

# Chapter 5

## Bioethics

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### ABSTRACT

*Bioethics, or ethics of life, is the study of the human moral behavior in the fields of life sciences and healthcare. As a branch of applied ethics, bioethics integrates studies in the areas of biology, medicine, ecology, and social, human, and legal issues. In this chapter, the evolution of morality along history is briefly described. The different disciplines of ethics, with emphasis on the accepted principles of biomedical ethics in modern times, are presented. Additionally, the merging of moral dilemmas to current multidisciplinary teams of biologists and engineers performing in health care settings is analyzed. Moreover, the contents of a simple program of bioethics education are outlined, calling attention to the evaluation of the moral development of biomedical engineers. At the end of the chapter, a list of societies and organizations of bioethics around the world is intended to guide the interested reader further into the field of Bioethics.*

### 5.1. CHAPTER OBJECTIVES

The rapid growth of engineering and medical biology technologies implies that the decision making process is currently marked with ethical considerations applicable to all areas of professional ventures in Biomedical Engineering. Biomedical engineers practicing in clinical and non clinical fields should commit themselves to

work under the principles of Biomedical Ethics. Also, teaching and discussing these principles at universities and working toward their acceptance at all levels, locations and settings where biomedical engineers act, represents an imperative task. These days, engineers in all areas of expertise engage in a wider range of activities and Biomedical Engineering, far from being the exemption, stands as a clear and almost unique example of strong multidisciplinary integration.

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The greater breadth and depth of ethics in engineering differ from those ethical issues which in the past were limited only to technology in medicine and health care distribution. Engineers and ethicists are calling for greater attention to topics related to the societal implications of biomedical engineering and technology, and not only oriented to specific moral dilemmas facing individuals. The main goal here is to emphasize the importance of Bioethics for biomedical engineers by presenting not only the philosophical concept but also by discussing the environment where health care professionals – including engineers – confront real moral dilemmas.

Hopefully the next sections will provide the reader with a more clear perception of ethics and of the moral obligation of professional responsibilities.

## **5.2. INTRODUCTION**

An understanding of fundamental moral values and the recognition of some rules of practices are essential to biomedical engineers.

Worldwide accepted accreditation criteria for engineering programs require that the curriculum introduce students to the ethical, social, economic, and safety issues arising from the practice of engineering (Guilbeau & Pizziconi, 1998).

Effective since the year 2000, ABET – the Accreditation Board for Engineering and Technology of the United States – promotes the advancement of education in applied sciences, computing, engineering, and technology, by accrediting qualitative and innovative educational programs. ABET (2010a) has established, among other program outcomes (Criterion 3), that Engineering programs must demonstrate that their students, by the time of graduation, attain the skills, knowledge and behaviors to professionally perform within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustain-

ability. Another program outcome, of particular interest to biomedical engineers, is the ability to function on multidisciplinary teams, almost a must for engineers working in clinical or biological settings. Also, an understanding of professional and ethical responsibility must characterize engineering graduates. More specifically, biomedical engineering programs must demonstrate that their graduates, not only have an understanding of biology and physiology, but that they also have the capability to solve the problems at the interface of engineering and biology, and the ability to address problems associated with the interaction between inert and living materials and systems. Almost unavoidably biomedical engineers will face particular ethical issues while dealing with living materials, issues which are not frequently found in traditional engineering dealing with inert materials.

The association of ethics and engineering is becoming stronger everyday. Not only must graduates have proficiency in using classical engineering tools but they should be able to explain basic ethical concepts and the importance of professional responsibility.

An effective assessment of the attained abilities in the ethical field requires the use of appropriate and relevant qualitative and quantitative measures. The evaluation process should be periodical to document and demonstrate the degree to which the ethical capabilities of biomedical engineers are successfully achieved. However, this is neither a direct nor an easy process. It is clear then the importance of Ethics as a central discipline to biomedical engineering students and professionals.

The next pages will illustrate on the formal definition of ethics, and more specifically of Bioethics. The increasing importance of moral dilemmas for physicians, engineers and health care workers will – hopefully – become evident once we present the evolution of the discipline along human history and the particular characteristics of the terrain of bioethics. Our discussion of the contemporary concept of bioethics and

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