GENES AND IDENTITY

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Abstract

This paper deals with the relation between the genetic endowment and the identity of a human individual, against the background of the question of the morality of Conceptus Genetic Modification. From a brief analysis of the character of modern medicine and medical genetics it is concluded that in the prevailing medical genetical thinking the role of genetic endowment is over-emphasized. With the use of a system theoretical analysis of the human being and of elements of the philosophy of Dooyeweerd and Vollenhoven it is argued that the human identity, just like the human being in his earthly existence, shows a stratified structure. This means that the genetic endowment is an important but not decisive factor in the personal identity of the individual.

Keywords: Genes, genetic modification, identity, scientific method, abstraction, system theory, christian philosophy.

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1. Introduction

A few years ago, the journal Bioethics contained a discussion of the morality of genetic modification of the human conceptus (CGM) [7,18,19,34,35].
A central point at stake was the question whether CGM is changing the identity of the conceptus to such an extent that the genetic modification is not so much a benefit to a particular person, but causes a change in the personal identity, so that it is not at all clear who really is benefiting from the genetic modification. Rather, the identity of the conceptus to be treated would make place for another personal identity of the treated conceptus. In this view, defended to some extent by Zohar, therapy would not be person-directed and, therefore, there would not be a strong moral obligation to either develop or to apply the CGM technique. Kahn rejects this interpretation of CGM. He rather views a genetic defect that may lead to a serious disease, as if it were a time-bomb that at explosion would cause a lot of harm. So, Kahn uses the term 'harmful condition' to describe the situation of a conceptus having a genetic defect that is likely to lead to a serious health problem. This reasoning leads him to the conclusion that there is a *prima facie* obligation to avoid `harmful conditions' caused by genetic disposition, which could be attained by a form of gene therapy. Kahn also concludes that a genetic disposition can bring individuals in such harmful conditions that obligations exist to avoid their conception or to prevent continued life.

Elliot, in turn, argues that neither Zohar nor Kahn have given a clear account of the metaphysics of gene therapy and so neither has completely traced out the implications of the metaphysics for the ethics of gene therapy [7, p.28]. Elliot distinguishes organisms and persons. From one organism, i.c. a human conceptus, more than one person could develop. In other words, the organism can be thought of as potentially being a number of distinct persons. As the organism develops, more and more possibilities are shut off until one is left. Interventions, among which genetic modification, prevent the organism from developing into some potential persons, and opens the possibility of developing into one or more other persons. Therefore, the genetic modification does not cause so much a change of personal identity, but rather causes some person coming into being rather than another. According to Elliot the identity of organisms is determined by material continuity, structural continuity and causal continuity (though on each point small changes would be consistent with continuity) [7, p.35,36]. On the other hand, personal identity is largely determined by continuities of psychological properties (memory, belief, intentions, attitudes, projects etc.). Once an organism has developed into a person, interventions in the organism which do not disrupt the psychological continuity, do not disrupt personal identity either.
This dichotomy between `organism' and `person' does not convince me. Neither does the foundation of personal identity on psychological continuity.

The discussion, that I will pursue here, focusses on an interesting issue regarding the ethics of medical genetics, namely the relationship between genetic endowment and personal identity. In other words, in how far does a change in the genic endowment of a conceptus imply a change of personal identity? This is the issue to be discussed in this paper. Firstly, I will give a description of the predominant medical view of man and of the role of the genes in the human organism. Subsequently, I will criticize this position mainly with the aid of system theory and, in the context of this, briefly from an epistemological point of view. In the last section I attempt to present an alternative model of the relation between genes and identity.

2. The role of the genes - the prevailing view

2.1 Modern science

Medical genetics, like medicine in general, is based primarily on the principles and results of natural sciences. Before discussing the predominant paradigm of medical genetics it is helpful to define the character of natural science in general as it prevails in our culture.

Modern science is characterized by a specific way of investigating the reality in which we live. The scientific methodology can essentially be characterized with one keyword: abstraction. Generally this goes together with reduction of reality, objectivization of what is investigated, quantification of what is observed, the establishment of causal relations between observations and the formulation of models and theories [6]. The meaning of these words shows some overlap. The most central notion of the scientific method, however, is abstraction [3,27].

