Theological Reflection

Is medicine losing its way? A firm foundation for medicine as a real *therapeia*

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Is medicine losing its way? This question may seem to imply a serious warning, one needing a further explanation. What I mean to say by the title of this paper is that we can detect an undeniable shift in medicine in the last forty to fifty years. Medicine used to focus on what we call “health care” in a classical sense, that is, the treatment of people suffering from diseases, injuries or handicaps, or the alleviation of pain and other symptoms. In addition to this, in the last half century, it has begun to offer more and more treatments aiming to perfect the qualities of people who are otherwise healthy.

Summary: Due to the rapid progress of research in the biomedical field, medicine is already and will ever more be able not only to cure diseases, but also to improve the characteristics of healthy human persons. This seems to be justifiable from the point of view of the contemporary view of man. This considers the mind as the actual human person and the body as an object of which he may dispose as he likes. However, serious and convincing objections exist against this view, because it does not do justice to the fact that we experience ourselves as a unity. Aristotelian-Thomist anthropology explains man as a substantial unity of a spiritual and a material dimension, of body and soul, which implies that the body is an essential dimension of man, participates in his intrinsic dignity and is never to be instrumentalized in order to improve the characteristics of healthy people. Medicine should apply all new medical techniques availed, but remain true health care.

Keywords: Medical-technical progress, Therapy, *restitutio ad integrum*, Enhancement, Instrumentalization, Manipulation, *transformatio ad optimum*, Culture of expressive individualism and authenticity, Ethical impact of human biological nature, Mind-body problem, Dualism, Aristotelian-Thomist anthropology, Christian view of man, Therapeutic principle

MEDICINE EXTENDING BEYOND THERAPY

More than others, novelists are often capable of describing the prevailing mind set of a certain culture or age. Few writers have observed medicine’s contemporary culture

more keenly than the Dutch author Renate Dorrestein (1997). She writes with much humor about absurdities and that is exactly what she does in her book *Want dit is mijn lichaam* (*Because this is my body*), in which she holds a mirror up to present-day people making use of medicine as well of those working in medicine.¹

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One of the leading characters of the novel, Cas, preparing breakfast for his pregnant wife Xandra on her birthday, is daydreaming about the child to be born in due course. It would be “a hundred percent certainly a boy, so the gender clinic had assured at the start of the very expensive treatment. Afterwards they intended to have a girl, and then new breasts for Xandra” (Dorrestein 1997, 27). The birthday present turns out to be a new nose for Xandra. While he, aware that he is facing another long day without food, is watching with unmistakably covetous eyes how she is eating her croissants, she encourages him:

This evening you may have six hundred calories ... His mother had fattened him up as a child and made a glutton of him, with her pancakes and her puddings ... In her kitchen smelling of bacon fat nothing had prepared him for the fact that in the real world everything resolves about physical perfection. (Dorrestein 1997, 30)

Less optimistic about what medicine can accomplish than Cas is his grandfather, Job Olson, who finds his prostate enlarged:

a downright ridicule of human dignity. Still, while washing his pale thin hands that half-baked baboon of a specialist had said without batting an eyelid: “You just have to learn to live with it” He had expected an operation, something with laser, or else at least an effective treatment with pills. They could separate Siamese twins, transplant hearts, make big breasts smaller and small breasts bigger, they froze sperm and fertilized ova outside the womb. Every scrap and snippet of man could be revised, repaired, perfected; new or much improved parts were available for the whole kit, only Job Olson missed the boat. (Dorrestein 1997, 51–52)

The striking point in Dorrestein’s observations, although of course exaggerated, is that people do not expect from medicine only

therapies for disorders or complaints, but also treatments in order to improve bodily functions or appearance and psychological or intellectual achievements. This also includes diverse interventions and techniques to influence ordinary procreation or substitute for it. This development is changing the world of medicine and will do so ever more rapidly due to the discovery of new treatments and techniques by which characteristics or functions of human beings can be improved or modified to one’s taste.

The classical view of medicine as a science or an art dealing with the treatment of people with illnesses, injuries, and handicaps in order to cure or prevent these and to alleviate suffering is well indicated by the Greek word “therapy” (θεραπεία). Originally, therapy meant “service,” from which it also got the meaning of cure, care, medical treatment, and healing. Medicine in this sense aims at a “*restitutio ad integrum*,” that is, restoring the anatomical functional integrity of the body of the human person and, though this, his psyche or mind.

