

## BIOTECHNOLOGY AND THE CREATION OF HEALTH CARE NEEDS

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### INTRODUCTION

Health care in western industrialized nations is being increasingly swamped by biotechnology. The impact has been considerable. Specializations that were once at the periphery of health care (e.g., gerontology and gene replacement therapy) have been propelled to the center. New ways of classifying people (e.g., surrogate parent) have been invented and other traditional social categories (parent, care-giver, medical discipline) are being rewritten. Clinical conditions are being brought into existence at such a rate that critics caution that even mundane aspects of everyday experience are being pathologized. Finally, the way that we think about health care needs—what we are prepared to count as a need—is now increasingly dependent on judgments about what biotechnology can achieve.

Though we will say something about each of these issues, in this paper we will focus almost exclusively on the issue concerning the relationship between biotechnology and health care needs. A working definition of biotechnology presents a special problem. Most theorists emphasize industrial processes, involving the use of biological systems, an approach which is at once too narrow and too broad. It is too narrow because it overlooks the collaborative role played by traditional technologies and new computer-based technologies in the development and delivery of engineered biological systems. By the same token, it is too broad because it is consistent with both the industrial use of naturally occurring organisms, in very old industries like brewing and pickling, and with the use of artificially prepared micro-organisms, such as genetically altered procaryotes (e.g., bacteria and yeast which provide an unlimited source of insulin). The emphasis on biological systems fails to highlight what is distinctive and novel about post-Second World War biotechnology, where the movement from the use of naturally occurring organisms to biological artifacts has been startling.

We make no pretense to a comprehensive definition here, and take it that

our central thesis speaks to all forms of biotechnology which are relevant to human health care practices and needs, ranging from bionic limbs and artificial hearts to the threshold science of gene therapy. Our central claim is that it is an *enablist* conception of health—as a normative assessment of our adaptedness to our particular circumstances and conditions, in collaboration with a conception of biotechnology as the pursuit of our own evolutionary scheme through artificial means—that underwrites and informs recent developments in biotechnology.<sup>1</sup> If we want to come to grips with the epistemic authority conferred on biotechnology, we need to look at the conceptions of technology and well-being that sustain these developments.

Our positive thesis about health care needs is shaped by these thematic deliberations on biotechnology. We had needs of a basic sort prior to the rise of modern technology—though perhaps we might disagree about what level of comfort is to be attained to satisfy our needs, the need for food and water, and perhaps clothing and shelter, would appear to be basic biological needs. Whether we are hurting or free from disease are facts about the way we are in the world that in some ways are beyond the reach of technology. What we focus on here, however, is the health care needs that arose hand in glove with modern biotechnology. In opposition to the deeply-rooted conviction that they have an immutable character, we will argue that some health care needs are instrumentally conditioned—i.e., they have a purely contingent existence within the technology that sustains them.

#### ARTIFICE AS IMITATION OF NATURE

Until very recently, health care practices were dominated by what we will refer to as a linear conception of health and its confederate—the so-called biomedical model. By a linear conception of health, we are referring to an influential developmental model of the life of an organism as moving in a *linear fashion from a state of health to a state of decay*, one that is seen to be as inevitable as the progress of diseases that beset the organism at every stage in its growth. This developmental model invites a negative conception of health as the absence of pain and other manifestations of disease in the organism.

Traditional attitudes toward the elderly furnish a dramatic illustration of this linear conception of health in action.<sup>2</sup> In many quarters, aging is still

regarded as a basic, inevitable, relatively immutable disease, involving inevitable decline, degeneration, disability, and death. This linear conception of aging implies a comparatively stable, homogeneous set of biological and psychological processes which unduly compromises many older persons who otherwise might be flourishing. Since the elderly cannot help but manifest the symptoms of what is regarded as a basic disease, they are invariably treated as suffering illness, physical and mental decline, and disability, which, as we might expect, has sweeping implications for the role of the professions and for public policy.

The biomedical model is somewhat difficult to unpack. Without a careful presentation of the central ingredients, however, it is difficult to fully appreciate the cognitive authority that many health care practitioners still confer on the linear conception of health, so we will present this model in some historical detail. The biomedical model is grounded in the scientific revolution of the seventeenth century—not in the experimental science which received its authoritative expression in Isaac Newton's celebrated *Principia mathematica* (1687), but in the formulation of a mechanical philosophy by a new generation of natural philosophers—Robert Boyle, Marin Mersenne, Thomas Hobbes, and René Descartes, among others—who were deeply influenced by the successes of the mechanical arts in fabricating such new instruments as the telescope, the microscope, and the thermometer.

