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The Biological and Evolutionist Bases of Ethics

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1. Introduction

A rational and naturalistic definition of ethical norms must stipulate the preservation of the DNA typical of the species and the maintenance of its intra specific variability. Indeed, this preservation is the basic principle of bioethics. The historically limited behaviour can be related to morality which can assume different norms in different historical contexts. Morality could therefore be governed by religion or normalized by discipline. Ethics, instead should be a purely biological and ecological discipline.

Religious ethics, medical ethics, political ethics, environmental ethics, business ethics, bioethics: a never-ending sequel of terms that began in 1892, when Felix Adler (1851-1933), questioning Christian and Jewish control of moral dogmas, established the Society for Ethical Culture in New York. Moreover, the terms moral philosophy and ethics are today often confused starting misunderstandings. So far, the development of ethical norms in western culture has been based on the distinction between theological ethics and humanistic ethics. Theological ethics follow Aristotle, according to whom everything has as an ultimate goal. According to this view, a contemplative life allows individuals to share divine life. The Stoics, following Aristotle, believed that living in accordance with Nature was the basis of moral philosophy, since they regarded Nature as a rational and perfect order being God himself.

Humanistic ethics base moral philosophy on human demands, primarily on survival. So it appoints moral philosophy to guarantee the survival of individuals or groups of individuals co-operating and living together in peace.

Ethical concepts are marked by duality because they can be either theological or humanistic. This duality peculiar to Western culture can now be overcome and integrated by a "global bioethics" with rational and naturalistic grounds, as required by the advances in scientific knowledge.

2. The historical, cognitive and cultural bases for "global bioethics"

On 11 July 1987 the Earth's total population reached 5 billion. Currently it is over 6 billion. In 1835 the figure of one billion was exceeded, thus in less than two centuries (or 8-10 generations) the human population has expanded more than six-fold. The current upsurge of the growth rate marking 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 5-10 million to over 100 million. The introduction of agriculture, breeding, fermentation and food conservation enabled Neolithic human kind to overcome the ecological crisis that had brought famine and despair to the hunters of the late Paleolithic.

Today it's a critical time when population growth and levels of raw material interact. Humanity will succeed in mastering this interaction only if a balance is found through intellectual faculties. Such a crisis can be overcome if the ethical problems concerning the applications of the biotechnology and genetic engineering, which call for quick and innovative decisions, are solved. Our knowledge has been revolutionized by the impact of scientific changes: firstly by nuclear fission, that changes the conceptual basis of matter; secondly, by the crisis of the concept of the individual, due to organ transplants; thirdly, by the development of molecular biology and biotechnology, of genomic information decoding, as well as that of "genetic engineering" undermining the very concept of species.

Will the development of "genetic engineering", that can yield energy and food, enable us to replace fossil fuels as a source of energy? Will bioengineering be able to produce cheap food to satisfy needs of a growing population? Will mankind be able to absorb the effect of these new technologies within a few years? What is going to be the impact of new technologies on the environment? What kind of world are our children going to inherit? As for governments, will they be able to manage such changes? How many lobbies will affect these choices? Will politicians be able to consider these issues in the short time left?

3. The self-consciousness of problems

The 1960s and 1970s were marked by a growing awareness of environmental issues and the critical relations between Humankind and Nature. This was the outcome of the critical remarks by scholars of various disciplines, including theologicians and philosophers, which gave rise to new cultural movements with a strong focus on environmental problems in the late 1970s. These remarks are summarized in the Stockholm Declaration on Human Environment (1972), that 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*".

Similarly, the solemn declaration of the Christian representatives gathering in Basel at the 1974 Council of European Episcopal Conferences reads: "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 connected, is confirmed by the final remarks of the UNEP Intergovernmental Conference on the Environment in Nairobi in 1982:

"*During the last decade new perceptions appeared: the effort to manage the environment, the deep and complex interrelationship between the environment, development, populations and resources. Population growth, especially in urban areas, gave rise to social tensions. A global, region-wide approach stressing these relations is going to promote a sustainable development*".

