

FEATURES / The ethics of gene-editing

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Mantegna, *Adoration of the Shepherds*

*The claims of a young Chinese researcher, He Jiankui, to have produced the first people born with edited genomes – twin baby girls – were met with alarm by many scientists. A leading philosopher looks beyond the risks involved in such techniques to the deeper ethical problems of attempting to overcome human nature. / By JOHN HALDANE*

**Respecting the human form**

Anyone who has had the good fortune to see the magnificent exhibition of paintings by Mantegna and Bellini at the National Gallery in London (continuing until 29 January) will have been struck by their attention to the human form: at once expert in rendering contour, proportion and volume but also perceptive in capturing or expressing posture, gesture and meaning. Some of those depicted, such as Loredan, Doge of Venice, are great and famous; others, like the shepherds approaching the Virgin and child, are humble and anonymous; and in the figure of Jesus, whether as cradled infant, crucified man or resurrected saviour, the artists endeavour to show us the transcendent in and beyond nature.

However ancient the period, unfamiliar the setting or dramatic the scene, the human form appears as a constant: a common element in art, history, philosophy, politics and religion. Anthropology and the interpretation of ancient texts and artefacts are made possible by and confirm the commonality of humankind. As the Roman dramatist and former slave Terence wrote: “I am human and nothing human is alien to me.” To endorse this maxim is not to say that no human condition is better or worse than any other, for there is both soundness and defect

of body, mind and spirit. But both good and bad are identified by reference to the human form, considered not just physiologically, but psychologically, morally and spiritually.



Bellini, *Portrait of Doge Leonardo Doredan*

The patrician figure who appears in Bellini's portrait of the Venetian Doge carries his inherited features as proudly as his official robes, and it did not require the theory of genetics to understand that physical and mental characteristics are inherited. Selective breeding goes back before the Greeks and Romans, but they certainly favoured it in the shaping of human offspring. The modern science of genetics dates from the mid-nineteenth century when an Augustinian friar, Gregor Mendel, when hybridising plants, realised that traits are produced not by the blending of "parental" characteristics but by the combination and interaction of units of inheritance. What those units were and how many of them there are would only be discovered in the following century, with the development of molecular genetics.

As in most other areas of scientific enquiry, our knowledge of genetics is growing rapidly. The largest collaborative undertaking in the history of biology was launched in 1990 and completed a little over a decade later. The identification and mapping of the human genome involved determining the molecular components in human DNA and the segments and sequencing of those that constitute genes. Because genes have structural and functional effects the success of the Human Genome Project prompted questions about the practical application of this knowledge.

The detail and precision of the mapping, together with the influence of causal determinism pervasive within quantitative theories and explanations, encouraged the idea that the genetic make-up of individuals necessarily leads to specific outcomes. But as Mendel suspected when he criticised the earlier theory that the character of the offspring is a blend of the traits found

in the parents, the way in which the character of human progeny is determined by that of their ancestors may be complex and indeterminate. In the case of contemporary genetics four factors stand in the way of any simple projections upwards from the genotype to the phenotype (ie from the genes in our DNA responsible for a particular trait to observable physical properties and behaviour). First, there are variations in the genomes of individuals, so one cannot appeal simply to general patterns to be found in the overall human genome. Second, few features are monogenic, rather they depend on interactions between numbers of genes. Third, those interactions, and the expression of individual genes in fixing the structure and function of cells, is subject to external environmental influences. And fourth, individual human bodies themselves contain a vast population of symbiotic micro-organisms whose presence and behaviour affect the expression of genes.

But as well as these physical facts, there is the significant difference made by consciousness, reflection and reasoning. Even if predictions are forthcoming about the upward effects of biology on the human form in its physiological and behavioural aspects there is also efficacy at the level of thought, so that as well as considering what is predicted, or what *would* happen, there is also the question of what is morally required or what *should* happen. I am not suggesting that by channelling our thoughts we can somehow impede or redirect biological processes, as some new age practices and meditative techniques imagine. But that as well as what happens, there is the issue of how to respond to it. It is in relation to the latter that the idea of the human form, or the form of the human, offers insight and guidance.

The issue of applied genetics is not just a speculative one – in one form or other it has been with us for decades. Preimplantation screening and prenatal diagnosis are routinely used to detect abnormalities and mutations (as well, of course, as being used to identify the sex of the embryo) – generally with a view to intervention, usually destructive. Such intervention can be positive, for example when it involves gene therapies intended to supply healthy genes, or when it leads to gene-editing to correct, delete or modify gene sequences. But all of these procedures give rise to ethical questions.

In the case of gene-editing, which has come to greater notice recently through reports that a Chinese scientist, He Jiankui, altered the genes of twin female human embryos to ensure they cannot contract HIV, there is the obvious issue of unpredicted and unpredictable consequences. The use of cellular repair mechanisms to modify DNA by genome editing offers the prospect of correcting mutations and of introducing additional functions. However, it also involves risks of producing harmful mutations. Some of these may result from selecting and cutting genomes that contain unintended sequences, and there is the further issue of the resistance of tissues and cell types to infection and transfection. The effects of this resistance and of additional efforts to overcome it are uncertain.

As with cloning, the risks of cellular mutation, physiological and functional malformation and early death provide several good reasons why we should not proceed with these uncertain and potentially hazardous techniques. However – though this research inevitably involves the creation of embryos for experimentation and destruction – these are contingent and consequential factors which may be overcome through further scientific research. We have to look beyond these risks, and consider deeper ethical and philosophical considerations.

First, it is necessary to distinguish between actions intended to remedy a defect and thereby restore a normal feature, and those aimed at changing the character of a thing, to give it

enhanced or additional powers. The former concern repair the latter transformation. Aside from unanticipated immediate effects there is the issue of further collateral consequences. By way of analogy, making people more ambitious may counter lack of attainment, but it may also remove associated circumstantial benefits, such as contentment.

The study of the physical aspects of the human form is the business of the sciences, but the understanding of human life and the place of norms, ideals, principles and values is the business of imaginative, ethical, philosophical and religious reflection. Current discussions of how genetic and reproductive technologies should be combined tend to be conducted almost exclusively in terms of harms and benefits. There are two problems with this: first, the calculations are crudely utilitarian; but second, they omit non-consequential factors. For most people, the challenges of reproduction are felt to be worthwhile and are accepted as the corollary of the creation of another human being. The sense of otherness which is felt at the sight of a newborn child registers a combination of continuity and difference that contributes in part to the value of conceiving and having children. By contrast, the deployment of genetic science in the service of enhanced reproduction suggests a wish to overcome human nature as it is in favour of some unspecified “improved condition”. It may be said that the application of genetics offers the prospect of creating children whose initial condition and subsequent development are likely to be better than those of natural offspring. But this reply embodies a disregard of the human form which is the condition of our existence, and the recognition of which binds us to peoples past or far away.



Bellini, *Presentation of Christ in the Temple*

A good human life is not one that tries to overcome the human form, but is one that is developed within the context of it. That is why we resonate to the art of Mantegna and Bellini and take hope in the idea that God took on our human form.

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