In science, this abstraction has at least two different forms [3]. In the first place the *generalisation*: not considering the concrete unique individual but considering the object under study as a representative of a class or a group, looking for regularities; e.g. in studying the body of man. Here, `man' is a generalisation.

The second form of abstraction is not considering the object of study, e.g. the human body, as a whole, but studying only certain characteristics of it or only particular relationships within the body, or of the body, with other entities. These characteristics and relationships are as much as possible expressed in terms of number and measure.

These abstractions imply a reduction of the real 'thing', or individual creature under study to an impersonal object (objectivation), taken out of the context in which it naturally or normally is situated. As a consequence, only what can be perceived by the senses, directly or indirectly, is taken into consideration. The search for the origin of things is transformed into a question about the material causes; reflections on the essence and meaning of things are replaced by querying their function and usage [29].

2.2Modern medicine

This approach also characterizes modern medicine. For main-stream modern medicine the explanatory strategy can be rendered with the words reductionism, dualism and determinism [9]. As a consequence of this methodology basic sciences like physics, biochemistry and molecular biology are considered the basis for the applied sciences that make up medical science: anatomy, physiology, pathology etc.

It has been argued that in medicine the mind-matter dualism of modern science manifests itself in three forms [22]: the mind-body dualism (the so-called Cartesian image of man [12]), the body-environment, and the individual-population dualisms [2,31]. Most scientific abstractions leave out the mind (one can also say, the soul), the environment and social relations of the individual patient. The body is studied as a separate entity, the 'machine' being the leading model. This approach leads to a *deterministic* view of man. In this model, disease is a deviation in the body's structure or

processes that in principle can be localized and treated on a material basis. This is succinctly expressed in the statement "...all disease is physiology gone astray" [9, p.170].

2.3Medical genetics

In medical genetics the 'medical model' finds a particular expression in the so-called central dogma of molecular biology [30]. This states that the hereditary information is stored in DNA in the form of a code, and that this information is expressed by two sequential processes: transcription into RNA and then translation into specific proteins, that are essential for the expression of the individual traits (see fig. 1).

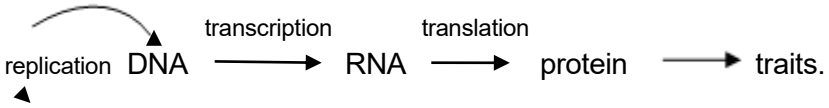

Fig. 1. The central dogma of molecular biology.

In other words, the genetic information encoded in DNA determines the phenotypic traits of an organism through the direction of the synthesis of proteins. The flow of information occurs in one direction: from DNA via RNA and proteins to traits. A gene is defined as a unit of heredity containing the information for one protein.

This model clearly implies a rather deterministic view of man. The genes determine how the individual will be, or at least how that individual can be. The environment influences the extent to which certain traits will be expressed, but not the character of the traits themselves as fixed entities [32,13]. This model clearly invites to study the genes and gene defects as the most fundamental causes of disease. At the Ciba Symposium in June 1989 Sydney Brenner, a leading scientist involved in the mapping and sequencing of the human genome, expressed his view on genetics as follows: "Genetics investigates the plan of the organism. This plan is embodied in a collection of genes that is handed down in the germ-line to specify the construction of the organism". And, at the end of his lecture: "The manifesto - if not the programme - of molecular genetics must remain the computation of organisms from their DNA sequences. Understanding the language of genes remains the major scientific objective of all genetic research" [4].

3. Criticism

3.1 Objections

It is clear that the prevailing approach in modern medicine has been very successful in elucidating the functioning of the human body and in discovering causes of many diseases at the material level. This has resulted in many possibilities for therapeutic or palliative interventions, that has been and continues to be of great benefit to many people. As yet, the benefits of medical genetics mainly concern diagnosis and counselling, not so much therapy.