These self-described moderns were responding, in different ways, to the distinction between nature and artifice which was a central element in the curriculum of the Renaissance university. In Book II of his *Physics*, Aristotle had suggested that some things exist by nature—animals and their parts, plants, and simple bodies like earth, fire, air, and water exist “according to” or “by nature.”<sup>3</sup> What distinguishes these natural things is that they contain within themselves a principle of their own development—a principle of motion and of stationariness. For Aristotle, it is these substances, consisting of an intimate union of matter and form, which are the objects of the physical sciences. Beds, coats, and items of this sort, in contrast, are products of art. Things which exist according to art are said to lack an innate impulse to change—they lack the source of their own development which is held, instead, to be found in something external to them, such as the skill of the artisan who created them.<sup>4</sup>

Plato's *Timaeus* (30c - 31b and 34 a-b) describes the cosmos as an

organism, as a divine being. Insisting that Christianity is the apex of Platonism, Aquinas's *De vera religione* (11.21), states unequivocally that "matter participates in something belonging to the ideal world, otherwise it could not be matter"—in short, that matter is caught up in a cosmic process and is, in an inescapable sense, living. For the alchemist of the Renaissance, matter is a necessary complement to spirit. Something similar is involved for Aristotle and his disciples. Not even prime matter—a logical construction for Aristotle—is utterly inert and "dead" material. Matter "desires" form and is intimately related to it. What underwrites Aristotle's distinction between nature and artifice, then, is the insistence that reality consists in the purpose or *telos* determined by the union of form and matter. Artifacts of human production, however, fail to achieve this kind of unity, as evidenced by their having a number of uses or extrinsic ends. In systematized art, for example, the material itself is important only as a substrate to be manipulated by the artisan. The implication of this view—elaborated by Aristotle in his ethical treatises—is that artifice is but a poor imitation of nature (*ars imitatio naturae*) lacking an internal principle of its development.

Artifice refers to both the act of fabrication and a conception, often unarticulated, of the nature of what one is working with in this act of fabrication. During the Renaissance, as the machine shop and natural philosophy enjoyed a period of fruitful collaboration, the concept of matter underwent a wholesale revision. Matter began to be regarded as indifferent from the sorts of cosmic processes that are central to Aquinas's writings, and came to be seen as something which can be assembled and disassembled in any number of ways, much like the parts of a machine. This transformation is particularly evident in René Descartes's definition of matter as inert and indifferent to its state of motion and rest (see Cottingham, *et al.*, 1985, p. 224). For Descartes, matter in itself is ordered toward nothing. It is something to do with as one pleases. More importantly, with Descartes matter ceases to be regarded in any special sense as organic or as having any spiritual manifestations of its own.

In a number of places, Descartes states that the substantial forms of Aristotle are unnecessary in the explanation of natural phenomena (for example, see Cottingham, *et al.*, 1991, pp. 205-206). The significance of this bold assertion is that, if we follow Descartes and regard matter as an undifferentiated extended substance (*res extensa*), we allow for the possibility that nature and artifice are one and the same. The following excerpt from Descartes's letter to

Henry More (5 February 1649) seems to bear out this contention: "Since art copies nature, and people can make various automaton which move without thought, it seems reasonable that nature should even produce its own automaton, which are much more splendid than artificial ones" (Cottingham, *et al.*, 1991, p. 366).

Descartes was not the first natural philosopher to proclaim an identity between nature and artifice. Indeed, it is arguable that Johannes Kepler's *Ad vitellionem paralipomena* (1604) charted the course of seventeenth century mechanism by treating the living eye, as far as the surface of the retina, as an inanimate optical instrument (see Crombie, 1967). All that remained for the new generation of mechanists was to generalize this result over the entire human body. Still, Descartes was the first natural philosopher to think deeply about the philosophical implications of this identity and discern that it warranted a powerful mechanical analogy whereby machines (which are held to be identical to things which exist in a pure state of nature) can serve as a *cognitive reservoir* for understanding the workings of physical things (now understood as machines made by the divine artificer). Whereas Aristotle and his disciples reckoned that machines are a poor imitation of naturally ordered entities, mechanists of Descartes's stripe concluded that things which exist in a pure state of nature can fruitfully be understood *as though they are artificially prepared substances*.<sup>5</sup> One of the pillars of the scientific revolution is encapsulated in this conviction.

The new mechanical technology called for a view of the world as a solution to a fantastic engineering problem. The cosmos is a machine which is to be understood in terms of the mechanics of machinery—namely, as a system of constrained material parts which operate generally according to the science of machines. Nature is therefore not an ideal that the artisan seeks to imitate, as followers of Aristotle had supposed. Although artificial combinations of bodies enable natural philosophers to comprehend bits and pieces of the world that exceed our grasp because of their size and remoteness, machines are not designed to explore alien parts of the world. They are consulted, rather, so that we can come to know the world we inhabit.

## THE PATHOLOGY OF ROBOTS

During the seventeenth century, the mechanical analogy was extended

throughout the natural sciences. With the publication of Newton's *Principia mathematica*, however, an important but largely undocumented rift developed between the physical and biological sciences. Newton argued that planetary bodies move with a freedom which is incompatible with the mechanics of machinery,<sup>6</sup> and he supplanted the received understanding of mechanics, as the science of machinery, with a powerful new theory of mechanics based on his three laws of motion and a gravitational force which acts as the cement of the universe. Newton's program for basing all science on the study of forces was eventually extended to other new scientific disciplines during the eighteenth and nineteenth century, notably to the fields of magnetism, electricity, and (with limited success) to experimental mechanics, but we should be mindful of the fact that the mechanical analogy was largely unchallenged in other fields, notably in human physiology, experimental optics, and studies of sensation.<sup>7</sup> Consider this passage from an important physiology textbook of 1856:

In this regard the human body may be spoken of as a mere instrument or engine, which acts in accordance with the principles of mechanical and chemical philosophy, the bones being levers, the blood-vessels hydraulic tubes, the soft parts generally the seats of oxidation. But if we limit our view to such a description, it presents to us man in a most incomplete and unworthy aspect. There animates this machine a self-conscious and immortal principle—the soul (Draper, 1856, p. 24).

