

## Chapter 3

# Assistive Technology and Rehabilitation Engineering

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### ABSTRACT

*The interdisciplinary fields of Assistive Technology and Rehabilitation Engineering focus on understanding the impact of disability, seeking to ameliorate the impact through the employment of appropriate technology. Aided by numerous illustrations, tables, and charts, this chapter provides the reader with an overview of this field in terms of its history, main concepts and principles, major activity areas, and some of the exciting current research and development projects. The chapter also covers the key psycho-social and technical challenges associated with various handicapping conditions, the employment outlook for this field, the training and educational programs that are available, and the professional societies and organizations that hold conferences, publish research reports, and seek to advance the field. Lastly, numerous references have been provided so that a reader can pursue his/her topics of interest.*

### 3.1. CHAPTER OBJECTIVES

The goal of this chapter is to provide an overview of assistive technology and rehabilitation engineering at a level appropriate to undergraduate and graduate biomedical engineering students. The material presented also can serve as a reference in libraries, accreditation agencies, governmental agencies, and, especially, academic institutions of higher education intending to launch or reform their bioengineering/biomedical engineering curricula. At the conclusion of this chapter, the readers will:

- Be aware of the major activities in rehabilitation engineering and the breadth of assistive technology.
- Be familiar with some of the physical and psychological consequences of disability.
- Understand the collaborative roles played by rehabilitation engineers, assistive technologists, clinicians, and governmental agencies in the rehabilitation process.
- Know the principles of assistive technology assessment, rehabilitation engineering, ergonomics, and product design.

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- Know the technical issues that an assistive device must overcome for several major categories of disabilities.
- Be familiar with career opportunities and information sources in rehabilitation engineering and assistive technology.

### **3.2. INTRODUCTION**

To achieve the chapter's objectives, the chapter begins with some basic definitions, followed by the history of this field and how major world events affected its development. Following this background material, the chapter presents some of the general concepts and principles that have coalesced during the past 60 years and offers some quantitative information about the prevalence of various disabling conditions that motivate work in this field. To humanize many of the medical and psychosocial aspect of disability, the composite life stories of two young men – one who has experienced a spinal cord injury and another who was born with cerebral palsy – are presented. The core principles of the field are then given along with many of the major areas of work in rehabilitation engineering and assistive technology.

To keep the chapter to a reasonable length and focused for the intended audience the following topics are covered in some detail: aids for blindness and low vision, aids for severe hearing impairments, interfaces for motoric impairments, communication aids, mobility aids, general purpose electro-mechanical manipulative aids and artificial arms, and lower limb prosthetics. If the above list omits an area of your particular interest, the author asks for your forbearance and recommends that you consult some of the general references cited at the end of the chapter, e.g., Cook & Polgar (2008).

### **3.3. COMPREHENSIVE DEFINITIONS OF ASSISTIVE TECHNOLOGY AND REHABILITATION ENGINEERING**

Since the late 1970s, there has been a major growth in the application of technology to ameliorate the problems of faced by people with disabilities. Various terms have been used to describe this sphere of activity, including prosthetics/orthotics, rehabilitation engineering, assistive technology, assistive device design, rehabilitation technology, and biomedical engineering applied to disability. With the gradual maturation of this field, several terms have become more widely used, bolstered by their use in some governmental legislation.

The two of the most frequently used terms today are assistive technology and rehabilitation engineering. While used somewhat interchangeably, they are not identical. In the words of James Reswick (1982), a pioneer in this field, "*rehabilitation engineering is the application of science and technology to ameliorate the handicaps of individuals with disabilities.*" In contrast, assistive technology can be viewed as an end-product of rehabilitation engineering activities, much like health care being the end-product of the practice of medicine. Furthermore, the term "*rehabilitation engineering*" carries the connotation that such endeavors often include a therapeutic or treatment component to them.

One widely used definition in America for assistive technology can be found in United States Public Law 100-407. It defines *assistive technology* as "... any item, piece of equipment or product system whether acquired commercially off the shelf, modified, or customized that is used to increase or improve functional capabilities of individuals with disabilities." Notice that this definition views assistive technology as a broad range of devices, strategies, interventions, and/or services that help an individual to better carry

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