At the same time we are becoming increasingly aware of the limits and insufficiencies of the just described predominant understanding of medicine in general and medical genetics in particular. The very character of such medical genetics constitutes a *danger to medical practice*. And its *theoretical framework*, though effective in certain respects, is inadequate in others. Both objections will be elaborated briefly.

3.2A danger to practice

To a large extent medical science is characterised by abstract scientific models about the functioning of the human body and about the deviations of normal functioning that constitute, or correspond to diseases. However, it is one thing to use a certain methodology to study reality, to set up models of certain phenomena and to have specific questions answered in a way that allows some intervention; it is quite another thing to consider these abstract models as true representations of reality itself, thereby conveniently omitting the notion that the models are an abstraction of reality. Yet, when dealing with actual people in practice, the limitations of the models can easily be forgotten. So, in modern medicine there is a constant danger that the objectivization that is characteristic for the scientific attitude, also comes to dominate the physician-patient relationship. This leads to practices whereby physicians treat patients as abstractions and thereby exert a control over them. Not because physicians are any worse than other people, but because they have been educated to study the human body with the aid of abstract models [26]. (Though, evidently, the danger to treat patients as objects is much more acute in some specialisms, e.g. transplantation surgery, than in others, e.g. general practice). The mass-character of modern medical care, and the enormous increase of the number of possibilities of medical interventions, together with the tendency in our society, to look upon science and technology as *the* instruments to solve all problems [6,16,27,29], has facilitated the danger just mentioned.

3.3 Epistemological objection

In this context I want to briefly mention an epistemological objection against the prevailing view on the role of genes in living organisms, including man.

In this view, a rather direct causal relation is supposed between the genes and the traits of an organism. So, one not only speaks of genes for physical traits like colour of eyes or hair, or of genes for well-known monogenic `genetic' diseases like sickle cell anaemia, or phenylketonuria (PKU). Reports are also dealing with genes for such complex conditions as Alzheimer [14, p.37], bipolar disorder, schizophrenia [14, p.66] and even alcoholism and homosexuality [14, p.94-103]. In some cases, a claim of having identified the gene for one of these conditions withstood the test of criticism only for a short time. But similar claims are being made time and again.

Such claims do not sufficiently distinguish between two kinds of knowledge [21]. Molecular biological knowledge of DNA sequences of a certain individual differs fundamentally from the knowledge comprised in a clinical diagnosis of an individual patient [8,21]. The former concerns scientific knowledge marked by the abstractions of the scientific method, whereas the latter relates to the health conditions of a unique individual. In the process of making a diagnosis general scientific knowledge is not just applied, but included in a cognitive process that is not so much marked by reduction and objectivization, but by recognition and judgement by which the scientific knowledge is integrated and interpreted in a wider framework of data, insights and meaning [11]. The two forms of knowledge presuppose two different epistemic attitudes and cannot, therefore, be equated [10]. When the clinical diagnosis is considered as the straightforward deductive implication of molecular biological and other scientific data, the patient is transformed into a medical `case'. This is one of the dangers of modern medicine (cf. § 3.2).

The observation that in a number of cases specific genetic defects are highly correlated with certain clinical pictures does not contradict the above. For that observation does not prove that genes are causally related to traits. It only proves that gene *defects* can cause a disturbed development of the organism. The former incorrect conclusion takes for granted the existence and functioning of the organism as the context in which the gene or gene defect only acquires meaning in the first place. In other words, the observation that concrete genetic information is a necessary precondition does not make that information a sufficient precondition for a 'normal' development [33, p.33-37].

3.4 Theoretical criticism

We saw that the so-called central dogma of molecular biology is still a leading model in molecular biological and anthropogenetic research. This model, however, over-simplifies and over-stresses the role of the genes in organisms, especially in humans. It presents a simple model for the biophysical and biochemical relationship that exists between a particular nucleotide sequence of some stretch of DNA and the structure of a particular protein. The structure of a protein determines its function(s), given the right circumstances. This knowledge of the fundamental role of DNA in the process of protein synthesis, in combination with recombinant-DNA techniques, has made possible the production of important human proteins, like insulin and interferon in bacteria at a reasonable price. This is done with micro-organisms, cultivated in special growth media, that are forced by specific manipulations to synthesize such a protein.