Draper postulates no particular mechanism to account for the development of the human machine, except perhaps the need to provide a seat for the soul. Contemporary molecular biologists (see Hopwood, 1981, p. 91), who in their own way are just as enamored of Cartesian mechanism, give this model scientific credibility by treating the organism as an integrated machine which has evolved to serve the ends of *survival* and *reproduction*. Though the distinctively Darwinian mechanism of survival has received scant attention, the end of reproduction is a staple in academic treatises and in popularizations of the new cybernetic model of the organism, which extol the social benefits of industrial applications.

Descartes's mechanism was not the sole dominant influence on the creation of the biomedical model. Machines furnished scientists in biology and in cognate disciplines with a model of corporeality which, as the citation from

Draper testifies, proved to be very influential. This model of corporeality, however, was incomplete because it failed to specify *what it is that causes machines to break down from time to time*. For Aristotle, an automaton exhibits a tendency to deteriorate because its form and matter are not really united. Having rejected the substantial forms of Aristotle, this line of argument was not a live option for the mechanist. If the human body is a kind of robot, as Draper insists in the above passage, what is it that causes human machinery to malfunction and break down? Machines break down for a number of reasons— chiefly, in consequence of wear and tear on their parts—and so it was fairly natural for eighteenth and nineteenth century physicians to see aging as an inevitable process of mechanical decay. But what about breakdowns in human machines which could not be attributed to age? A physiology based on an analogy with machines would be useless to medicine and health care unless it could answer this question.

Pathological anatomy and, its institutional confederate, clinical medicine furnished the greater part of the answer. With the rise of clinical medicine in the late eighteenth century, the knowledge of diseases became the forte of the physician. Michel Foucault has documented, however, that measurements mattered to the physician, not as an indication of the well-being of the patient, but rather as a yardstick for the intensity of the pathological quality or the form in which the disease is presented to sensation:

In order to grasp the disease, one must look at those parts where there is dryness, ardour, excitation, and where there is humidity, discharge, debility. How can one distinguish, beneath the same fever, the same coughing, the same tiredness, pleurisy of the phthisis, if one does not recognize here a dry inflammation of the lungs, and there a servous discharge? How can one distinguish, if not by their quality, the convulsions of an epileptic suffering from cerebral inflammation, and those of a hypochondriac suffering from congestion of the viscera? A subtle perception of qualities, a perception of the differences between one case and another, a delicate perception of variants—a whole hermeneutics of the pathological fact, based on modulated, colored experience, is required (Foucault, 1973, pp. 13-14).

This passage is a snapshot of what Foucault (1973, p. 89) refers to as the

“clinical gaze.” Since no measurable mechanics of the body can, in its physical or mathematical particularities, account for a pathological phenomenon, the physician’s expertise is essentially qualitative (Foucault, 1973, pp. 13). Coughing may be induced by asthma, and this is clearly a phenomenon of a mechanical nature, Foucault points out, but it is a mechanics of inter-linked qualities, articulated movements, upheavals that are triggered off in series, and not a mechanics of quantifiable elements. It may involve a mechanism, but coughing cannot be a mechanism in the strict sense of the word. Cough, fever, pain in the side, and difficulty in breathing are not the disease itself. In order to know the disease which besets the patient, the physician must subtract the individual, with her particular qualities, because diseases have courses and histories which are governed by immutable laws that one soon discovers if the course of the disease is not disturbed by the patient.<sup>8</sup>

Pathological anatomy proved to be a natural ally for the conception of the human body as machine. First and foremost, the combination of mechanism with a pathology of diseases was consistent with the negative conception of health that still dominates many medical contexts, namely, the condition of being free of disease.<sup>9</sup> In addition, pathological anatomy squares with the brand of reductionism which is involved in the mechanics of machinery (where the machine is really just an assemblage of parts), while restating Cartesian mechanistic physiology in pathological terms as “the gall-bladder in Room 312.” Finally, it authorizes the judgments of physicians—since disease and the chance of a cure is their forte, health care needs are largely ascertained by the qualitative judgments of doctors about the natural history of diseases.

#### HUMANITY’S OWN EVOLUTIONARY SCHEME

The previous section outlines a relationship between mechanism and Foucault’s conception of “the clinical experience.” In recent years, the early modern conception of technology as a cognitive reservoir for modeling natural phenomena has been superseded by another theory of technology which invites us to look at biological systems in a new and surprising way. As we shall see, the emergence of this new theory, and its interplay with a new non-linear conception of health, places the biomedical model and the traditional portrait of health in a difficult position.



