

Education in ethics for Biotechnologists

Franco Celada

Università di Genova, Dipartimento di Oncologia, Biologia e Genetica

1. *The state of Bio-Ethics*

Biotechnology is defined as "*the integration of natural and engineering sciences in order to achieve the application of organisms, cells, parts thereof and molecular analogues for products and services*" and is the meeting point of different disciplines, originating in Biology, Chemistry, Biochemistry, Physics and Engineering. Historically, their interactions have resulted in a burst of industrial activities with a huge although ambiguous impact on the planet. Among the assets accrued are large distributions/accumulations of wealth, new food sources and new medicines. But there are also liabilities, such as environmental contamination and degradation of genomes. This is a wide, complex field. Accordingly, the professional activities and the personal responsibilities of biotechnologists are extremely diverse and the frequency by which scientists are confronted with decision-requiring situations increase exponentially with their proficiency. A proportion of the decisions to be made are momentous; they involve or may affect the well-being of other individuals, of society at large, of the environment, even the quality of life on Earth for the present and future generations. These decisions are of moral nature: while technical knowledge is indispensable to locate and evaluate the concrete alternatives, an appreciation of ethics and ethical issues is indispensable in making the choice between them. This choice may be on occasion difficult, considering the prevailing social, economic and political pressures.

Another factor that adds stumbling blocks to the situation is the tendency of grouping all ethical issues concerned in any way with "life" under the label Bioethics which, in turn - by virtue of the perception of the general public and especially the media - is heavily skewed towards Medical Ethics and issues concerned with, e.g., human conception, prenatal testing, sex selection, health care, terminal care, psychotherapy.

These are important and sensitive issues and the way they are approached is influenced by religious and socio-political decisions in society at large and also among the scientists. We feel that expansion and advances in

other branches of ethics, e.g., Environmental, Biotechnological and Industrial Ethics are hampered by the overwhelming accent on Medical and personal problems and also by the fact that a certain polarization of opinions is artificially transferred out of context from the latter, thus blurring and freezing issues where consensus could be expected and would accelerate solutions. The unbalance among sub-disciplines is confirmed by a rapid survey of the 1998 Catalogue of Contracts in the field of Ethics, legal and social aspects of the Life Sciences issued by the European Commission. Out of 61 contracts, 33 (54%) are on Medical Bioethics, 22 (36%) on biotechnological aspects and the rest on Communication and Public Perception. Even more significantly, the researchers involved in the first group are 415 (58%) while those engaged in the second group are only 138 (19%).

We are encouraged in the quest for better identification of BT-Ethics by the survey currently run jointly by the AAAS American Association for the Advancement of Science, a UNESCO World Commission on the Ethics of the Scientific Knowledge and Technology (COMEST); see www.nextwave.org) The survey seeks to identify the ethical issues that advances in science and technology are likely to raise in the 21st century. The results of the survey will provide first hand material to theoretical and educational work.

Developments in Biotechnology have provided numerous issues and concerns of an ethical nature. These take the form of media and public alarm at the new products and process which involve the genetic modification of microbial, plant and animal materials. In particular we can point to the controversies which have arisen over:

- the distribution of genetically engineered plant foodstuffs,
- the use of a hormone to improve milk yields (Bovine Somatotrophin),
- the cloning of sheep,
- the ownership of human and other genes,
- drugs which can be used to enhance human athletic performance (Erythropoietin and Growth Hormone),
- vaccines,
- xenotransplantation,
- genetic enhancements.
- In addition, we have to note that while some 700 Biotechnology companies have been recently instigated in Europe, the misbehaviour

of the directors of several such companies has led to a decrease in public confidence in Biotechnology as a way of adding to human benefit. For example:

- British Biotechnology was held to have overstated the benefits of an anticancer drug which was in clinical trials,
- A company prevented the publication of trial data showing that an alternative material was of equivalent potency to their in-house product,
- Endotronics inflated their sales of cell culture equipment artificially,
- Genentech, without prior permission, took out a patent on Growth Hormone which was based on work which was done in the University of California.
- A third type of ethical malpractice stems from the way in which laboratory research is effected. The literature is replete with examples of the way in which bench workers have:
 - falsified data,
 - fabricated data,
 - plagiarised the data and ideas of others,
 - obstructed and obfuscated the research of others so that they would be misled and held back,
 - had conflicts of interest,
 - been abused for whistle blowing,
 - prematurely released data to the press,
 - misused animals and humans in experimental situations and
 - have abused the supervisor-researcher relationship.
- Biotechnology has the potential to provide major economic gains to society. It is a vital activity which can beneficially affect the health and longevity of humans and their animals. It is, therefore, imperative that we do all in our power to prevent this nascent industry from becoming moribund as a result of a growing malaise which could be generated by the ethical concerns delineated above. Not only must we provide a supportive environment for the development of the industry but we must also provide for the protection and fostering of the well-being of our citizens through the developments of the appropriate Science and Engineering. We hold that an essential means whereby these ends

can be achieved is through the more thorough and informed posing and developing of ethical questions (for example, are we allowed to do research on cloning, stem cell research or transgenic production of drugs? At which moment of the biotechnological process should there be attention to ethical problems?) and their translation into education and training of all putative Biotechnologists.

- 2. Education

- Among the consequences of biotechnological development, there is the creation of great wealth, with attendant effects on the global economy as well as on politics. Naturally, there is an intense competition for brains and markets among the most developed countries. We believe that the race is going to be decided on the grounds of education, and that the EU has a chance only if the next generation of leaders in this field will be scientifically advanced, socially aware and truly European. To take up this challenge, scientists and organizations concerned have founded the European Association for Higher Education in Biotechnology.
- HEduBT was founded in Strasbourg in November 1995 and is the vehicle chosen to establish European titles in Biotechnology. The purpose of HEduBT is to develop European standards for both the PhD and MS in Biotechnology and to ensure that graduates from universities and research institutes all over the European Community obtain a qualification which is considered appropriate and is recognized by the biotechnology industry.
- The qualification of HEduBT is provided by its membership, its organs and by the representation in its Scientific Board of European organizations such as:
 - CRE (Confederation of the European Union Rectors' Conferences);
 - EMBO (European Molecular Biology Organization);
 - EFB (European Federation of Biotechnology).

HEduBT identifies a combination of skills found in many different university systems, which together provide the multidisciplinary training which is needed in the rapidly developing area of Biotechnology. HEduBT's raison d'être is that the complexity of the field must be met by a multi-dimensional education combining Science and international/interdisciplinary culture. Thus, to be awarded an EDBT - European Doctorate in Biotechnology - the required credits are earned by courses in technical disciplines and in interdisciplinary topics. Candidates must have spent a part of their research time in another European country, and produced a thesis of excellence.

The requirements of training in interdisciplinary areas is exacting. A total of six credits should be earned by following courses and doing field work in Ethical, Social, Legal and Managerial aspects of Biotechnology (examples: Bioethics, Patenting, Environmental Sciences, Computer Science, etc.).

The activity of HEduBT is well on its way, and, end 2000, the first ten European Doctorates titles have been awarded, while enrolled students (60) and the number of member Universities (30) and Institutes are increasing. However, in our experience, the most challenging tasks for the students has been to find ways to satisfy the EDBT requirements of international and interdisciplinary training, in particular the training in ethical issues pertaining to technology and its impact on Biological sciences. Today, in most universities, education in ethics is not part of the training of biotechnologists. This may be a consequence of the Socratic optimism trusting that good science is sufficient for good behaviour, but this "soft" approach is certainly a factor in the increasing number of mistakes, misdemeanours and worse, perpetrated at the interface of Biology and Industry and in the oblivion of posing questions about the social and fundamental acceptability of Biotechnology. In 1998, 1999 and 2000 HEduBT has inspired the delivery of a number of courses in Bioethics and Public Perception, held in different European countries and attended by many EDBT students.