The character of medicine changes radically when it goes beyond therapy by offering treatments aimed at improving or perfecting otherwise healthy human beings. A growing number of people make use of these possibilities, deeming their improved appearances and functions useful for their performances and opportunities as movie stars, sportsmen/women, or wherever in professional life. For this improvement of the characteristics of otherwise healthy people, one often speaks of “manipulation” of human beings, for instance in the expression genetic manipulation, by which is meant the modification of DNA of an individual in order to improve his talents. Thus, gene-doping is used in order to increase the muscular force of sportsmen. The Latin roots of this term are the words “*manum plere*,” literally “filling the hand.”² When one fills the hand with kneadable types of material, this may take the form of the hand. The Italian verb “manipolare” originally meant

“preparing something while kneading (or molding) it.” Secondly, it got the figurative meaning it now has in most modern languages. Scientists often find the term “manipulation” offensive, for manipulating if applied to human beings in the sense of kneading, molding somebody to one’s liking may have a negative connotation, that is, treating people unfairly or insidiously for one’s own advantage.³ This is not what we mean by this term. We will therefore use the term, preferred by scientists, that is, “enhancement.” Enhancement goes beyond therapy, by aiming at the improvement of a healthy person, in Latin a “*transformatio ad optimum*.”⁴

Molding one’s body to one’s own will is quite widespread in contemporary Western culture, judging by the popularity of cosmetic interventions, tattoos, and piercings. These examples may perhaps not be qualified as very drastic forms of enhancement of the human body, although the transformation of Michael Jackson’s face went quite far. However, medical science and technique already offer, and will offer ever more, forms of manipulation of the human body that go much further.

FASCINATING NEW POSSIBILITIES

To illustrate our issue at stake, let me give a number of examples of already available possibilities to enhance human biological nature and some fascinating new developments.⁵ I hasten to say, however, that by “fascinating,” I do not mean that I consider all of them “ethically recommendable.” I give these examples deliberately regarding the main fields of medicine in order to show that enhancement occurs or will occur in practically every branch of medicine.

1. A far-reaching form of remodeling human biological nature, already available and fairly

often applied, concerns sexual reassignment treatment. In transsexuals or transgender individuals, first by administering hormones and subsequently by surgery, the external sexual appearance, including the external sexual organs, can be modified to that of the opposite sex to a certain extent. Especially in young male transsexuals who undergo sexual reassignment treatment in order to become females, at least externally spectacular results can be seen.

2. One of the most intriguing actual developments perhaps concerns the insertion of neuro-implants in the brain or other parts of the nervous system. It turns out to be feasible to connect devices by means of electrodes, placed in neural tissue, with neuronal networks. By way of a cochlear implant, which transmits sound waves to the auditory nerve, very many people suffering from deafness are already able to hear again. It is also possible to connect a camera with the optic nerve by way of a neuro-implant in order to make blind people see something. Deep brain stimulation by means of neuro-implants or neuro-prosthesis placed deeply in the brain and transmitting electric impulses to special neuronal networks is used with some success to cure the tremor of Parkinson’s disease, epilepsy, and obsessive compulsive actions. This technique also seems to be effective in curing depression, anorexia and addiction. The connection of computers to neuronal networks by a brain implant, called a brain computer interface (BCI), offers even more tantalizing possibilities. A brain computer interface, implanted in the motor part of the brain cortex of a patient with quadriplegia, a paralysis of both arms and legs, is able to “read” his thoughts and to translate them into a signal, subsequently transmitted to a computer. By thinking, the patient is able to move a cursor on the screen to certain icons and click on them. In this way he could switch on various devices and read and answer his e-mail.