Before we pass on to this new conception, we need to return to our working definition of biotechnology. Most theorists regard molecular biology as the core discipline in the creation of our modern biotechnological complex. If our intention is to frame an accurate account of the source of the practical techniques that are responsible for such startling new initiatives as the Human Genome Project and the refinement of a host of new techniques for the delivery of artificially prepared biological material, then it is clear that any thematic ruminations on the subject of biotechnology and the human condition will need to key on molecular biology. If our intention, however, is to unpack the epistemic purchase that biotechnology has, not only among the scientific community, but among informed laypersons, then something more needs to be said.

Technology has always been enshrined as a tool that can help us to realize a predetermined set of values. Those values which are related to our sense of our wellness as organisms, however, have been colored by the linear conception of the life of an organism as moving inevitably from a state of health to degeneration. Our view is that the critical factor in the epistemic purchase that we now confer on biotechnology is the rejection of this traditional view in favor of an enablist conception whereby our health and well-being are now seen in terms of our adaptedness to our particular circumstances and conditions. This new conception has a Darwinian flavor to it, with the caveat that this assessment of our well-being opens the door to normative assessments of how well we think that we should be faring. Since modern technology is largely responsible for the conditions in which we live, there is now every reason to pursue technological solutions to any difficulties we may encounter, even solutions that involve tinkering with our own biological endowments so that we can be better adapted to our particular situation. This places a premium on technological interventions, while sustaining a view of biotechnology as a way of improving our given health allotments.

In order to fully appreciate this thesis, we need to look more carefully at evolutionary biology and its significance for early modern conceptions of technology. Darwin taught scientists that organisms evolve gradually through the selection of minute variations, but it is not immediately apparent how mechanical contrivances fit into Darwinian evolutionary histories. We have seen that seventeenth century mechanists portrayed living things as material systems of interconnected parts which produce mechanical effects. With the exception of the

size and perhaps the complexity of natural things, early modern natural philosophers treated machines and organisms as directly analogous. However, if living things are subject to evolutionary change at the hands of natural selection, as Darwin contended in *On the Origin of Species* (1859), the consequence would appear to be that mechanical devices must be subject to evolutionary change as well.

Samuel Butler attempted to sort out the relationship between evolutionary biology and mechanical contrivances in a provocative letter of 1863. Here Butler attempts to superimpose a Darwinian history on technological devices, arguing that there is a “mechanical kingdom” which displays the same kind of evolutionary change which we encounter in the natural world.

Examine the beautiful structure of the little animal [the watch], watch the intelligent play of the minute members which compose it; yet this little creature is but a development of the cumbrous clocks of the thirteenth century—it is no deterioration from them. The day may come when clocks, which certainly at the present day are not diminishing in bulk, may be entirely superseded by the universal use of watches, in which case clocks will become extinct like the early saurians, while the watch (whose tendency has for some years been rather to decrease in size than the contrary) will remain the only existing type of an extinct race (Jones, 1917, p. 44).

Just as the vegetable kingdom was an outgrowth of the mineral kingdom, Butler contends that the mechanical world is an outgrowth of the animal world—in particular, it is an outgrowth of human activity (see Jones, 1917, pp. 42-53). Humanity plays the same role in the natural history of machinery for Butler as natural selection plays in the animal and vegetable kingdom. Indeed, the machine is polished by human selection to such a remarkable degree, Butler suggests, that humanity will eventually find itself to be the inferior race:

inferior in power, inferior in that moral quality of self-control, we shall look up to them as the acme of all that the best and wisest man can ever dare to aim at. No evil passions, no jealousy, no avarice, no impure desires will disturb the serene might of those glorious creatures (Jones, 1917, p. 44; cf. Clarke, 1971, for a similar sentiment).

Despite Butler's enthusiasm for the mechanical analogy, it was placed under increasing pressure as evolutionary biology was articulated at the turn of this century by such proponents of Mendel's particulate theory of heredity as William Bateson (1902). What emerged from the fusion of Mendelism and Darwin's theory of natural selection was that mechanical devices are not the sorts of things that can be subject to evolutionary change, except in a metaphorical and uninteresting sense of the term.<sup>10</sup>

Butler was wide of the mark in other respects that deserve some attention. In particular, although he recognizes that machines surpass humans in many respects, Butler did not explore the possibility that machines could serve as confederates in our ongoing evolution—not just as mechanized standard-bearers for social virtues like punctuality, but also as resources for shaping and refining individual human physical and moral potential. If it is true that machines lack the physical and moral defects of humanity, as Butler insists, then it seems reasonable to explore the prospect that machines can serve as resources for eliminating these defects altogether—defects that ultimately are rooted in our natural allotments.

Machines have come to play just this role in our social lives. The subtle transformation in our use of time-telling devices is a case in point. The very symbol of the new science of the seventeenth century, clocks within years of their first appearance, were employed to divide up work time and recreational time. They served as the model for the creation of a new mercantile virtue: respect for time—a person's punctuality—became a standard for proper social interaction. Though the new discipline of the clock was tied to conceptions of goodness, it did not occur to anyone that the clock could be a tool in improving our adaptedness to our particular conditions. What we are now witnessing is that recreational time, and the health value that this time has for us, is increasingly being defined in terms of a new generation of clocks. Heart-rate monitors accompany us when we run or jog. They measure both our pulse and the kind of exercise we are getting—indeed, whether we are exercising at all. As a blanket statement we say that we need to exercise, but what it means to exercise, and the value that it has for us, are now measurable quantities. Exercise used to be a qualitative pastime but, under the gaze of modern biotechnology, it is quickly being transformed into an exact science carried out under the supervision of the newest of health care workers—the personal trainer.