With his typical sharpness the Nobel Prize laureate, Carlo Rubbia (1984), said: "We are witnessing an experiment where the test tube is the Earth. Moreover, we can watch from

inside, and nobody can guess what will happen". However, the development of genetic engineering also enables scientists to modify the human and other species genomes. In 1984, the Austin friar Arrano Rodrigo remarked: "For the first time in history a biological species is in a position to plan its own future by using its descendants as experiment tools". The well-known geneticist Francisco Ayala, (1985) wrote in support of this view: "Before the human race appeared no species could determine its evolution patterns; now humanity has the technical skills to do and maybe we can even direct genetic changes ". Which was echoed 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 used to be 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" (1984).*

The words uttered by Francois Jacob in 1987, on the centenary of the Institute Pasteur, are also clear:

"*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*".

Therefore, it has become imperative to revise the idea of Nature exploited by Man and the common use of biotechnology. Humankind must manage environmental resources and his scientific heritage with a sense of responsibility. According to the aphorism by Galileo Galilei, "I *look for the light and for the benefit science can bring*". Scientific culture must revise its position by placing the training of scientists before that of technologists. Our relationship with nature is wrong, because the current establishment can neither raise conscious citizens nor upright statesmen. So we must find an ethic based on responsibility and solidarity as a requirement for human survival, as Hans Jonas (1990) Russel Van Potter (1971) maintain. The natural environment must be understood as a living system of which the human species is an integral part. Environmental awareness requires us not only to know the natural balance, but also to respect and recover it. This implies an attitude based on sharing and helpfulness replacing the exploitation peculiar to western culture. In this perspective, we must revise all our attitudes based on the exploitation of nature and the unlimited use of biotechnology. We must manage environmental resources and scientific heritage. Today's ethical problems are mainly noticed by biologists and natural scientists, but they affect all sciences and their solutions will be vital for all living species to survive.

4. The story of ethical concepts

In tracing the development of ethical concepts either a historical method or a naturalistic method can be followed. To date most scholars have followed the historical method. In order to understand how the concepts of good and evil, right and wrong developed and

how they can be applied to our life, we can start from ancient Greece. Their systematisation started from things and was applied to Men; by following what we could call an experimental method a concept of good on a human scale was elaborated.
Ethics was in fact the third, highest branch of philosophy, alongside with logics and physics. According to this view men were also "things", and one's own happiness was the ultimate goal. Individuals had not to care about harming others, but only about their own pleasure: this was a hedonistic conception. The same process marked the development of concept regulating relations amongst men as well as those between men and things.
The original ethics involved human relationships, restrictions on personal liberty affecting the members of a social group (father and mother, son and daughter, husband and wife, etc.) and their own rights. The Mosaic law from the ten commandments summarizes these norms very well.
Western culture was deeply affected when the experimental bases of ethics were replaced by the metaphysical bases. This change started with Plato, according to whom the way to knowledge is a conversion to good. A leading role was played by the ascetical concept of the Neoplatonists, aiming at detaching themselves from this world and looking on a transcendental world. Ethics was thus affected by mysticism. These mystical trends were further developed by Christianity. In the Middle Ages, Christian ethics were unable to solve the contrast between Man and Nature, liberty and need. Christian moralists divided the world into two parts: good and evil, with the former being placed in some distant future (happiness, heaven, etc.). During the Reformation, free will was carefully considered, but contrasts between good and evil could be reduced only in part.
The ethics which then developed in the Western world affected relations between individuals and society. This is how law and its rules developed, included democracy, peculiar to Western culture. The philosophical theories of the early nineteenth century led to the utilitaristic and positivistic doctrines that spread into mid-central Europe. For example, Hegel's positivistic 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). But 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 systematized. Current humanity, is constantly pervaded by such dilemmas, as it is thwarted 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/utilitaristic view of individual happiness as the only aim to pursue and a mystical vision of good as perfection to strive for. If the issue of ethics is founded on scientific bases this first leads to agnostic attitudes, then it excludes all branches of learning but scientific ones. Science is regarded as the only source of knowledge and the only way of considering reality. In this formulation the theological conceptions of ethics are meaningless. So we reach the bioevolutionist position peculiar to the schools of Lorenz and Wilson.
According to Lorenz, animal and human behaviours are "*functions of a system created and shaped by a historical and philogenetic* " (1978). According to Wilson, 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, 1980). Yet in western culture there is no coding of ethics regulating the interaction between Man and the natural world. The relationship between Man and Nature,

as Aldus Leopold asserts (1933), remains strictly economic. The Earth is regarded only as a property, and the rules regulating the relationship between Man and Nature only provide only rights and no duties. The extension of ethics to the natural environment is required by both evolution and the current environmental crisis. It is the third stage of a sequence where the first two have already exceeded.

