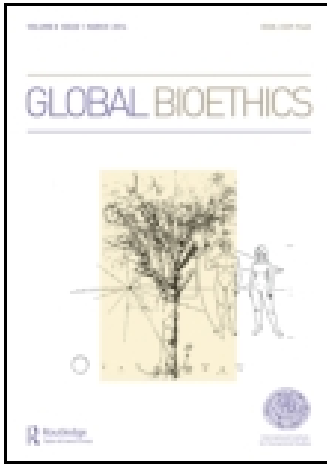


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## RESEARCH ARTICLE

### The bioecological bases of global bioethics

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Adaptive success and evolution are determined by how we interact with the natural environment and all other forms of life (bios). Yet in our pursuit to dominate the natural world, we have lost sight of this basic premise and continue to exploit natural resources, to contaminate, to consume more than necessary and to misuse our reproductive capacities. For this reason, global bioethics emerged in the 1980s, a culmination of mental resistance on the part of many observers who sought to readdress the balance between humankind and nature – a balance which must be reinstated if we are to survive. Corrective measures are required, which should be free from purely religious or political influences because their ideologies are frequently founded on strategies of power, with little regard for the general well-being of all living species. Global bioethics, as opposed to bioethics, was formulated by myself, Van Rensselaer Potter, Antonio Moroni, Laura Westra and others, to transcend the restraints of science, uniting it with the humanities to create a new expanded consciousness, an alliance between life and the environment in which all factors – environmental, biological, physical, psychological, social and economic – recognize that they are interdependent.

**Keywords:** biological; evolutionary; ethics; global bioethics; natural world; humankind

#### 1. Introduction

The term “global bioethics” was the scientific formulation of a globalized thinking promoted in the 1980s by myself (Chiarelli, 1984a, 1984b, 1990, 1993, 1994, 1995), Van Rensselaer Potter (1970, 1971, 1988, 1992a,b, 2000), Antonio Moroni (1989), Laura Westra (1991) and others, which sought to communicate across ideological and scientific domains, to ignite a new phase of conscious awareness of the need to re-establish the balance between humankind and nature. It endeavoured to create an alliance between life and the environment in which all factors – environmental, biological, physical, psychological, social and economic – are recognized as being interdependent, motivated by the realization that it is only by protecting our ecosystems that we will protect ourselves and all other forms of life (bios).

It was necessary to globalize the more limited concept of bioethics which had preceded it, and to extend it to the planet, because we can no longer allow ourselves to concentrate on isolated fields, but must look to the whole, while respecting all of the integral parts which contribute to its ultimate equilibrium. Therefore, there was a need to draw a line between all previous definitions (medical ethics, business ethics, bioethics, etc.) and global bioethics, and to shift our collective vision away from religious and moral dogmas, towards the naturalistic origins of humankind, so that we are not so much preoccupied with what is right and wrong, but with

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what is *natural*, and therefore best for nature as a whole. Through this vision alone will we make the right adaptive choices to ensure the survival of our species.

Therefore, any rational and naturalistic definition of ethical norms must first stipulate *the preservation and propagation of the DNA of any given species and the maintenance of its intraspecific variability* – this being the founding principle behind global bioethics. Morality, on the other hand, assumes different norms in different historical contexts and therefore tends to be governed by religion and regulated by different cultures. Ethics should be a purely biological and ecological discipline. Religious ethics, medical ethics, political ethics, environmental ethics, business ethics and bioethics represent some of the many attempts at collective self-regulation that followed the establishment of the Society for Ethical Culture in New York by Felix Adler (1851–1933) in 1892, who challenged the Christian and Jewish monopoly of moral dogmas. Moreover, the terms “moral philosophy” and “ethics” are today confused, causing misunderstanding. Thus far in western culture the development of ethical norms has been based on a distinction between theological ethics and humanistic ethics. Theological ethics follow on from Aristotle, who believed that everything has as an ultimate goal related to God. According to this view, a contemplative life leads to a divine life, whereas the Stoics, who came later, believed that living in accordance with nature is the basis of moral philosophy, since nature is a rational and perfect order, a manifestation of God himself. Humanistic ethics, on the other hand, base moral philosophy on human needs, primarily related to survival, thus appointing moral philosophy to safeguard the survival of individuals, or groups of individuals, cooperating and living together in peace. Ethical concepts, therefore, are characterized by duality because they are either theological or humanistic. However, this dichotomy that pervades western culture can now be overcome by global bioethics, which was built on rational and naturalistic premises, in line with current scientific requirements (Jonas, 1990).