However, the relationship between a specific protein and the expression of a trait of an organism under normal conditions is mostly unknown, even for micro-organisms, let alone for man. The relation between the biochemical structure of proteins and the structure of organs or an entire organism are probably only indirectly related [31, p.78]. An undisputed expert like Francois Jacob has formulated this as follows [15]: "...during the development of the embryo, the world is no longer merely linear. The one-dimensional sequence of bases in the genes determines in some way the production of two-dimensional tissues and organs that give the organism its shape, its properties, and... its four-dimensional behaviour. How this occurs is a mystery". So, to postulate a straightforward relation between genetic information and traits is unfounded.

The approach of the machine metaphor of the human body and of the central dogma to the role of genes in the body is insufficient. System theory has been developed to precisely overcome some of these inadequacies.

4 The role of the genes: other approaches

4.1 A system theory approach

A system is an organised and ordered entity. A system is not cumulative, it is not a conglomerate of substances or building blocks. In a system the whole is more than the sum of its parts. This `more' does not refer to mass or volume, but to a more in information content that is lost when a system is broken down to its constituent parts. This means that the essential difference between a conglomerate of parts and a system is that the system contains additional information in its order as compared to the conglomerate of the parts.

Living organisms can be described as hierarchically organised systems. This means that a living organism can be considered as a system that is constituted of a series of subsystems that demonstrate an hierarchically ordered, layered structure. Considering the human organism as a system, at least the following subsystems can be distinguished: organs, tissues, cells, macro-molecules, bio-molecules, molecules. Typical for such a system is that when one moves from one layer to a higher layer new phenomena can be observed that the lower subsystems do not possess. Cells form the basic unit of biological life that demonstrate phenomena not found below this level. One of these is the storage of information in the biomolecule DNA. At the level of tissues and organs regulatory mechanisms can be observed as a novum. Consciousness can be observed as a novum at the level of the human organism as a whole. When a system is broken down to its subsystems, at each step down the layered order both the novum of that particular layer and the information contained in that novum are lost [31, p.34-36].

For understanding systems it is very important to realize that in the system the structure of the whole determines the operation of the subsystems or parts. This in contrast to a machine in which the

operation of the parts determines the outcome of the whole. This means that in a living organism each subsystem, i.e. each layer of the system, directs, controls the functioning of the lower subsystems, integrating them into a functioning whole. In other words, the higher system level informs, that is, determines the form and function of the lower levels. An understanding of the role and meaning of a certain subsystem for the system as a whole cannot be acquired by extrapolation from the regularities and principles that govern lower level subsystems, but only by looking at the function that particular subsystem fulfils within the higher level subsystems [33, p.15]. For example, the functioning of an animal cell is not well understood by just studying the biochemical and biophysical reactions between molecules within the cell, but by studying the function of the cell in the higher level subsystems of tissues and organs and for the system, the animal, as a whole. In other words, the organism as a whole should not be explained on the basis of knowledge of biochemical and biophysical reactions, e.g. protein synthesis, but those reactions should be explained and understood in their meaning for the organism as a whole.

This is related to another characteristic of living organisms studied as systems, namely the process of centralisation. In many types of system one of the subsystems assumes a control function as the regulation centre [31, p.47-50]. In biological systems, subsystems have a relative individuality and autonomy. The increasing complexity that is a consequence of the increasing number and differentiation of subsystems provides the organism with a higher capacity of adaptation to different environments. At the same time the increasing number of subsystem layers also results in a higher potential instability of the system as a whole. The function of a regulation centre is to make the system function as an integrated whole. Such a regulation centre also functions as a centre of identity. So, in a cell the nucleus can be seen as a regulation center. The central and autonomic nervous systems perform that function in higher animals. By controlling and directing the system as a whole, the regulation centre can be seen as a supra-system. By assuming this special function the regulation centre gives expression to a fundamental property of open systems in general and of living organisms in particular: purposiveness. This word expresses the observation that the organism in its functional and developmental processes, in the way it relates to the environment, seems to demonstrate a purpose, a `will'. In line with this the biologist A. Portmann presented the notion of `inwardness' by which he meant to say that living organisms are always centres of activity, autonomously acting beings that relate actively to their environment even in activities that go beyond those necessary for sheer survival [24,25].