5. The birth of bioethics and its naturalistic bases

Man, (i.e. the science produced by human evolution), now regards Nature as a liveable environment (ecology) and a process shaping him and all living organisms (comparative biology). "*A reflection of the mind on nature, where the mind is matter itself*" (Chiarelli l994). Bioethics originates in this frame of ideas. The scholar who coined the term, Russel van Potter (1971), defines it as a science of balance between Man and Nature, a bridge for the future of mankind. Yet the actual inspirer was *A Sand County Almanac, with Other Essays on Conservation* by Aldo Leopold (1949). So it is by its very nature and its historical environment that bioethics must highlight the problems related to the best survival of Man, both as an individual and as a species, in the present as well as in the future. Bioethics expresses the concern within the relationship between Man and Nature and 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 as medical ethics is different and incomplete, since it must develop as a broadening and updating of medical deontology. This discipline has to be regarded as that branch of global bioethics specifically dealing with the interaction between patient and doctor and between patient and society.

Bioethics, as a science, subtends a general theory for evaluating the principles of good and evil between co-specific beings and must thus be based on biological principles.

According to these assumptions, a definition of bioethics must primarily propose "*the preservation and propagation of the DNA peculiar to the species and the maintenance of its intraspecific variability*". This definition contains the basic principle of bioethics. In essence, all living things deserve respect and ethical regard, be they species, individuals or preliminary forms (spores, gametes, embryos) or products of cloning (cuttings).

Yet, these ethical reflections are dissimilar and have a different weight - depending on the various biological groups - since their ontogenetic cycles are different. This hierarchization of values is inherent to the evolution of life on Earth.

A biological entity marked out by an haploid structure of genes, as a bacterium, a gamete, a spore or a halophyte, is **the first hierarchical level** of bioethical note. Because it has only one filament of DNA it is subject to random changes (mutations) that inevitably lead to extinction. The fusion of the two haploid structures presupposes sexual reproduction and therefore meiosis, acting as a selector of random changes, most of which would have led the haploid entity to extinction.

The diploid entity is **the second hierarchical level** in the complexity of living forms marking life evolution on Earth, and the greater complexity of this stage must be regarded from a bioethical viewpoint. Yet ethical considerations are different depending on whether:

1. The diploid entity cannot survive on its own, as to embryos, or
2. its reproduction cycle is already completed, or
3. the diploid entity is formed by individuals whose life is unrelated to the transmission of specific DNA to descendants, as it happens in sterile castes of social insects, or

4. it is devoid of specific variability and its reproduction is asexual (cuttings, clones).

The biological entities in category I can seldom help in supporting specific DNA and its variability in future generations, because their life and development are conditioned by a variety of environmental factors which eliminate a large number of individuals. The same happens to the seeds of plants and to the fertilized eggs of sea animals, reptiles and birds that other animals use to prey upon, or the zygotes of mammals that do not succeed in settling in the uterine wall. This state of uncertainty perspective limits bioethical evaluation of these entities.

Category 2 entities are those that have completed their reproductive cycle, or whose reproduction is inhibited by different causes. They are biologically useless so their existence is meaningless from a strictly biological viewpoint.

Category 3 includes of sterile castes of social insects.

Category 4 - among vegetables and some animals one finds diploid entities (such as cuttings and clones) that cannot be called individuals because they are copies of parental DNA, i.e. genetically identical to the parental individual. These are devoid of individuality and do not allow the production of genetic variability through sexual reproduction.

Other species (e.g. higher animals) are of greater bioethical interest because they can be labelled "individuals", i.e. as biological entities distinguished by "uniqueness, indivisibility and unrepeatability" throughout their entire ontogenetic cycle. These individuals are the outcome of a fusion between gametes that were produced by the meiotic process of parental generation. The germinal line is potentially active in all individuals of the population. This is **the third hierarchical level** of life evolution on Earth. In such organisms, the preservation of the DNA peculiar to the species and its intraspecific variability are assured by precise rules of socialization. For stimuli lead to the: behaviour and socialization which preserve the DNA peculiar to the species and its intraspecific variability:

A. Parental care;
B. Reproductive behaviour;
C. Co-operation in searching for food;
D. Co-operation in defending the group

A and B are strictly dependent on the biology of the species, whilst C and D are related to the environment. As far as the latter group is concerned, we must insert a constant called k that is linked to the environmental conditions where the species or the population (or the individual) live.