## 2. The historical, cognitive and cultural bases for “global bioethics”

On 11 July 1987 the Earth’s total population reached 5 billion. Currently, it exceeds 7 billion. Around 1835, the global population had grown beyond 1 billion; hence, in less than 2 centuries (or 8–10 generations), the human population had expanded more than sixfold (Figure 1). The current surge in the population growth rate at the turn of the millennium can be compared to the period of transition between the Paleolithic and the Neolithic (10,000–8,000 years ago), when the world’s population rose from 5 to 10 million, to over 100 million. The introduction of agriculture, breeding, fermentation and food conservation enabled Neolithic humankind to overcome the ecological crises that had brought famine and despair to the hunters of the late Paleolithic.

Now, however, once more humanity is experiencing a critical moment, marked by an increase in the population on one hand, and a decrease in natural energy resources and food on the other. This is the complex challenge which we must successfully overcome during the third millennium, if we are to restore a balance between ourselves and the natural world. In recent times, human knowledge has been revolutionized by the impact of scientific innovations: firstly by nuclear fission, which changed the conceptual basis of matter; secondly by organ transplants, leading to a crisis in the concept of the individual; and thirdly by the development of molecular biology and biotechnology, genomic information decoding and “genetic engineering”, which have undermined the very concept of the species. The solutions necessary for the present crisis give rise to many questions, many of them ethical, related to the application of biotechnology and genetic engineering. Decisions must be reached quickly and implemented, guided by an innovative vision of the future based on individual conscience and traditional ideologies (Chiarelli, 1996; Chiarelli & Vaglio, 2006).

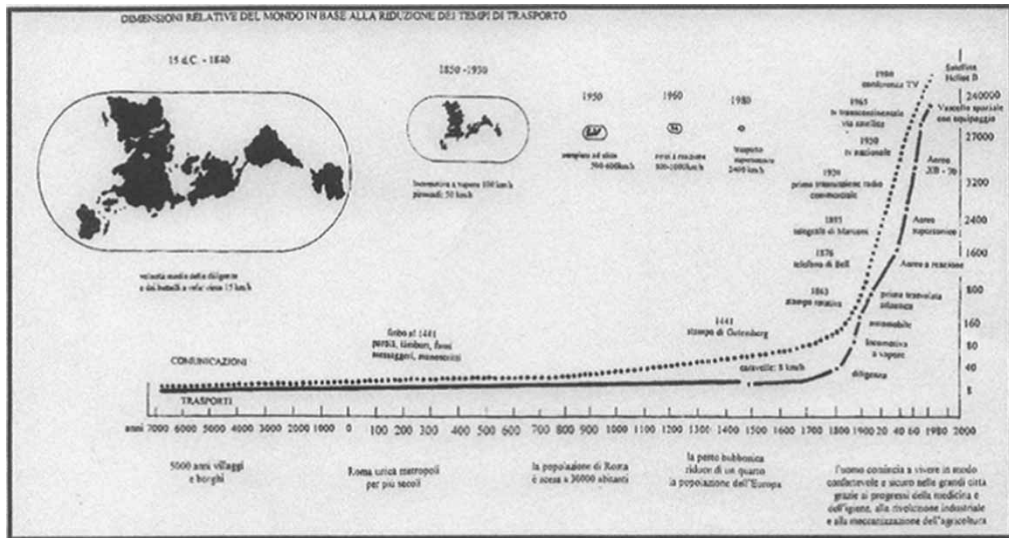


Figure 1. With the development of technology, the reduction in travel time and improved communications, the relative dimensions of the world reduced progressively. Yet the possible future survival of humanity depends on the maintenance of biodiversity and heterogeneity of culture (ethnocide is homologous with genocide) (Chiarelli, 1993).