Heart-rate monitors are modest interventions which arguably are designed to correct defects that are part of our genetic inheritance and our sedentary lifestyle. However, biotechnology has taken an unprecedented step in the fabrication of artificially prepared biological systems which are used, not merely to cure lifestyle ailments, but in some sense to improve our given health allotments. Hearing aids may delay loss of hearing which, until very recently, was considered inevitable, *but we have now come to see that biological artifacts can improve on nature*.<sup>11</sup> Biotechnology has become involved, not just in our understanding of what it is to be human, our self-image, our self-interpretation, as Don Ihde (1983, p. 22) suggests but, more profoundly, in the material realization of our own humanity.

Our central thesis on biotechnology, then, is that it is best seen as the pursuit of an evolutionary scheme through artificial means.<sup>12</sup> Nature, of course, has its own evolutionary scheme, but the promise of biotechnology is that it will furnish us with adaptive tools that will enable us to realize a scheme that is infused with our own normative assessments of how we should be faring, whether this squares with nature's own wishes or not.

This thesis has sweeping ramifications for conceptions of health and health care.<sup>13</sup> The biomedical model places biology in the familiar role of hand-maiden to medicine. It construes health in a linear fashion as a transition from a state of health to a state of decay, one that is as inevitable as the progress of diseases themselves. Under the gaze of modern biotechnology, we can now see ourselves in a position of improvement with respect to our given health allotments. First, health can be seen *organically* as a question of our adaptedness to our particular circumstances and conditions. Second, health can be seen *holistically* as a matter of our well-being, and not merely as the absence of disease and pain.

Health care and biotechnological interventions can now focus on living with a disease, instead of mastering it. Returning to the example of aging, under the rubric of biotechnology, gerontology is quickly being transformed into a new kind of discipline which explores the ways that the elderly can be adapted to their changing conditions and circumstances. Living with this condition, if we still insist on construing aging in this way, now takes priority in many quarters to making old age itself the object of study. Furthermore, the focus is now on ways

that biotechnology can improve the conditions of the elderly, whether these interventions involve traditional technological therapy like a hip replacement or a cornea transplant or new biological therapies involving the delivery of hormones and other artificially prepared micro-organisms that promise to give the senior another lease on life.

What holds for the elderly holds for the very youthful as well. Being premature (birth before 32 weeks) has always been a pathological condition. However, where neonates were once left to die, neonatal technology enables a range of specialists—neonatologists (a special kind of pediatrician), bioengineers of all kinds, and NICU nurses—to abandon nature's scheme of gestation in favor of our own evolutionary scheme with the adaptive tools afforded by biotechnology.

## THE FABRICATION OF HEALTH CARE NEEDS

Biology has been transformed from a science that was centered on the organism to a science that is centered on artificially-prepared biological systems.<sup>14</sup> In the wake of this transformation, biotechnology has now swamped most aspects of our social lives. Instrumental considerations now condition many (though admittedly not all) of our health care needs. As machines— which only a few years ago were only found in the ICU and in specialized clinics —continue to colonize existing health care spaces and to transform our homes, offices, and public recreational areas into new health care spaces, making the general practitioner's office a quaint relic when the physician's qualitative gaze and the clinic dominated health care practice, it is growing increasingly difficult for us to be unhealthy outside of the measure taken by some machine.<sup>15</sup>

Infertility furnishes a vivid illustration. A small percentage of any animal population will always be infertile. Where infertility once was a pathological condition which could be "cured" by such mundane procedures as laser surgery to repair a blocked oviduct or low tubal ovum transfer, whereby the egg is relocated in the body to a position where fertilization can take place, reproductive technologies now list more than one hundred and twelve ways to become a parent, many of which reshape what we mean by this word.<sup>16</sup> Most instances of infertility are now preventable, which, in turn, has created a host of new health care needs and associated moral issues. Lesbians, for instance, lobby for access to fertility clinics on the grounds that their needs cannot be met by ordinary means; prior to the creation of new reproductive technology, lesbians were not infertile.<sup>17</sup> Now many are infertile, but only in the sense that their needs have been created by biotechnological therapies which enable us to pursue our own *nact of reproduction* through artificial means. Many post-menopausal women who by-passed family for career want to have children late in life. Many men who seek to retain their control of reproduction look forward to the perfection of an artificial womb (extracorporeal gestation) which is predicted to arrive before the end of the century.<sup>18</sup>