These four factors (A, B, C and D), unrelated to one another, are the grounds of the bioethical rules of **the third hierarchical level.** These four stimuli can also be quantified as energy-giving consumption (calories) and as the amount of time invested to fulfill the bioethical imperative of the reproductive process or survival (time). This quantitative transformation enables us to formulate an equation. Its result, if related to the individual energy-giving consumption, shows the minimum and the maximum population of a given species that can survive in a certain area:

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

From a genetic viewpoint, Δ is identical to the concept of "Deme". This defines the minimum number of individuals in a panmixial local population that is needed to guarantee the genetic variability assuring survival for an endless amount of generations. This definition of the deme stresses that genetic variability is an essential requirement. Four conditions are required so that the frequency of genes in a population remains constant: 1) lack of selection;

2) panmixia; 3) lack of mutations; and 4) lack of differential migrations. So the minimum number of individuals required for a population to survive for several generations must take these four conditions into account. On the contrary, the maximum number of individuals of a population in a given area is related to its genetic and ontogenetic variability as well as to the means of support found in that territory. (So the population cannot be made up of individuals of one sex and of the same age).
Starting from this general formula (applying to all higher animals), we can easily deduce ones which can be applied to man and his cultural development, taking into account that they affect the environment, i.e. C and D. Thus, a new formula can be expressed by the following exponential function of human intellectual faculties (ei), which could be identified as a quantifiable event of human activity as the concept of space-time:

$$[(A + B) + k(C + D)]\ e^{i} = \sim H$$

The social and intellectual control of the environment in the natural system can be the qualitative leap leading to **the fourth hierarchical level** of ethical rules, those related to Man, his culture and his relationship with the environment. For these reasons, the minimum or maximum number forming the Deme can differ according to the environment in which human populations live and their historical background.
The interaction between man and the environment produced and constantly produces rules marking his behaviour throughout history (moral philosophy, customs, mores) and facilitate survival. Thus moral philosophy is that branch of bioethics dealing with the rules that assure the best survival of our species depending on various cultural and historical contexts. This survival is strictly connected to the aforementioned stimuli, i.e. the relationship between parents and children (A), the relationship between man and woman (B), co-operation in searching for food (C), co-operation in defending individuals and populations (D), all of which depend on the environment the individual or population inhabits. This interaction between the four ethical drives of socialization and behavioural rules shows an interesting link with the trine interpretation of brain suggested by Mc Lean (Chiarelli, 1995). While the behaviours and the stimuli of socialization indicated by A and B are governed or received by the reptilian brain, those indicated by C and D are mainly centred in the paleomammalian brain (limbus). Both these brain stratifications suffer the inhibitory, corrective and stimulative action of the neomammalian cortex. For instance, the knowledge acquired through imprinting can be controlled, as can those imposed by induced habits, usual behaviour, the trend to social and political conformism, behaviour and knowledge with their main seat in the reptilian brain. Analogical, critical and causal thinking is what distinguishes the neomammalian cortex, especially that of humans (tab. 1).