However, these techniques, though welcome for therapeutic purposes, can

- also be applied for the improvement, or enhancement, of certain capacities of otherwise healthy people (Schermer 2009). Could one use brain computer interfaces to imitate or enforce, for instance, the function of the hippocampus, a structure at the inferior part of the brain, responsible for memory? Would it not be possible to transmit information directly to this part of the brain of people whose professional activities or even whose lives depend on the quick exchange of information, like stock traders and military personnel? A report of the Developments, Concepts and Doctrine Centre of the British Defense Ministry, published in 2007, which presents a Global Strategic Trends Program from 2007 until 2036, foresees that toward 2035 an implantable information chip will be available, making it possible to connect the brains of soldiers with a communication center and with one another as to exchange information directly to their brains such that they could be mobilized in a short time (British Defense Ministry 2007, 82; Norton-Taylor 2007). This implies that one of the members of the European Union—at least at the moment I hold this lecture Great Britain is still member of the Union—is seriously considering this possibility. Does this not open the way for the production of cyborgs, that is, human beings who have developed an intimate and sometimes even necessary relation with a machine or even a physical fusion of a human being and a machine? (*Oxford English Dictionary* 1989, Vol. IV, 188).⁶
3. Another field that man is in growing control of is that of artificial reproduction. Cloning, already possible in sheep, thus in mammals, once possible in human beings, would enable us to reproduce one human person without making use of sperm and egg cells and create, if required, an infinite number of human beings having the same DNA in the nuclei of their somatic cells. The possibilities for control of human reproduction have been augmented greatly by a recent success in cultivating sperm and egg cells from skin cells in mice. Induced pluripotent stem cells can be produced from skin cells by transferring to their nuclei four genes in order to reprogram them. These stem cells can be triggered to become precursor cells of sperm and egg cells. In mice by applying in-vitro-fertilization, it is possible to bring about live births with the thus-produced sperm and egg cells. By injecting precursor cells of sperm cells, created from a man's skin cells, into the testis of a man who lost his sperm-producing tissue by radiation therapy, one may perhaps enable him to beget children by ordinary sexual intercourse. However, it also seems possible, for instance, to produce by this method even egg cells from skin cells of a male. This would imply that a homosexual couple could have children biologically related to both partners. However, at the moment, this is only in theory, as in practice there are still enormous hurdles to be overcome before this could be realized (Cyranoski 2014; Vogel 2016; Cyranoski 2016; Li and Wang 2014).
 4. A possibility of modeling the human being of the future that goes still further concerns genetic engineering. Once the modification of DNA, especially in germ cells, will be practical, one could perhaps design the shape and size of the human being of the future to one's own taste. Until recently, DNA-modification in human beings looked like a non-starter. It turned out to be very difficult to insert genes in the right place in the genome so as to replace pathological ones. They often arrived in the wrong place, as a result of which either they did not function or they disturbed the functioning of other genes.
- The general media hardly noticed it, but a method termed CRISPR-Cas9, by which one can remove or insert pieces

of DNA precisely in the desired places in the genome, was qualified by the periodical *Science* as the breakthrough of the year for 2015 (McNutt 2015).⁷ This breakthrough concerned the fact that the method in question, developed in the last ten years, was applied in 2015 for the first time in human embryos by Chinese scientists.⁸ It is remarkable that scientists, fearing that the time would not be far away anymore in which it would be possible to design human beings, asked for a moratorium on this research in order to create time for reflecting on the ethical issues involved. They were worried because gene modifications in the germ line will be transmitted to future generation with unpredictable and uncontrollable effects. Moreover, they feared a slippery slope toward other unsafe and ethically objectionable applications.

Enhancement of human beings by DNA-modification is already taking place in the form of gene-doping, for instance, which is aimed at increasing the oxygen transporting capacities of the blood or strengthening muscle power (Friedmann, Rabin, and Frankel 2010).

Additionally, it is clear that CRISPR-Cas9, when applied in somatic cells in the laboratory taken from patients with, for instance, a genetic disease and then returned to the patient's body, may be a welcome and ethically acceptable gene therapy, on the condition that the risks are proportionate to the gravity of the disorder in question.

The techniques mentioned here promise very effective new therapies for thus-far incurable and often very serious diseases. However, one cannot fail to see that they may transform and are already transforming medicine from a therapeutic discipline or an art into one that also enhances (or supposedly enhances) human biological nature in healthy human beings. These techniques, once available, may seduce

many to make use of them. This would not only change the character of health care, but would also radically influence culture by changing the way human beings will view their biological nature: they will more and more consider it as something they may dispose of in order to improve their qualities and talents. This is in a certain way comparable to the change of culture induced—among others—by the introduction of oral contraception at the beginning of the sixties of the last century. This implied the first possibility to have procreation under control in an easy way and led to the sexual revolution. It radically changed the way in which many conceived marriage and sexual relationships. Or, one could think of the fact that the introduction of sexual reassignment treatment and surgery apart from other factors stimulated the development of the gender theory: the idea that gender identity is the result of one's own choice and not a consequence of one's biological sex. On the other hand, the present-day prevailing culture in the western world is very open to the acceptance of techniques improving the characteristics of otherwise healthy individuals. In all these developments there is a strong reciprocity between culture and medical techniques.