### 3. Awareness of the problems facing humanity

The 1960s and 1970s were marked by a growing awareness of environmental issues and a turning point in the relationship between humankind and nature, clearly manifested in the critical remarks of various scholars from different disciplines, including theologians and philosophers, which gave rise to new cultural movements with a strong focus on environmental problems. The prevailing concerns were summarized in 1972 in the Stockholm Declaration of the United Nations Conference on the Human Environment held in Stockholm as follows:

We see around us growing evidence of man-made harm in many regions of the earth: dangerous levels of pollution in water, air, earth and living beings; major and undesirable disturbances to the ecological balance of the biosphere; destruction and depletion of irreplaceable resources; and gross deficiencies, harmful to the physical, mental and social health of man, in the man-made environment, particularly in the living and working environment. (point 3)

Similarly, the solemn declaration by Christian representatives gathering in Basel at the 1974 Council of European Episcopal Conferences stated: "Our prosperity is mainly based on other peoples' poverty. We soil the world we live in with our selfishness and self-interest." The concept that the quality of life and the quality of the environment are closely linked was reflected in these remarks in the Nairobi Declaration of the United Nations Environment Programme adopted at the 13th meeting of the session on 18 May 1982:

During the last decade, new perceptions have emerged: the need for environmental management and assessment, the intimation complex interrelationship between environment, development, population and resources and the strain on the environment generated, particularly in urban areas, by increasing population have become widely recognized. A comprehensive and regionally integrated approach the emphasizes this interrelationship can lead to environmentally sound and sustainable socio-economic development. (point 3)

With his usual brilliance, the Nobel Prize laureate Carlo Rubbia (1984) said: “We are witnessing an experiment where the test tube is the Earth. The observer, which is us, is not outside but inside the test tube itself, and nobody has a clue what will happen”.

Also in 1984, developments in genetic engineering, which made it possible for scientists to modify the genomes of humans and other species, led to the remarks of the Austin friar, Arrano Rodrigo: “For the first time in history a biological species is in a position to plan its own future by using its descendants as experimental tools”. A year later, the well-known geneticist Francisco Ayala (1985) reaffirmed this view: “Before the human race appeared no species could determine its evolution patterns; now humanity has the technical skills to do so and maybe we can even direct genetic changes”. This follows on from similar observations by Carlo Rubbia:

Now man claims he can change the genetic code. Let us consider we can plan, change and recognize the dualities of a person by his genetic code. We have not gone so far yet, for nature can still defend itself well. But man is used to being tenacious in this field, so one day he will be able to modify the genetic code. This is an Aladin’s lamp that we had better wonder whether it is worth opening. (Rubbia, 1984)

The advantages and pitfalls of such technology were expressed by Francois Jacob, in 1987, at the centenary of the Institut Pasteur:

In the solar system nothing is more amazing than a cell turning into a man or a woman. It is a real wonder! Even science fiction becomes a stammering of imagination. A single cell, then a group of cells, then billions of cells. A universe where other cells are individualized so the human being starts speaking, reading, writing. I am bewitched by this. I would like to know the details [...] so far, genetic engineering has not been applied to man. We all agree that this must not be done. Biologists mistrusted first. The genetic values of man must be respected. There have been too little advances in scientific knowledge. If we want to make out what AIDS is, we must resort to genetic engineering. Each new discovery has a positive side and a negative one. When the Stone Age ends and the Iron Age begins the knife is discovered. This is a useful tool, if you want to peel an apple, but it can be a deadly weapon as well. Nobody knows what science can achieve. Current forecasts are short-term, so they are uninteresting. Genetic engineering is a fantastic tool, but we must make a clear distinction between the atomic bomb, that is a bad use of science, and science itself. (Jacob, 1987)

As we have seen, there were clear calls for a responsible use of science and guiding principles, such as those expressed by Galileo Galilei: “I look for the light and for the benefit that science can bring”. Humankind must manage its scientific heritage and environmental resources with care and foresight. The natural environment must be recognized as a living system, of which humankind is an integral part. Environmental awareness requires a revision of attitudes which endorse the exploitation of nature and the unlimited use of biotechnology, in order to restore the natural balance, which is vital for the survival of all living species.

#### **4. The history of ethical concepts**

In tracing the development of ethical concepts, one can examine two distinct contexts: the historical and the naturalistic. To date, most scholars have followed the historical route. To better understand how concepts such as good and evil, right and wrong have developed, and how they have been applied to life, we should start with ancient Greece. The systematization of these concepts started with things and was then applied to humankind, by following what could be regarded as an experimental approach, in elaborating a concept of good on a human scale. Ethics was, in fact, the third highest branch of philosophy, alongside logic and physics.