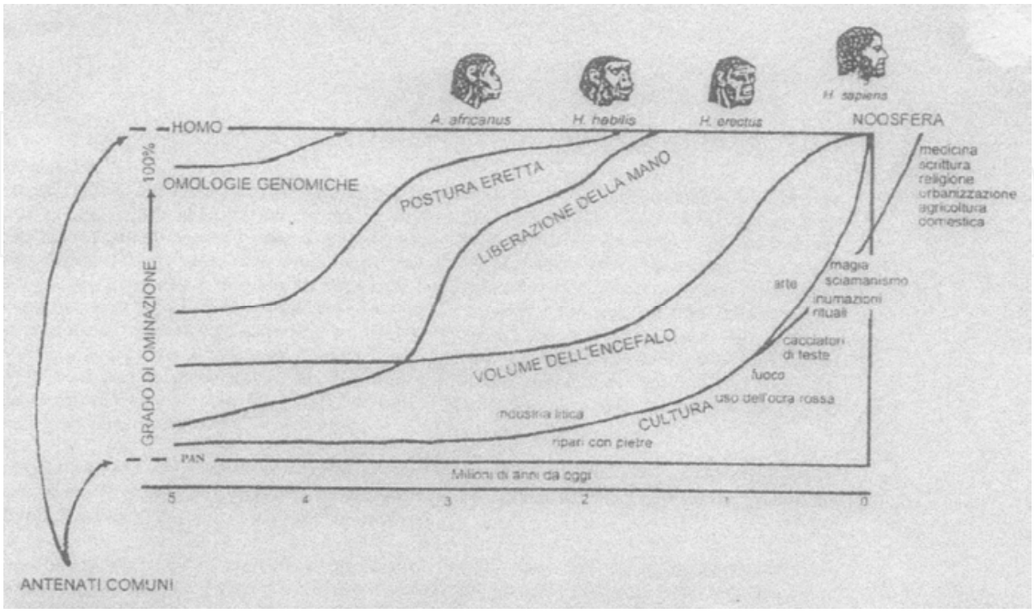
6. From bioethics to global bioethics

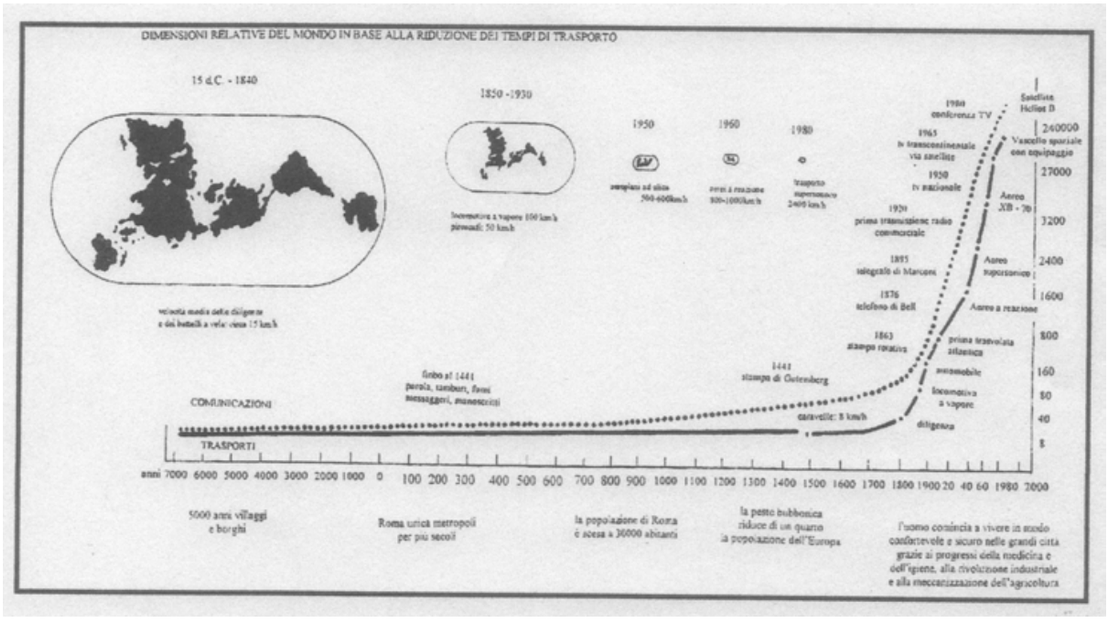
The moral and adaptation choices of the human social structure, including biotechnological and biomedical ones, are consistent with the above formulation and the interaction between human populations and their environment (traditions). Moreover, they must be unrelated to the influence of religious or political leaders, because these ideologies aim at power and disregard this balance; a balance which must be kept and improved for the survival of our species.
In fact, Nature may be oblivious to human survival because humans and other species are the result of evolution. However, man misuses his reproductive capacity and overexploits natural resources, risking to destroy both himself and other species.