WHY IS WESTERN SOCIETY SO OPEN TO ENHANCEMENT?

Why is Western society so open for the enhancement of biological human nature by applying medical techniques? One of the main factors is obviously the actual culture, often described by sociologists and philosophers as the “culture of expressive individualism and of authenticity” (Taylor 2002, 79–107). This culture became a mass phenomenon in the Western world as a consequence of the rapid

growth of prosperity, which enables the individual to live more independently of others. According to this culture the individual has not only the right, but even the obligation to distinguish himself from others by determining his appearance, convictions, philosophy of life, religion, and set of ethical values and norms. In short, the ideal is: “I want to be myself.”

However, I would here like to stress another important factor making actual culture very receptive to enhancement of the body by biomedical techniques, that is, its predominant dualistic view of man. It is dualistic because it divides the human being into two parts: the mind and the body. The mind is—often unconsciously—viewed as the human person in itself and the human body as something external or secondary to the human person as such.

The human person is reduced to the mind, that is, the rational conscience, the center of autonomous decision making and typically human social behavior. The mind is conceived as being constituted by very complex neurophysiological and biochemical processes in the higher structures of the brain, the cerebral cortex and the higher brain nuclei. This implies a materialistic explanation of the human mind. The view of man at stake is known as the Identity Theory of Mind (Place 1956; Smart 1959; Armstrong 1968), because it identifies the human person with his mind, which is considered most specific for man as such. The body, considered as something that man has in common with the animal world, is viewed as not specific for him and therefore as something extrinsic to man. This theory is actually a materialist version of the Cartesian view of man as being composed of two separate factors, the soul and the body.⁹ The Identity Theory of Mind is the foundation for the medical-ethical writings of the American physician and philosopher H. Tristram

Engelhardt (1996) and the Australian philosopher Peter Singer (1993).

The body, conceived as something extrinsic to the human person, reduced to the mind, would therefore not participate in the intrinsic (essential) value of the human person as an end in itself, but only has an instrumental value; the body would serve the human person as a means to realize self-chosen ends. This view of man assigns to him the right to dispose of his biological nature to a large extent. He is not only allowed to apply medical treatment in order to cure disorders, but also to apply medical treatments and techniques in order to improve his biological nature, for instance in the form of gene doping or to reassign it, for example, by changing his sex. One could then also arrive at the conclusion that the human person is allowed to dispose of his life in the most radical sense, that is, by disposing of life and death: when life would be tarnished by incurable disorders and handicaps or would have lost all meaning for other reasons, he could conclude that it has lost its instrumental value, does not serve as a means to achieve something anymore and may be ended. On the basis of this dualistic view of man disposing of one's life in the most radical way, euthanasia and medically-assisted suicide, would be justified.

For good reasons, however, one can wonder whether this dualistic view of man is really tenable.

1. In the first place, we do not experience ourselves as being composed of two parts, but as a unity. Philosophy does not start from scientific knowledge, but from what is directly obvious. And, this is that we experience ourselves as a unity.
2. Another point is that dualism cannot explain in a satisfactory way that our rational knowledge is the result of the

processing by reason of what we experience by the senses of the things outside us and of our bodies. Introspection, too, is ultimately based on images we have through our senses of the outside world and our bodies. In thinking we use symbols, the fruit of abstraction from material things we know. Rational knowledge has its origin in things known through the senses. This underlines the fact that in rational conscience the senses and thus the body have an essential part.

3. A dualistic view of man cannot explain that every human being is unique and unrepeatable. This does not arise from our capacity to abstract thinking, making autonomous decisions or typically social relationships, which we all have in common. Our unicity stems from the characteristics of our bodies, our emotional experiences, our history and biography, which are closely connected with bodily-sensory information and thus with our bodies. Differences in Intelligent-Quotient do not arise from the capacity for abstract thinking, which we all have in common, but from the capacity of our brains to process sensory information (Aquinas, d. 85, q. 7).¹⁰

Rational consciousness is the fruit of the processing by reason of information received through the bodily senses. The differences between human beings, which determine their uniqueness, are bodily differences or differences directly derived from the body. It is unthinkable that a dimension such as determinative for the identity of the human being would be something extrinsic to him. His bodily identity, his procreative identity, and his being male or female are rooted in his very being.