We suspect that this reproductive technology and the health care need are born at one and the same moment.<sup>19</sup> Bringing concerns of everyday living under the biotechnological gaze has its positive features. People take them seriously. More money is made available for research. Fields that seem best equipped to

address these concerns move to the center. Others move out. On the downside, some critics insist that biotechnology is pathologizing everyday concerns, creating a society where the vast majority are deficient in the sense that they cannot measure up to the standard set by some machine. This kind of worry is behind much of the resistance to the Human Genome Project, which interconnects and sustains a number of new biotechnological initiatives. In vitro fertilization is necessary for germ cell or embryonic gene based therapy, not only as a way of ensuring that a particular genetic trait (say, hemophilia) is not passed along but also to supply essential research material (e.g., eggs and embryos). But it is impossible to introduce heterologous genetic information into defective or damaged tissues unless we know the location of genes responsible for those diseases that are genetically based.<sup>20</sup>

It is now possible to identify some of the genes which cause Mendelian diseases (so called because they are inherited by simple Mendelian rules), such as Huntington's chorea or Duchenne muscular dystrophy, but many widespread ailments, such as cancer, coronary artery disease, and Alzheimer's disease, likely have multifactorial genetic backgrounds in which many genes cooperate or many alternative genes are involved in creating a predisposition to disease (see Gilbert, 1987, p. 30). When the protein product of a gene is identified as a health care concern, scientists first attempt to isolate and clone the corresponding DNA fragments and work out their structure by sequencing. Only then can one address the biological problem of ascertaining what the gene does. The Human Genome Project promises to eliminate much of this work: knowing the full sequence of the genome, at the moment a new protein is isolated and a bit of its amino acid sequence is ascertained, the biotechnologist will be in a position to identify in a data base a portion of the gene and the region of the genome from which it came. This will make it possible to isolate and examine the relevant genes directly, moving research way from cure to prevention.

Since each person is genetically unique, however, what will be mapped by this project is a normal or standard human genome (or range of genotypes), departures from which constitute abnormalities. It is likely that the normal will not be defined by reference to human genes because the costs involved in determining statistical normality are staggering. Instead it will be ascertained at the phenotypic level and extended by reductive identification to the genotypic level. Will alcoholism and other behavioral phenomena be targeted? The UK Clothier

Committee (1992) has concluded that it is ethical to use gene therapy in a variety of somatic ways, with the exception of gametes, but there are genuine worries here which undermine the confidence that many now place in this new technology.

It is not part of our view that health care needs are mere fabrications. We all recognize the existence of certain basic human needs, such as the need for food, water, and shelter. These needs are genuine precisely in the sense that they powerfully influence our material and intellectual well-being. Failing to satisfy these needs can have dire consequences. Our point, rather, is that the forces that shape and inform health care needs are increasingly informed by the latest technological developments. Health care needs are created within a technological complex and continue to exist so long as this technology remains stable. Within this complex, they come to be seen as basic needs—their satisfaction as critical to our well-being as food and water can be in cultures that are not shaped by biotechnology.

Nor should this relationship be cause for alarm. We have always been shaped and polished by technology. The technological forces that shape us are as powerful as the forces of nature, the forces of the market, and any other force that comes to mind. The watershed for human development, however, occurred precisely at that moment when technology came to be seen as a means for regulating and improving our given health allotments. Technology causally interacts with us, and serves as the benchmark by which we are valued and measured. If we function poorly against some new technological device, then we create an opportunity for improvement—an opportunity to put technology to work in the pursuit of our own evolutionary scheme.

As our technology grows more invasive—as its tendrils seize new opportunities for assimilation—these benchmarks have grown increasingly sensitive. We can now scan for arterial weaknesses (aneurysms) that have not occurred and may never occur. In this way, magnetic resonance imaging (MRI) may create a new health care opportunity and, on the view of some, a new health care need. Does a person have a right to an MRI in the event that his family has a history of aneurysms? Can we even engage in debate about this claim or right without importing the very instrumental framework that gives it substance in the first place? We value human life and we value our ability to correct any



deficiencies in our given health allotments. Our technology draws our attention to a human health weakness, while at the same time affording us the opportunity for treatment that may save a life. Can we take a neutral position with respect to the ethical frameworks that the bioethicist needs to preface her deliberations? We can still raise moral issues, but deliberation will now be skewed in a direction which favors intervention, which is what one would expect from a culture that embraces an enablist conception of health and well-being.

Infertility is now a health care need and new reproductive technology is now the means to its satisfaction. Neonates have needs as well that can be served by the latest biotechnology. We are convinced that we cannot now dispassionately stand back and debate lifeboat scenarios, with their emphasis on resource allocation, when this technology is seen as a good in itself. It is difficult for us to debate, say, the rights of the mother versus the rights of the fetus when biotechnology enables the fetus to survive outside of the womb at earlier and earlier periods of development. The rights of the mother seem to count for less under the biotechnological gaze, and, indeed, it becomes an open question as to who is the relevant parent in such situations—the bioengineer or the mother. Our attitudes towards the family seemed less homophobic and androcentric a generation ago when the “ordinary method” was a woman’s only option for parenting. If our reproductive technology is restricted to heterosexual women in a “stable relationship,” as the Council of Europe’s 1989 information document on Human Artificial Procreation recommended, can we see our public policy in any other way except as marginalizing non-traditional parenting?<sup>21</sup>

#### CONCLUSION: THE LIMITS OF INTERVENTION

There was a time when death was thought to be a fact of life—as detached from us as the fact of gravitation and the fact of evolution. It was widely believed that at birth we were given a number of health units that were gradually spent during the course of living. Hard living made for quick spending. A slower pace was better, since this could make our units last longer. Decay and death were regarded as entitlements. What an adult male could expect was a gradual loss of hair, teeth, and strength during middle life, followed by a fast decline into old age, and eventually death. Decay and death were inevitable, just as machines, which served as the model of corporeality and of the human body, eventually break down and stop working altogether.