4.2 Dutch philosophy

An interesting parallelism can be noticed between the system theoretical approach to living organisms and the Christian philosophy school of H. Dooyeweerd and D.H.Th. Vollenhoven. This philosophy also recognizes an intertwinement and coherence of several substructures or layers in living organisms. Parallel to the situation in a system, the highest and qualifying substructure, guides, opens up, the functioning of lower substructures. However, in that philosophy these substructures do not refer so much to physically recognisable subsystems or parts but rather represent some of the modes of being, or aspects that can be distinguished in reality. The human being can also be described in his bodily existence as an intertwined coherence of a number of substructures that represent some of those modes of being. The first substructure is the physicochemical: the molecules of which the body is made. Secondly, there is the biotic substructure, expression of the irreducible mode of being that is qualifying for micro-organisms and plants and that man shares with all living organisms. The third substructure that can be distinguished in man is the sensitive; this substructure human beings shares with animals, for whom it is qualifying. In the human being a fourth substructure can be observed, the so-called normative act-structure that qualifies and opens up the before-mentioned substructures. This act-structure manifests itself in a diversity of acts (including acts of mind and will) that are subjèct to a variety of normative principles [20, p.280 ff]. This act-structure is rooted and centred in the human Self, the `I', that is embodied in the body with

its intertwined substructures and at the same time transcends it. From a biological point of view this Self can be seen as the human form of `inwardness' that, according to Portmann, can be observed in all organisms [24,25].

With respect to the identity of individual entities, a distinction is made between the species-identity and the subjective individual identity of each entity, i.c. a human being. The *species-identity resides in the constancy and continuity in time of the structuredness of the individual in the various substructures described above* [20, p.179-188]. The subjective individual identity rests on the species-identity -- the individual belongs to a species -- but constitutes an unique realisation of each of the substructures (the only exception being the identical genotype of monozygotic twins). This means that the uniqueness of the individual identity does not reside only in one of the substructures but expresses itself at the various levels. Whereas the manifestation of the identity can be studied scientifically, this is not possible for the unique subjective identity. It withdraws itself from scientific analysis precisely because it is unique and does not fall under scientific studies of regularities in reality (cf. par. 2.1 and 3.3).

5. Genes and identity: A tentative model

We saw that the identity is related to the structuredness in the substructures of which the individual identity is a unique realisation. System theory tells us that complicated systems often have a regulation centre. Let us see where these ideas lead us to.

At the level of the physicochemical substructure the identity relates to the genetic information encoded in the DNA sequences. The genotype constitutes the species-identity and at the same time expresses the unique individual identity at this level. This information is important but not all-determining. The genes are not active, directing units of information, but rather constitute a passive essential precondition for the optimal functioning and survival of the living cell or the living organism. The genetic information in itself neither describes nor determines the life of the organism as a whole. A defect in the genetic information can often be related to or can cause a more or less serious disorder in the organism.

The genetic information provides the boundary conditions for the development of the organism along the lines that are characteristic for the species. But at the same time the expression of this information is guided by the higher substructures [23]. This is already clear from the fact that every cell of, for example, the human body contains the complete genetic information of the individual, while in each cell only a small proportion of the genes is expressed, dependent on the place and the function of that particular cell within the body. The influence of the architecture of the higher substructures, of the coordination of functional processes and of environmental influences is so significant that it is concluded that the observation of changes at one specific level of the organization of a system does not permit a reliable statement to be made on the healing process of the organism as a whole [31, p.60,77,78].