Returning to demography, according to forecasts 2025 the Earth's population will, reach 10 billion. It will be catastrophic if this population is granted with Western-style living conditions (as is desirable); the human species will be unlikely to survive. As the world is tormented by economic, cultural and moral crises, becoming aware of this new phase is a pressing need. Bioethics aims at a balance between Man and Nature in order to assure human survival on Earth. A complex but useful challenge, that has to be contested and won within the third millennium. Even the birth and the abuse of the word "bioethics" stress that corrective interventions are urgently required. Van Potter and I established the journal "*Global Bioethics*" and I wrote the book *Bioetica Globale*, for this reason, to show a naturalist and anthropological distinction of bioethics from moral philosophy and medical deontology. In fact, the distinction between ethics and moral philosophy claims to discuss the problem of the choice between good and bad, i.e. what is allowed and what is forbidden. It aims at doing this rationally and by refusing the influence of humanistic culture. The issue of "ethical anthropocentrism" is linked to this new way of organizing daily life as well as to our future choices, so that the survival of our species is assured.

7. Notes and definitions

A rational and naturalistic definition of ethical norms must stipulate the preservation of the DNA typical of the species and the maintenance of its intraspecific variability. Indeed, the aim of preserving the DNA of the species and preserving its intraspecific variability is the basic principle of bioethics. A historically limited behaviour can be related to morality which can assume different norms in different historical contexts. Morality could therefore be governed by religious or normalised by discipline. Ethics instead is a pure biological and ecological discipline.





The definition of Bioethics: *"Preservation of the DNA typical of the species and maintenance of its intraspecific variability"*

Hierarchical order in the history of life and its ethical significance

1st level Haploid (n): microorganisms, gametes, spores, haplophytes

2nd level Diploid (2n): sexual reproduction (meiosis).
In this 2nd level peculiar ethical concerns must be reserved to the biological entities as:
a) cutting: they are identical copies of an original individual, as they do not have variabilities,
they are produced asexually. It regards mainly cultivated plants and lower animals, now also artificial cloning in animals and possibly man (nucleo-transfer).
b) subsidiary class of social insects: they do not transmit the DNA of the species and they do not have reproductive potentialities
c) early stages of life as embryos and seeds: they have no certitude to reach the reproductive stage.
d) final stages as they have lost reproductive potential.

3rd level Diploid Biological Entities: with individuals which are unique, unrepeated, and indivisible.for the entire biological cycle.

4th level Vertebrate animals in which the maintenance of the DNA variability typical of the species and its intraspecific variability is assured by socialization defined by the interaction of internal and external factors (A: mother-offspring relation; B: sexual partner relation; C: cooperation in food research; D: cooperation in defence) and quantitative formula could be created to give the maximum and minimum number of individuals who could survive in a certain environment.
$(A+B) + K(C+D) = \Delta$

5th level Mankind in which the maintenance of the DNA typical of the species and to its intraspecific variability is assured also by the product of the brain activities (history, traditions etc). In this case Ethics can also become Moral Code as the four types of socialization input can be influenced by history.

Table 1.

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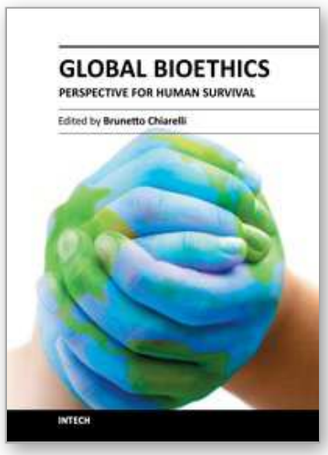

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Two new factor have been added to the ideological change in the second half of the past century: the “ecological impact” of humankind on the environment due to the population increase; and the “ innovative impact of science, first with atomic physics, which introduced the scission of the fundamental unit of matter, the atom, and then witch molecular biology, which led to the decoding of genetic information and intervention of biological engineering that annihilate our concepts of individual and species as fundamental units in biology. This stage of fundamental rethinking is however overshadowed by the threat of ecological disaster and catastrophic population increase, which not only impose limits to development, but undermine the very survival of Humankind. The future survival our species in fact depends on the interaction between its reproductive characteristics and the productivity of the territory, which, even if increased by the intellectual capability of the human brain, has intrinsically limits. The adaptive choices (which are also biotechnological and biomedical) of the interaction between human population and the natural ambience is the conceptual basis of the new discipline “Global Bioethics”.

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