

# Chapter 3

## Social and Ethical Concerns of Biomedical Engineering Research and Practice

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### ABSTRACT

*Biomedical engineering is an advanced and relatively new field in the healthcare sector. Owing to the very nature of the various professional challenges faced by healthcare professionals, the moral and ethical values seem to have taken the backburner. The factors contributing to it may include a sound knowledge of the healthcare professional on the legally-permissible ethical values, and the desperate situations requiring precise split-moment decision-making. No technological advancement without a human face is worth it, and hence, during the course of the degree, a biomedical engineering student needs to be exposed to various ethical issues through theory, live cases and demonstrations. Being intrinsically multi- and inter-disciplinary, biomedical engineering lacks precise ethical rules that delineate and delimit professional responsibility, thus blurring the ethical understanding of biomedical engineering. The solution seems to lie in giving due place to human virtues. In the coming days, bioethical issues are expected to be increasingly complicated and dominating the decision-making process owing to the advancements in sciences, and the ever-complicated cases handled by healthcare professionals. A global healthcare and ethics-related online open-access portal may serve as a common platform for all the stakeholders in the interest and ethical growth of biomedical engineering in particular and medical sciences in general.*

### INTRODUCTION

Technology and ethics are neighbours, not foreigners, facing rather than interfacing each other in the world of human accomplishment. Personal

face of ethics looks at the impersonal face of technology to comprehend the latter's potential and limits directed at human purposes and benefits. Technology is a human achievement of extraordinary ingenuity and utility, and is far-off from the human accomplishment of ethical values. In an effort to make one face the other, it is important

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to examine critically-accepted views, evaluate and draw universally-acceptable conclusions.

Biomedical engineering is an integrating medium for two dynamic professions, Medicines and Engineering, and assists in the struggle against illness and disease by providing effective tools for research, diagnosis and treatment by healthcare professionals. They are relatively new members in the healthcare delivery team seeking effective solutions for the difficult problems the modern society faces. Artificial limbs, heart valves, blood vessels, biosensors, biomaterials, respirators, pacemakers and artificial kidneys ('spare-parts' surgery) have redefined medical sciences. Numerous routine diagnoses now use wide-ranging highly sophisticated life-saving image processing and artificial intelligence devices.

These various advancements albeit, have not been entirely benign, having significant moral consequences, be it the cardiovascular assist devices to maintain breathing/heartbeat, or organ transplants in the terminally-ill patients. Society is forced to reevaluate the meaning of such terms as death, quality of life, heroic efforts and acts of mercy, and consider such issues as the patients' right to refuse treatment (living wills) and participating in experiments (informed consent). As a result, these advancements have added complex moral dimensions of healthcare more and pose new, troubling moral dilemmas for the society at large. Healthcare system continually relies on researchers to produce improvements in patient therapy. New technology has a large social impact and is setting the new treatment standards. In this light, the society increasingly expects a researchers' moral responsibility to uphold those virtues that ensure good ethical conduct. It is disturbing that bioengineering health professionals, as they represent new medical innovations, had relatively little contact with moral and legal theory in light of developments (Naurato and Smith, 2003).

Biomedical engineering involves various scientific disciplines, viz., tissue engineering, neural engineering, biomedical instrumentation,

nanotechnology, physiological modelling, rehabilitation engineering, medical bioinformatics, clinical engineering, biosensors, biomedical analyses, biomechanics, prosthetic devices and artificial organs, medical imaging, biomaterials and biotechnology. Biotechnology for instance, further, is a multi-disciplinary science encompassing many applied sciences together (Mishra, 2007). This calls for 'engineering ethics' oriented towards protecting the public from professional misconduct by engineers and the harmful effects of technology, promulgated by negative rules. Some aspects like sensitivity to risk, awareness of the social context of technology, respect for nature and commitment to the public good cannot be adequately accounted for in terms of rules, certainly not the negative rules (Harris, 2008). The importance of humanities and social sciences in promoting these are crucial in the professional education of engineers.

With an increasing focus on molecular biology and concern for increasing human health and longevity, modern biotechnology, an integrated component of Biomedical Engineering, is about the future. This 'biotechnology-of-tomorrow' presses in sparking imaginations daily, and elicits wariness or even fear that humanity is gaining too much power or too little choice over human evolution and destiny. Some ethicists explain it as transgressing in to the God's domain. Permeated as it is by a ferocious 'moral approach' to science policy, political climate has heightened this public concern, thus seeming to have the researchers lost their capacity for rational discourse in the public arena. For better or worse, science is political. Advancements in research and development in biotechnology has been adversely affected in the recent past attributable less to the lack of funding or skilled workforce, and rather more to the embattling social, ethical and legal issues (in short, SELI). The challenge of the new-breed researchers in biotechnology in general, and a touchy focus area as medical bioengineering in particular, is to address these issues in greater detail by indulging

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