

BIO-EDUCATION AND ITS CONTRIBUTION TO BIO-CULTURE IN THE NEXT MILLENNIUM

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The world has come to the threshold dividing two millennia. The development of industry, which brought about the technical-scientific revolution, has made possible the use of the most powerful sources of energy, as well as chemical and biological technologies, to satisfy the most sophisticated requirements of humanity. Simultaneously, the huge expansion in our requirements, the lack of reasonable self-limitation, a deficiency in spiritual and intellectual culture have led us to a global crisis in morals, demography, ecology, and social life.

To prevent further degradation, it is important that people understand that these dangers exist. First, the decision makers and leading personalities in culture, art, science and religion must understand.¹ There is no doubt that the way to overcome this crisis will be through the development of the individual personality that will be simultaneously, internally free and morally responsible, possessing a new, so-called, ecological consciousness. Such people should be capable of reasonable self-control in the name of the future of the bio-environmental prosperity of caring for the earth and humanity; they should be capable of internally accepting moral and material values, and understanding the relationship between them. In creating the new consciousness, which will be necessary for the next millennium, the leading role should be played by bio-education. The aims of bio-education have also been formulated: respect and appreciation for the bio-environment should be at the core of every education system.² Three main areas of emphasis have to be included in bio-education¹:

- the education of highly-qualified specialists in the fields of biology, ecology and biotechnology
- the development of research in these important areas of contemporary science²
- the inclusion of elements of bio-education (lectures, seminars, specially developed practical work) in the course work of specialists in the humanities, chemistry, physics, mathematics and engineering ³
- bio-education, from the pre-school level and throughout the continued education, to help people identify themselves as part of the living world of the earth.

This task is not simple. Frequently, there is a deep misunderstanding of the modern problems of bio-environment and ecology, shown by specialists in the humanities and technical fields. The uniqueness of the earth, its biosphere, the necessity for its defence, is often perceived as banal, of no worth. At the same time, the problems of environmental pollution are often regarded perfunctorily or are dismissed, as merely a subject for political speculation.

There are scientists, such as Jacques Yves Cousteau for example, who understood the core of the problem long ago, and still do their best to warn people about the danger to the environment and to life. But even alarmist actions, although very important and useful, do not always take into account the main purpose - the need to work at the base of the pyramid, not only at its apex. Without any doubt, it is necessary to influence authorities throughout the world, who make the policies, to include the welfare of the environment in all their decisions. Even more important, is the need to create an ecologically reasonable and responsible mode of life for the hundreds of billions of people on the planet earth. The whole complex of these problems, and the creation of a sense of responsibility among decision-makers and common people, is one that humankind should solve and for this, we need bio-education in all countries of the world.

Generally, in many developed countries, the rules of reasonable and responsible behaviour are accepted and supported by organisational measures such as the collection of glass and plastic bottles, waste-paper and so on, for the purpose of recycling. The situation is more complicated in Russia. Even officials at high levels, for example the Head of the Ministry of Ecology of the former Soviet Union, said two years ago that Russia needed a new generation of people, in order to solve its ecological problems. But creating this new generation means we have to change our educational programmes at all levels to include bio-courses that are interesting and easily accepted. The creation and introduction of these courses, into pre-school, elementary school and university education, is possible only if decision-makers are first persuaded to do so. Therefore, dialectical unity in our world is needed.

In Russia, the task is to create an understanding of our personal responsibility for life, existence and the improvement of the quality of life on earth. Bio-education should begin at pre-school level, go on through elementary school and university levels, and continue throughout life. For this type of education, new didactic materials are necessary which can explain life on earth, its natural and social history, in a vivid and exciting way. These materials can predict the different scenarios which would develop under various versions of human behaviour. Books, films, including science-fiction, popular scientific and animated computer games, and the new types of intellectual attractions so successfully used at the Tsukuba World Exhibition, can play an important role in this first stage of bio-education. It should also be mentioned that there are

good examples in related fields, such as the computer game called "Civilisation." Popular science films, in a very modern and appealing style, made by Vladimir Kobrin, are shown here by Professor Andrew Rubin.³ A higher level of responsibility among governmental, industrial and social leaders, as well as the scientific society, can be achieved if we can impart the feeling of personal responsibility for the environment to everyone.

Biological and ecological indices should be involved in the concept of life-quality. In many countries ecological indices, characterising a situation in a specific region or country, are already included in estimating quality of life. But today this is not enough; in life-quality estimates, these global ecological indices must be included. If technology can bring about local life-quality improvement, but causes ecological disorder in other regions as a result, successfully buried in the dumps of developing countries, it should be recognised as unacceptable, inadmissible. The Chernobyl accident is one of these examples which makes us realise the fact of the interdependence of all people on earth.⁴

The second important factor for decision-makers around the world, from international and governmental to regional, is the promotion of new, ecologically pure technologies. The decision-makers, who fulfil the will of the people, should recognise the necessity for technological improvement in the areas of safety for life, bio-diversity and human health. This task should become considerably easier, as the first level of bio-education develops.

Scientists, working in the field of basic natural sciences, already understand their responsibility, to a considerable extent. For example, in the Keldysh Institute of RAS, the technology of water cleansing by electrical discharge was developed, which is better, from an ecological point of view, than normal chlorination and deodorization, and comes close to these technologies, on economic indices. In the same institute, a technique was developed for the gasification of refuse with large amounts of water and a low level of combustibility. This technology gives us the solution to a very difficult and important problem by processing domestic refuse at a more acceptable level of environmental pollution. The Biophysics Chair of the Biological Faculty of Moscow State University, in collaboration with the Federal Institute of Marine Fishery and Oceanography, developed a new technology for producing a preparation from mussel meat, called MIGI-K. It was accepted as a viable food product, having a preventive and curative effect, by the Health Ministry of Russia. This product acts favourably on the immune system and, because our immune system suffers from a range of harmful conditions, from radiation injury to psychological stress, it has a very wide variety of potential biological applications. Under clinical tests, MIGI-K shows good results in the chemo- and radiotherapy of cancer tumours. In traumatology, it diminishes infectional complications after surgical operations. It was successfully used among people who suffered after the Chernobyl disaster,⁵ and also on people suffering from the effects of toxic substances in industry. It is worth mentioning that the waste, from the industrial processes of MIGI-K production, also possesses biological properties and is used in veterinary care and poultry production with good biological and commercial effects. An analogous preparation can be developed and produced from the waste of cultivated pearl production (preliminary data exists) which would make this industry waste-free and supply valuable food and veterinary products. But, in our opinion, this type of industry is one of those which should be reduced, under the terms of the reasonable self-restriction of human requirements.

Other fundamental studies carried out by the Biophysics Chair, in relation to the primary mechanisms of photosynthesis, were used to develop devices for the ecological monitoring of water-quality. One of these devices was successfully used in studying Baykal, in the Mediterranean.

In such ways, scientists working in the natural science fields, and especially ecologists, seem to be accepting the challenge of the times.

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