



INSTITUTE OF BIO-MEDICAL TECHNOLOGY LIAQUAT UNIVERSITY OF MEDICAL AND HEALTH SCIENCES, JAMSHORO

INTRODUCTION TO REHABILITATION ENGINEERING

Lecture#1-2

REHABILITATION

- The noun *rehabilitation* comes from the Latin prefix *re-*, meaning “again” and *habitare*, meaning “make fit.”
- Means to restore to good health,
- act of restoring something to its original state.

WHAT IS 'REHABILITATION ENGINEERING'?

'Rehabilitation engineering is the application of science and technology to improving the quality of life for people with disabilities.'

As defined by the *Rehabilitation Act of 1973*, Amended 1998

- ⦿ *systematic application of engineering sciences*
- ⦿ *to design,*
- ⦿ *develop,*
- ⦿ *adapt,*
- ⦿ *test,*
- ⦿ *evaluate,*
- ⦿ *apply, and distribute technological solutions*

WHAT DO REHAB ENGINEERS DO?

◉ Work in

- research lab
- clinic
- industry (i.e. product development lab)

◉ Work with

- Clients and their families, teachers, employers
- Health care providers

◉ More clinical work than other engineering fields

- Engineers must learn how to work with people with disabilities

- Rehabilitation engineers are key to the development and delivery of ‘assistive technology’
- Assistive technology is often associated with education,
- rehabilitation,
- employment,
- transportation,
- independent living, and recreation.

RESEARCH AREAS

Augmentative communication



Computer access



RESEARCH AREAS

Ergonomics



Prosthetics and Orthotics



RESEARCH AREAS

Recreation



transportation

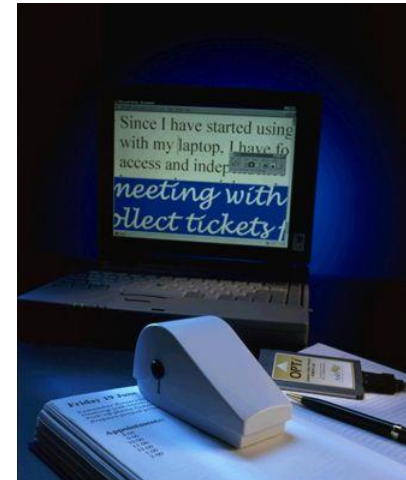


RESEARCH AREAS

Seating and wheeled mobility



Sensory aids (hearing, vision)



RESEARCH AREAS

Universal design



The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design.

R.E REQUIRES

- ◉ knowledge related to: physiology, anatomy, biomechanics, and neuroscience
- ◉ Engineering Expertise
- ◉ Scientific expertise
- ◉ Assistive technology expertise
- ◉ Rehabilitation engineering in practice
- ◉ Specialized education services

REQUIRED CONTRIBUTIONS IN REHABILITATION ENGINEERING

- ◉ development of technological products required the contributions of mechanical, material, and electrical engineers,
- ◉ orthopedic surgeons,
- ◉ prosthetics and orthotics,
- ◉ health professionals, and computer professionals.

WHAT IS THE ROLE OF REHABILITATION ENGINEER?

- The role of a rehabilitation engineer may include:
 - ❖ research to develop new technology, but also to make it more effective
 - ❖ suggesting commercially available devices
 - ❖ modification of existing devices
 - ❖ manufacture of a custom device or design a modification
 - ❖ testing of equipment for safety and compliance to International Standards



HISTORY

- This effort became more pronounced and concerted in the United States after World War II.
- The Veterans Administration (VA) realized that something had to be done for the soldiers who returned from war with numerous and serious handicapping conditions.



- Few well-trained artificial limb and brace technicians to meet the needs of the returning soldiers. To train these much-needed providers, the federal government supported the establishment of a number of prosthetic and orthotic schools in the 1950s.



- The orthoses and prostheses available in the 1940s were uncomfortable, heavy, and offered limited function.
- As a result, the federal government established the Veterans Administration Prosthetics Research Board, whose mission was to improve the orthotics and prosthetic appliances that were available.
- Scientists and engineers turned their energies toward helping people, especially people with disabilities.

- As a result of their efforts, artificial limbs, electronic travel guides, and wheelchairs that were more rugged, lighter, cosmetically appealing, and effective.



SOURCES OF INFORMATION

- ◉ Knowledge base for rehabilitation engineering was scattered in different publications in the early years.
- ◉ rehabilitation engineering research papers appeared in *Archives of Physical Medicine & Rehabilitation*, *Human Factors*, *Annals of Biomedical Engineering*, *IEEE Transactions on Biomedical Engineering*, and *Biomechanics*.
- ◉ In the early 1970s, many important papers were published by the Veterans Administration in its Bulletin of *Prosthetic Research*, a highly respected and widely disseminated paper.
- ◉ This journal was renamed the *Journal of Rehabilitation R&D* in 1983.

- In 1989, RESNA began Assistive Technology, a quarterly journal that focused on the interests of practitioners engaged in technological service delivery rather than the concerns of engineers engaged in research and development.

STATISTICS

- ◉ 3% of any country population had a disability(1950),
- ◉ 500 million people had a mental, physical or sensory impairment(1983),
- ◉ 80% of all people with disabilities are located in rural areas.

- ⦿ Industrialized countries report diabetes, cancer, disease or trauma and allergies as cause of disability.
- ⦿ Developing countries were more likely to report inadequate nutrition, parental care, lack of immunizations and violence as the causes of disability.
- ⦿ Conflict and violence are often underplayed when investigating disability etiology.

- ◉ In Zimbabwe, approximately 13% of all disability is caused by violence.
- ◉ In Japan, 5% of disability among people over 18 years of age was caused by war.
- ◉ In U.S, violence is the fastest growing cause of disability.

- ◉ WHO in U.S has proposed the WPA(world program of action) for prevention of disability,
- ◉ It involves activities for promotion of hygiene, education, nutrition, better access to food and health care.
- ◉ **WPA plans for reducing disability and improving rehabilitation:**
- ◉ Early detection, diagnosis and intervention
- ◉ Medical care and treatment
- ◉ Social, psychological and other types of counseling and assistance;
- ◉ Training in self care activities
- ◉ Provision of technical and mobility aids and other assistive devices

LAWS REGARDING DISABILITY

- ◉ Many countries have not implemented laws regarding disability,
- ◉ Many countries have not policies,
- ◉ Rehabilitation resources are often unavailable where needed most
- ◉ Rehab centers are located in cities
- ◉ Restrict access to these facilities

REHAB LAW IN PAKISTAN

- ◉ According to 1998 census report 2.49% of the total population are persons with disabilities
- ◉ In Pakistan rehabilitation law was introduced in 1981,
- ◉ In 2002, law was revised to increase the quota system for disable persons from 1% to 2%
- ◉ Self employment schemes have been introduced.

TELE-REHABILITATION

- ⦿ Provide AT in rural areas
- ⦿ Reduce cost associated with service delivery
- ⦿ Require just internet and computer set
- ⦿ 3D models have enhanced the ability