People were also regarded as “things”, and one’s own happiness was the ultimate goal of life. Individuals did not need to care about harming others and had only to look to their own pleasure: a hedonistic concept. The earliest forms of ethics concerned relations between individuals and the delimitations of individual freedom with respect to others in a defined social group (father/mother, son/daughter, husband/wife, master/servants, etc.) and the rights and appurtenances of each. The Mosaic law (from commandments 4 to 10 of the Ten Commandments) best summarizes these norms.

Western culture was deeply affected when the more experimental bases of ethics were replaced by metaphysical ones – a change which started with Plato, according to whom the way to knowledge was the conversion to good. Further influenced by the ascetical observances of neo-Platonism, ethics were affected by mysticism – a trend which developed further via Christianity.

In the Middle Ages, Christian ethics were concerned with the struggle between humankind and nature, liberty and need, and to better define these opposing forces Christian moralists irrevocably broke the world into two parts, good and evil. During the Reformation, free will was carefully considered, but contrasts between good and evil could be reduced only in part.

Subsequently, in the western world, ethical concepts were refined to encompass individuals and society, the latter being understood as an unspecified group of individuals. Law, with its rules, was consequently developed, together with the principles of democracy, a particular feature of western culture. Following this, the philosophical theories of the early nineteenth century led to the utilitarianism and positivism doctrines spreading into mid-central Europe. For example, Hegel’s positivist theory of history (the rational and the real are identical) led to Marx’s economic concept of ethics (history has no moral sense, and will has no conceptual value).

However, beyond the metaphysical barrier, the whole problem subsists. The natural world, as well as the concepts of good and evil, fair and unfair, right and wrong, obedience and disobedience, obligation and liberty, must be clearly arranged. Humanity has constantly been assailed by such dilemmas, by the responsibility of a continual choice and by the search for general rules to resort to.

The concept of ethics can also be analysed in a naturalistic and rational way, replacing a hedonistic/utilitarianism view of individual happiness, or a mystical vision of good, with individual striving to reach a state of perfection and balance. However, if ethics are founded on scientific bases alone, agnostic attitudes prevail with the exclusion of all branches of knowledge, other than scientific knowledge, which is deemed the only way of considering reality. In this formulation the theological concepts of ethics are meaningless.

These factors led to the bio-evolutionist position associated with Konrad Lorenz and Edward Wilson. According to Lorenz, animal and human behaviours are “functions of a system created and shaped by a history and phylogeny” (1978). Wilson sustains that ethical values and physical characteristics may have developed and stabilized through natural selection, giving rise to a genetic evolution of moral predispositions: “So in the human brain there are censors that affect our ethical premises unconsciously and deeply; these roots develop into the instinct of morality” (Wilson, 1978).

Yet in western culture there is no coding of ethics regulating the interaction between humankind and the natural world. The relationship between humankind and nature, as Aldus Leopold asserts (1933), remains strictly economic. The Earth is regarded only as property, and the rules regulating the relationship between humankind and nature provide only rights and require no duties in return. However, an extension of ethics to encompass the natural environment is required, both by evolution and the current environmental crisis.

### 5. The birth of global bioethics and its naturalistic bases

We now regard nature as a living environment (ecology), part of a process which shapes us and all other living organisms (comparative biology): “A reflection of the mind, being of the same matter as mind” (Chiarelli, 1994, p. 5). Global bioethics originated from this framework of ideas. The scholar who coined the term, Russel Van Rensselaer Potter (1971), defined it as a science of balance between humans and nature, a bridge for the future of humankind. Yet the actual inspiration came from *A Sand County Almanac, with Other Essays on Conservation* by Aldus Leopold (1949). By its very nature, global bioethics must highlight the problems related to ensuring the survival of humankind, both as individuals and as the representation of a species. Global bioethics is an interdisciplinary science, linking information from mainstream branches of biology, ecology and sociology. These are organized in a philosophical formulation focusing on *Homo sapiens* and forming an anthropological and naturalistic discipline par excellence. Conversely, the approach of bioethics in medicine, for example, is different and incomplete, being limited to medical deontology.