“I AM MY BODY”

Classical Christian ethics considers the human body as an essential dimension of the human person, both from a theological

as well as from a philosophic perspective. The French Christian existentialist Gabriel Marcel (1889–1973) formulated this very pointedly: I am my body and know, at the same time, that I am something more (Marcel 1927, 236–237). This “more” concerns the spiritual dimension of man.

Christian anthropology does of course not agree with a purely materialistic view of man, for theological and philosophical reasons. The process of thinking, based on abstract notions, cannot be explained by mere physical-chemical reactions. Human freedom, too, cannot be explained by mere physiological-chemical processes, because these proceed according to a determinate pattern. The process of thinking and freedom transcend the material level and can only be explained by the presence of an immaterial life principle, in classical terms the soul.

Although we saw in the aforementioned discussion that the human being cannot be explained in a dualistic way, the Christian view of man also has to face the challenge that there is a certain duality in the human person, who is constituted by a spiritual and a material dimension. The most convincing philosophical analysis of the relationship between the spiritual and the material dimension in man is that of the Aristotelian-Thomist tradition, which considers this relationship analogous to that between the form and the primary matter in all things. The human soul is considered as the substantial form of the human person. The soul as the specific spiritual life-principle of human beings “forms” the matter into a human body. The same life-principle is responsible for both spiritual and rational processes as well as sensitive and vegetative processes in the body.¹¹ This analysis explains that man is a substantial unity of soul and body: both constitute the human person and are both essential to him.

The anthropology in Sacred Scripture is nowhere dualistic and views the body as an essential dimension of the human person (International Theological Commission 2004, nos. 27–28). Man is in his entirety, soul and body, created in the image of God. This is affirmed by the central dogmas of the Christian faith. For instance, “that the body belongs essentially to the human person is inherent to the doctrine of the resurrection of the body at the end of time, which implies that man exists in eternity as a complete physical and spiritual person” (International Theological Commission 2004, no. 29). The formulation of the relationship between soul and body as that between “form” and “matter” is used by the Church’s Magisterium in diverse documents, the most important of which is the encyclical *Veritatis splendor* (John Paul II 1993, no. 48; The Council of Vienne 1312, Denzinger and Hünermann 1995, no. 902; The Fifth Council of the Lateran 1512–1517, Denzinger and Hünermann 1995, no. 1440; *Catechism of the Catholic Church* 1997, no. 365).

The human person is thus not reduced to the soul, but is constituted by both the soul and matter. The body is according to this view of man an essential dimension of the human person and participates in his intrinsic value. The body does therefore not have a purely instrumental value determined by the human person himself (Eijk et al. 2014, 61–77), as John Paul II points out in his encyclical *Veritatis splendor*: we have to consider “the correct relationship ‘between freedom and human nature’” (n. 48), when questions of moral natural law arise concerning what we may do with our biological nature. Contemporary culture tends to think that this freedom is practically absolute. This implies that the human body is treated as a “raw datum,” or “raw” material, which will have the meaning that man in his freedom assigns to it. The functions and inclinations of the

human body would no longer “constitute reference points for moral decisions.” The finalities of these inclinations would then be merely “*physical*” goods, called by some “pre-moral,” because they would not be moral reference points. However, this view contradicts the truth and the Church’s teaching regarding human freedom and the value of the human body. The human body, formed by the soul as substantial form from primary matter, is an intrinsic dimension of the human person. Therefore, participating in the intrinsic value of the human person it has not only a physical good, but a moral value in itself as well.

Our freedom does not imply that we may design ourselves, without respecting the value of the human body, its goods and its inclinations. Without respecting the fundamental goods they represent, “one would fall into relativism and arbitrariness” (John Paul II 1993, no. 48). Human freedom implies the responsibility to treat the human body, its goods and its inclinations with respect for their fundamental value as intrinsic dimensions of ourselves as human persons, because we are our bodies, though we know that we are more than that alone. In this way one deals with them “in conformity with the wise plan of the Creator” (John Paul II 1993, no. 48).

As previously mentioned, what concerns the human body as such, also concerns the finalities of the inclination to procreate: these are not only physical goods to which the human person could assign a meaning as he pleases in all freedom. The capacity to procreate, although resulting in a direct sense from the biological reproductive organs, is intrinsically anchored in the person, because the body is an intrinsic dimension of the person, which constitutes him together with his substantial form, the soul. For this reason sexual reassignment implies a violation of the intrinsic value of the body and thus of the human person himself.