From an information theoretical point of view it can also be argued that DNA cannot be the `cause' or origin of biological life. Speaking of the genetic code or of the genetic message, as geneticists do, in itself presupposes that there is someone or something that can read and interpret the code or the message. The word `message' implies that there is a meaning to be interpreted. The really astonishing thing about the genetic information, and of the living organism, is that the DNA sequence contains a message for the organism, because the organism contains the 'mechanism' that can translate the DNA sequence into meaningful activities. The meaning of the DNA sequence is not generated by the mechanism; this mechanism presupposes the meaning of a genetic message. Nor has the DNA generated the translation mechanism. This is impossible, since for the expression of this meaning the DNA precisely needs that mechanism [5,17]. So, the genetic message cannot give a sufficient explanation of the development of the organism; the genetic code as a meaningful message itself needs an explanation, both a final and a causal [23,28].

The genetic information, concentrated in the nucleus, is the central element of the regulation centre and, therefore, centre of identity of each somatic cell.

But there are higher-level substructures. At the level of the sensitively qualified substructure, the central nervous system (CNS) functions as a regulation centre for the organism as a whole. The CNS provides the substrate for consciousness and `translates' the signals from the senses into meaningful perceptions. This makes it also an essential element of the species-identity of each human being (a human being with total brain death has ceased to live as a whole human being). As such it is also the substrate of the psychological identity of each individual and fulfils an essential role in the individual subjective identity.

At the level between the nucleus (genes) and the CNS there does not seem to be a centre of regulation and identity. Yet at this level of organic life of the organism as a distinct entity the immunological defence could be considered as an expression of the identity of the individual. This subsystem is very much related to the two substructures just mentioned, but in a system theoretical approach can yet be seen as a level of its own.

In man, on top of the three substructures mentioned before, the normative act-structure can be distinguished. Its centre of identity is the Self, the transcendental unifying root of the human being that ultimately remains a mystery to scientific analysis. This Self is spiritually qualified, which implies that through it the human being is orientated towards that which it considers as ultimate reality. Since the life of an individual is ultimately qualified by the highest level, as explained above, the human being both in its bodily existence and its act-structure ultimately is spiritually qualified.

The different conceptual levels or aspects that can be distinguished in a human being, form an integrated unity and totality in the individual human being. Influences are exerted both 'bottom-up' and 'top-down'. There certainly are genetic and physiological influences on, for example, mental processes. But on the other hand, the body's processes can be influenced by the self-experience of the person and the meaning the person gives to these experiences. Relatively new research demonstrates that personality characteristics and emotional distress factors influence the onset of certain diseases, as well as the healing process. These results also indicate that brain cells, neuropeptides, and immune cells are influenced by experience [1,9,22, p.530-535].

6. Conclusion

Based on the reasoning above, we conclude that the identity of man does not reside in his genetic endowment only, nor in the natural and social environment, nor exclusively in his brain consciousness. The individual subjective identity of each human being is related to - but can not be totally reduced to - an unique realisation of the different substructures that are intertwined in an integrated coherent structure that is determinative for the human species.

This means that introducing a change in any of the substructures does not destroy the ultimately spiritually qualified, individual, unique identity, nor create another person. As a change in the substrate and expression of the individual identity in one or more of the substructures, it may influence the manifestation and psychological experience of personal identity. It depends on the kind and extent of change in how far this can be ethically justified.

With respect to the morality of CGM we come to the conclusion that the significance of the genes for the organism as a whole does not, in itself, resist a substitution of DNA-sequences, if this could be done in a technically correct and completely safe way. However, it is doubtful whether it will ever be possible to neatly substitute specific DNA-sequences, let alone to exert a positive influence by an intervention that aims at a phenotypical enhancement of an individual. For the human being is very fragile at that early developmental stage in which the different substructures of the human being are concentrated in one cell, especially taking into account the complexity of the human genome in its interaction with the organism as a whole and with the environment. This study suggests that any attempt to control the development and functioning of an individual by

genetic modification is likely to be an expression of a form of genetic determinism that will ultimately turn out to be unfruitful or cause a violation of the individual. Somatic gene *therapy* in some cases may form an exception to this rule.

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