As a science, global bioethics is concerned with the application of ethical norms to all biological entities, whether they be species, preliminary forms of individuals (spores, gametes, embryos) or products of cloning (cuttings). Its basic principle is *the conservation and the propagation of the DNA of any given species and the maintenance of its intraspecific variability*. Therefore, all living forms are worthy of respect and ethical consideration. Yet the latter will vary according to the biological complexity of the particular group of living entities, because their ontogenetic cycles are different. This hierarchization is inherent in the evolution of life on Earth (Chiarelli, 1996, 1997, 2005).

At the *first hierarchical level* are those entities which are characterized by a haploid structure of genes – for example, a bacterium, gamete, spore or halophyte. Having only one filament of DNA, they are subject to random changes (mutations) which inevitably lead to their extinction. The fusion of the two haploid DNA filaments presupposes sexual reproduction and meiosis, which acts as a selector of casual mutations, creating diploids.

Diploid entities, being the product of meiosis, have two complete sets of DNA filaments, one from each parent. Diploid cells reproduce by mitosis and represent *the second hierarchical level*. On this level, ethical considerations will be determined by the type of biological entity, as can be seen from the following:

- (i) Cuttings or clones, for example, are exact replicas of the organisms from which they have originated, devoid of individuality or variation (i.e. reproduction is asexual). These are the by-products of fractionation and do not contribute to the perpetuation of the genetic variability of their species.
- (ii) Subordinate classes of social insects are another example. They have no reproductive potential, their existential significance is reduced to their own brief lives and they are unable to transmit the species' DNA.
- (iii) Early stages of life, such as embryos or seeds, should also be viewed separately since their chances of survival or reaching the reproductive stage are uncertain.
- (iv) Likewise, the final stages of life, which have lost all reproductive potential.

On *the third hierarchical level*, however, are those entities, or higher animals, in which the concept of “individual” is present and characterized by “uniqueness, unrepeatability and indivisibility” for the entire ontogenetic cycle, the germ line being potentially active in all members of the species. In this group, where we find humankind, the preservation of DNA and its intraspecific variability is assured through precise rules of socialization (moral norms) and ethical



norms, which respond to four stimuli: two related to the biology of the species (sex and nurture) and two related to the environment in which the members of the same group of species live (food and defence). More specifically, these are:

- (A) Reproductive behaviour
- (B) Parental care
- (C) Cooperation in the search for food
- (D) Cooperation in the defence of the group

As mentioned earlier, moral norms are the branch of bioethics concerned with social rules that best promote survival, and likewise respond to the same aforementioned stimuli: relationships between men and women (A); relationships between parents and children (B); cooperation in the search for food (C); and cooperation in the defence of the group (D).

Furthermore, interaction between these stimuli will determine the specific social structure.

In other words, differences in the intensity of biological stimuli and the required energy intake will determine the minimum number of individuals necessary in order to maintain the survival of a population from one generation to the next (*deme*), while the productivity of the territory, and humankind's interaction with it, based on custom, will determine the maximum number of individuals that can be sustained:

$$(A + B) + k(C + D) = \Delta$$

In humans, this number is also influenced by culture (sapienization/technology), or rather the evolution of human intelligence ( $ei$ ), which enhances survival prospects specifically in relationship to C and D, so that the formula may be elaborated as follows:

$$[(A + B) + k(C + D)]ei = \Delta Homo$$

The maximum number for humankind has already been surpassed, thanks to the intellectual potential of the human brain; but will the passage from the industrial to the post-industrial era allow further unrestricted numerical population growth?

## 6. Concerns for the future

The moral and adaptive choices of human social structures, including biotechnological and biomedical ones, must all respond to the above formulae. For three decades now, global bioethics has sought to stimulate corrective measures, to reinstate the balance between humankind and nature, attempting to redirect our efforts towards the formulation and implementation of more equitable and ethical social and economic policies, with the common interest at heart.

Yet unremitting abuse of natural resources and reckless strategies, in the pursuit of short-term gains, have undermined our very likelihood of survival.

In 2025 the Earth's population is set to reach 10 billion, extreme weather events have impacted on agriculture, and with industrialized countries (where only 20% of the global population lives) consuming 80% of the world's natural resources, food and energy shortages are continually on the rise. And this, coupled with the global financial crisis and spiralling food prices, has left many struggling with poverty, making us increasingly reliant upon new technologies, such as biotechnology, to combat the risk of starvation for many of the world's population. We may yet be in time to reverse this alarming trend, but only with a radical overhaul of collective values and strict compliance with the concepts advocated by global bioethics.

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