EPILOGUE

What do we have to conclude? Medicine should maintain its therapeutic character: it should serve the human person through his body by a "*restitutio ad integrum*." For this end, we should try to develop our medical arsenal as much as possible, making use of the techniques previously mentioned. I am not arguing against medical-technical progress. However, the application of them, aimed at improving human biological nature, a "*transformatio ad optimum*," will not serve the human person in his body, but instrumentalize him for an interest outside himself, that is, not rooted in his being. Medicine, available for that, will lose its way.

We have only a limited right to dispose of our bodies. This limit is indicated by the *therapeutic principle* or the *principle of totality*, which says that a part of the human body may only be sacrificed, if that is necessary in order to preserve the human person as a living totality. Respecting this principle prevents us from instrumentalizing our bodies and thus ourselves. Medical treatment and surgical interventions are allowable at the conditions that the risks of collateral effects and complications are proportioned to the seriousness of a disorder from which a patient is suffering and the chance that he will lose his life. This aspect implies another problem of improving the qualities of the body of an otherwise healthy person: in (supposedly) improving the qualities of the human body, risks are taken that cannot be balanced against the good of the person involved in himself, but only against an interest that is extrinsic to him. Gene doping does not serve a good rooted in the being of the human person, but prestige or financial interests. These do not balance the possible damage to health by gene doping.

Apart from the fact that instrumentalizing the body is a violation of the intrinsic dignity of the human person, we may question the end for which one is trying to improve human

biological nature. The attempts to look better or to have better achievements may easily stem from feelings of inferiority. In that case, we may expect that improving the body by medical and surgical interventions will not be helpful. There will always be other people with better achievements who will challenge them. For inferiority complexes, people need prudent psychological assistance instead of medical-technical interventions.

Apart from the intrinsic objections, it also appears from other perspectives that violating the intrinsic value of our body is not nothing. You may perhaps remove a neurotransplant from your brain, if it does not suit you anymore, but you cannot remove a piece of DNA, inserted in the cells of your body, if you wish to stop gene doping. The same concerns occur in relation to sexual reassignment: one can stop hormonal therapy, but sexual reassignment surgery cannot be undone anymore and the integrity of the body cannot be restored. Although some researchers of the long-term effects report positive results in relation to the impact of sexual reassignment on gender dysphoria, others report quite negative effects. A report of the ARIF of the University of Birmingham observed that at least in older studies, that is, before 1997, "the degree of uncertainty about any of the effects of gender reassignment is such that it is impossible to make a judgement about whether the procedure is clinically effective" (Aggressive Research Intelligence Facility 1997). An update in 2004 "remained concerned about the quality of evidence on effectiveness (particularly adverse outcomes)." Concerns remained principally because many patients who underwent gender reassignment were not followed up. A long-term follow up of a cohort in Sweden showed that there were considerably higher risks for mortality, suicidal behavior, and psychiatric morbidity for transsexuals who underwent sex reassignment than with the general population. According to the researchers involved, the findings

suggest that sex reassignment, although perhaps alleviating gender dysphoria in a number of cases, may not be sufficient as treatment for these persons (Dhejne et al. 2011). Of course, we should take care of people suffering from gender dysphoria, whose problem may not be underestimated, but rather by offering psychological assistance and pastoral guidance.

No doubt the technical possibilities, previously mentioned, to improve human biological nature will be further developed. New possibilities will be discovered. We will constantly have to watch that medicine will not lose its way, but will remain what it is meant as: a “therapeia,” a real service to the human person by restoring the integrity of his biological nature in as far as possible. However, this is no easy task, especially not when the most radical form of disposing of life in the form of euthanasia or medically-assisted suicide has already been legalized or allowed by means of legal regulations.