This fatalism still holds many in its grip, but it is gradually being displaced by the new enablist conception of health. We now think of our body as a commodity, as something that can deflate and inflate in value, healthwise. Even the damage caused by a rough and tumble lifestyle, many of us are coming to believe, can be reversed. A slower pace need not be better. If anything, a fast pace is better for the body and for the mind. Where tooth loss only a generation ago was viewed as inevitable, both by dental practitioners and by the layperson, most of us now believe that we should keep all our teeth throughout our lives. If teeth are crooked, straighten them. If eyes are weak, correct them with lenses, re-attach retinas, replace corneas. We refuse to countenance any kind of disability as inevitable or, for that matter, as a disability at all. We may be abused, threatened, or challenged, but we are not thereby disabled. We now think of long life and health as entitlements—in short, we now think of our health and biotechnology in the same terms, namely, as part and parcel of our own evolutionary scheme.

There are those who may want to distinguish merely cosmetic improvements from those that are necessary for well-being. Moral philosophers are at home with the discourse of resource allocation, insisting that we need to prioritize medical needs on the malthusian grounds that our resources are scarce. But who is to say that the new bionic arm for the senior who lives to golf is any less of a need than the hip for the senior who watches television? Who is to say that a large nose is any less in need of medical attention than that face deformed by an auto accident? Where are our benchmarks? Biotechnology creates both needs and both possibilities. Ethicists and government administrators may set their priorities, but the current wave of technological optimism does not discriminate between them, or help us to discriminate between them. It just creates new benchmarks against which we judge ourselves to be in need of improvement. And if these needs are not satisfied, we will seek to remove the economic constraints that stand in the way of our ongoing evolution.

What of death itself and the technology that has traditionally been used to sustain life, even when that life seems not worth living? Here there is a tension between the traditional linear conception of health, with death as the inevitable consequence of a lifelong diminishing of natural powers, and the new enablist conception of health. We think of life support as the delivery of health care which, we have seen, for us is geared towards improving the patient. Health care

practitioners often portray life support as a way of coping with illness and suffering. But this suggestion seems to be an unhappy compromise between a view of life which is something that has a value in its own right and the idea that death is not something that we should seek to regulate.

Biotechnology opens up a whole new realm of options where death is concerned. Once we had no or little choice in how we met death. If we were struck by a fatal illness, we could choose to succumb to the inevitable degeneration or commit suicide, but both options are equally frightening to us. Shooting ourselves may be just as violent a death as death by asphyxiation. Just as medical technology gives us new ways of living, it gives us new ways of dying—a way of deciding at what point in the course of an illness we choose to die, a way of deciding how we shall die. Death, too, at least in principle, can now be seen as a positive value, where once it was an inevitable, brute fact of life.

Even government officials are now speaking in hushed terms about a “good death,” in recognition of the fact that biotechnology can regulate death in a way that accords with our own wishes. Once legal restrictions are removed, however, we suspect that this new health care need—a good death—will itself be constituted by the available technology. Though technology seems to promise us a number of ethical options where death is concerned, we will, we believe, begin to think of a good death in precisely the terms laid down by the available technology. Death will be measured, just as we are learning to measure health—in terms of our capacity to make improvements in our given allotments.

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#### NOTES

1. In his pioneering work, *Technics and Civilization* (1930), Lewis Mumford depicts technology as advancing in three stages, distinguished by their different sources of energy. Three stages in the development of technology are also identified in this paper, but they are distinguished by different conceptions of the relationship between artifice and nature.
2. Estes and Binney (1989) note that the idea that old age is a social problem dates back

to the 1930s and the early days of gerontology, which intersected with major social events of the time and resulted in mass public interest in both academic research and public policy initiatives to help identify and solve the so-called "problem of aging."

3. The Greek word *φύσις* or nature is derived from the verb that means beget, engender, generate. The role of generation is central to Aristotle's conception of nature. In response to the eternal question, what comes first—the chicken or the egg—he answered that it was the chicken (or the rooster) because coming first means "first in the order of being" or in causal efficacy, not in the order of time.

4. This contrast between nature and artifice is captured by Aristotle's assertion that "if you planted a bed and the rotting wood acquired the power of sending up a shoot, it would not be a bed that would come up, but wood" (*Physics* 2.1 193b).

5. Haraway (1991, p. 152) contends that "pre-cybernetic ... machines were not self-moving, self-designing, autonomous. They could not achieve man's dream, only mock it. They were not man, an author himself, but only a caricature of that masculinist dream. To think they were otherwise was paranoid.... Late twentieth-century machines have made thoroughly ambiguous the difference between natural and artificial. ..." Be this as it may, it is perhaps more accurate to suggest that modern technology realizes the dream of the first generation of mechanists.

