., CRICK, Francis. "Molecular Structure of Nucleic Acids: A Structure for Deoxyribose Nucleic Acid." *Nature* 171 (1953): 737–738.
- WRÓBEL, Józef. "Kiedy ciało może przyjąć duszę." *W drodze* 3 (199) (1990): 19–29.
- WRÓBEL, Józef. "Godność poczętego życia ludzkiego." *Homo Dei* 2–3 (1992): 36–51.



The preparation of the English version of *Roczniki Teologiczne* (Annals of Theology) no. 3 and its publication in electronic databases was financed under contract no. 753/P-DUN/2017 from the resources of the Minister of Science and Higher Education for the popularization of science.