NOTES

1. The next paragraphs concerning Dorrestein’s novel have partly been taken from Eijk (1998).
2. The Latin verb “manipulare” merely occurs in one text; that is, in the *Miracles of Holy Genulphus*, a French bishop in the third century, where it means to “lead somebody by the hand.” See *Miracula S. Genulphi auctore Gonzzone Abb. “Unde tam hospes quam maritus satis admirati, postquam gratias retulerunt tali curator, mulier illa quae prius marito manipulante advenit, libero et inoffenso gressu domum rediit,”* here quoted from Du Cange (s.v. “manipulare; manu ducere”, 1678, 655). Du Cange thinks by the way that “to manipulate” derives from “manu ducere.” See *Glossarium Mediae et Infimae Latinitatis* (Du Cange 1678, 655). See also Niermeyer and van der Kieft (1976), s.v. “Manipulare”: “*guider un aveugle à la main*” (to conduct a blind man by the hand).
3. This mainly results from the third definition of the verb “to manipulate”: “to manage by dexterous contrivance or influence, especially to treat unfairly or insidiously for one’s own advantage” (*Oxford English Dictionary* 1971. See also *Oxford English Dictionary*, s.v. “manipulation”).
4. These Latin expressions are derived from Wiesung (2006).
5. Much of the list of examples has been taken from Eijk (2016).
6. The term was introduced by Manfred Clynes and Nathan Kline (1960, 26–27, 74–75), which was reprinted in *The Cyborg Handbook* (Gray and Figueroa-Sarriera 1995).
7. “CRISPR” means: clustered regularly interspaced short palindromic repeats. It consists of pieces of RNA that correspond to specific pieces of DNA in the genome. The pieces of RNA serve as a guide to find a specific place in the genome. Cas9 is a nuclease, an enzyme, able to cut DNA at a specific site.
8. CRISPR-Cas9 consists of pieces of RNA that serve as a guide to find specific places in the genome, and of a nuclease, an enzyme that is able to cut DNA at a specific site. In this way one can modify, switch off, remove genes, or replace them by healthy exemplars. This system, originally an immune system of bacteria to defend themselves against the infection with viruses, is already applied in food industry to render bacteria, used in producing yogurt, immune against viral infections. It is also used in research aimed at the removal of retroviruses that are present in the genome of pigs, by which their organs might be made safe for transplantations to humans. And last year, Chinese scientists reported editing the genomes of human embryos with CRISPR-Cas9. In order to avoid ethical objections, they used non-viable human embryos, especially created by local fertility clinics fertilizing one ovum by two sperm cells (by the way, the creation of embryos in this way does already raise a fundamental ethical question). They aimed at modifying the gene responsible for β -thalassaemia, a blood disorder, which is potentially fatal; see Liang et al. (2015). The method was not without failures, but seems to have already been improved, and other perhaps more effective methods are available (see Cyranoski and Reardon 2015).
9. See Ashley (1985), particularly Chapter 3, in which he explains that the most difficult problems of humanism in

the last three centuries were:

how to overcome the dualism of Mind and matter proposed in the seventeenth century by René Descartes, a proposal that is commonly said to have initiated “modern” thought. In order to solve this problem humanists have either reduced the whole of human reality to Matter, or conversely the whole of physical reality to Mind, but today the former reduction predominates. (52)

See Braine (1992):

It is little realized that the principal objections to dualism apply equally to the kind of materialism which for some is now philosophical or scientific orthodoxy ... before mental states and events can be identified with brain-states or events, or regarded as “realized in the brain,” these mental states and events must be conceived in a way that makes them purely “inner,” logically segregated from the “outer world” and the “outer man” with his behavior in the way which is characteristic of dualism. (23)

10. See Thomas Aquinas *Summa theologiae* I, q. 85, a. 7; as we will still see, Thomas explains man as a substantial unity of soul and body. Thomas, following Aristotle, considers the soul as the substantial form of the human person. Differences concerning the soul as substantial form would imply that there were differences between diverse species of human beings. This would lead to the absurd conclusion that human beings do not all have the same value. He explains the difference in intelligence and insight between human beings not on the basis of different souls (substantial forms), but by differences in expression of the same substantial form, caused by differences in the disposition of the matter, that is, by differences in the body (see Aquinas *Scriptum super Libros Sententiarum* II, d. 32, q. 2, a. 3).
11. Thomas Aquinas, *Quaestio disputata de anima*, aa. 10-11; Aquinas, *Summa theologiae* I, q. 76, aa. 1, 3, 4, and 8; Aristotle, *II De anima*, 1, 412b4-6. Assuming different life-principles for the diverse spiritual and material functions in the human being would lead to a dualist anthropology (Aquinas, *Summa theologiae* I, q. 76, a. 3, 1978; Aquinas, *Summa Contra Gentiles*, bk. II, chap. 58, 1934).

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