6. The General Scholium of Newton's *Principia* (1934, p. 543) mounts a devastating critique of Descartes's attempt to mechanize astronomical phenomena which is grounded in a distinction between the movements of mechanical systems (constrained bodies) and natural systems (free bodies). See Baigrie, 1995.

7. Newton contended that force is empirically determinable in a way that corpuscular mechanisms are not, but he also held out the hope that other kinds of force might eventually become equally as well understood as gravity. Some of his disciples, such as John Keill, attempted to extend the law of gravitational attraction to physiological phenomena, and so attempted to subsume biology and cognate disciplines under the rubric of Newtonian natural philosophy.

8. Biochemical manipulation has led to definitive therapy for few diseases because it has not targeted the underlying basic defects. See T. Friedmann, 1993, p. 156.

9. Note, however, that the World Health Organization defines health as "a state of complete physical, mental and social well-being." See International Health Conference, 1946.

10. The extension of Darwin's evolutionary theory was not limited to mechanical devices. Herbert Spencer, for example, argued that scientific theories are subject to a struggle for survival. Philosophers of science have argued in recent years that our cognitive structures (say, the way that humans characteristically process information) are adaptations (see Ruse, 1986).

11. For the sake of brevity, we take it as a given that we see in biotechnology a powerful means for the improvement of nature. This rise of this conviction, however, calls for careful historical and philosophical analysis.

12. The expression "evolutionary" does not have its Darwinian meaning as something which is bereft of progressivist connotations. Our own biotechnological project may just as well be described as "progressivist," with the qualification that the naturalist/progressivist dichotomy makes little sense in a world where humanity is self-engineered.

13. This thesis also has ramifications for ecological concerns, particularly for those who believe that nature's evolutionary scheme is in conflict with our own biotechnological scheme.

14. Haraway (1991, p. 45) notes that this transformation "did not occur in a historical

vacuum; it accompanied changes in the nature of technology and power, within a continuing dynamic of capitalist reproduction." We are less interested in the relationship between technology and politics than we are in that between technology and health care.

15. Intensive Care Units emerged in the early 1950s as discrete areas where special patients could be monitored by nurses (see Fairman, 1992). ICUs were an extension of the patient triage employed by nurses to protect critically ill patients. Equipment was secondary to caring for patients.

16. Robert Francoeur (1971) presents the following scenario: a barren woman receives an ovarian transplant from another woman. She conceives but has difficulty continuing her pregnancy and arranges for a third woman to carry her baby to term. Since this woman's husband is sterile, she had been artificially fertilized by another man who had passed away eleven years earlier but left his frozen sperm to posterity. Francoeur asks his readers to work out who the parents are and how many there might be (one hundred and twelve). Reproductive technology is not new but our list of reproductive resources is growing on a daily basis. By one count (DeMarco, 1988) there are now twenty-three ways to have a baby.

17. Gorovitz (1985, p. 272) attempts to minimize the impact of new reproductive technologies: "But a very small percentage of the population is in any position to benefit from such procedures . . . the traditional method, on the other hand, is cheap, can be performed at home, takes little time, training, or skill, and is a great deal of fun. It will remain the method of choice, and atypical reproduction will have little overall impact on the institutions of marriage or the family." Since they are not in a position to practice the so-called "traditional method," it would appear that Gorovitz has excluded lesbians from his sampling. If lesbians are allowed access to this technology, as has been the case in the USA, we can safely say that the impact on the institution of the family will be considerable. Perhaps this is why the Council of Europe's information document on Human Artificial Procreation seeks to restrict fertilization techniques to heterosexual couples (see Knoppers and LeBris, 1991, pp. 332-333). The Canadian Bar Association has made a similar recommendation. (see Knoppers and LeBris, 1991, p. 347). See also DeMarco, 1988, p. 328, where an unmarried woman's legal action against a fertility clinic on the grounds that its policy of restricting services to married couples violated her right to privacy is portrayed as "demean[ing] marriage" and fostering "a consumer mentality."

18. Some lobbyists envision artificial wombs in sufficient quantities to "solve" the abortion debate by providing incubation for all those unwanted fetuses who are "deprived of a mother's womb." See DeMarco, 1988, p. 337. Others welcome artificial wombs because it keeps pregnancy under the clinical gaze of physicians and scientists. See Fletcher, 1979, p. 103; and DeMarco, 1988, p. 338.

19. Gorovitz (1985, p. 270) points out that in the USA public policy determination lags behind technical innovation: the acceptance of reproductive technologies, such as in vitro, has been accelerated by the failure to develop a comprehensive set of recommendations for a coherent set of policies.

20. The Human Genome Project focuses on genetic material but the gene receives its given phenotypic expression only in the presence of other activities within the cell and organism.

21. Of course, there may be other over-riding political reasons for resisting reproductive technologies. Some feminist essentialists see women's procreative capacity as the source of women's distinctiveness. Reacting to the fact that procreation can be achieved by other means, an

international network of feminists (FINRAGE), organized for the most part in response to these technologies, recommends the immediate closure of all in vitro clinics (see Longino, 1992, p. 327).

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