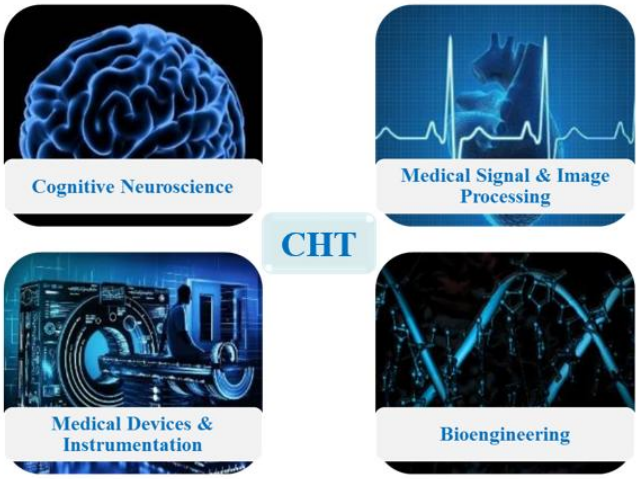
Center For Healthcare Technologies



The Department of BME coordinates CENTRE FOR HEALTHCARE TECHNOLOGIES – A multidisciplinary research initiative, which carries out world class research activities in the field of cognitive neuroscience(CN), medical signal and image processing(MS&IP), medical devices and instrumentation(MI) and bioengineering (BE). The highlights of the department to carry out fruitful research under CHT include industry-institute interactions with eminent healthcare organizations like NIEPMD, Philips, Siemens,. The department has academic partnership with abroad Universities like Drexel University USA, Birmingham City University UK along with National institutions like Sri Ramachandra Medical College & Research Institute, Indian Biomedical Skill Consortium (IBSC) etc. Several consultancy projects in biomechanics, biomaterials and artificial organs have been carried out for National and overseas clients. Department has successfully conducted a retreat on "How to make India ready for 21st Century Medical device revolution?" with International and National delegates presenting their views on the topic.

Vision

To infuse **research driven technology in healthcare** and to provide impactful, reliable and affordable health through innovation.

Mission

To achieve and uphold excellence in healthcare technology, the centre will

- work on a research culture attributed to a strong team that ally all the domains of the centre toward achieving the vision
- voice-the-thought through **neuroscience** and empower humans through human computer interactions, alleviate human errors in healthcare reliability through **biosignal and medical image processing,** support professionals by affordable **medical instrumentation** and integrate innovative **bioengineering** research in rehabilitation, implant design and nanotechnology.
- emulsify real-time learning and innovation in the areas of **national healthcare importance** to make a **societal impact** on sustainable living and affordable healthcare
- emphasise on collaboration and encourage intensive participation of different types of stakeholders to deliver impactful technological outputs.

- to aid **incubation of business ideas** from the research team and students, and mentor them to develop as entrepreneurs

Objectives

- ✓ Develop novel diagnosing and training methodology for **cognitive neurodevelopmental disorders** such as Autism, ADHD, Dyslexia and Anxiety by adopting traditional as well as modern brain training platforms.
- ✓ Integrate technology in **identifying thoughts and to translate thoughts to actions** through neuroscience research.
- ✓ Develop and improve the quality of diagnosis and prognosis in diseases by advanced **imaging and signal processing routines** to improve healthcare.
- ✓ Develop **indigenous medical instruments** to cater to the healthcare needs of the nation and to create an **affordable health** to all.
- ✓ Develop **low cost implants, prosthetic & assist devices and, novel & sustained drug delivery systems** using modern bioengineering principles involving a complete **interdisciplinary** approach in technology, designing, characterization and manufacturing domains.

Domain	Topics
CN, MS&IP, BE	Functional connectivity in learning and memory disorders, Speech imagery, Implant design and Prosthesis
MS&IP, MI	EEG Analysis on various human participants, Carotid Ultrasound Imaging, Low Cost Dialysis Machine
CN, MS&IP, BE	Development of NIRS for measurement of muscle oxygenation, EOG based Assist Devices, Development of Wearable system for Gait Analysis
MS&IP	Non Invasive device for Siddha Diagnosis
BE	Wound dressing material with impregnated nanoparticles and active compounds, Nanofibers for filtration, Nanoparticles for cancer therapy
CN	Brain cognition, Music Perception
BE	Synthesis of hydrogel for tissue engineering applications, Mg based alloys and its biomedical applications
BE	Drug delivery systems, Nanocomposites, Enzyme Immobilization
BE	Structure function relationship of coagulation Proteins
MS&IP	An automated pre transfusion test based on image processing
MS&IP	External aid for amyotrophic lateral sclerosis (ALS) patients, Assistive device for visually challenged - Smart cane
MS&IP, MI	Six-lead EGG procurement belt for gastric oddities Sign Language Converter for Deaf and Dumb. Assisted Vision smart glasses for blind

Socially relevant projects:

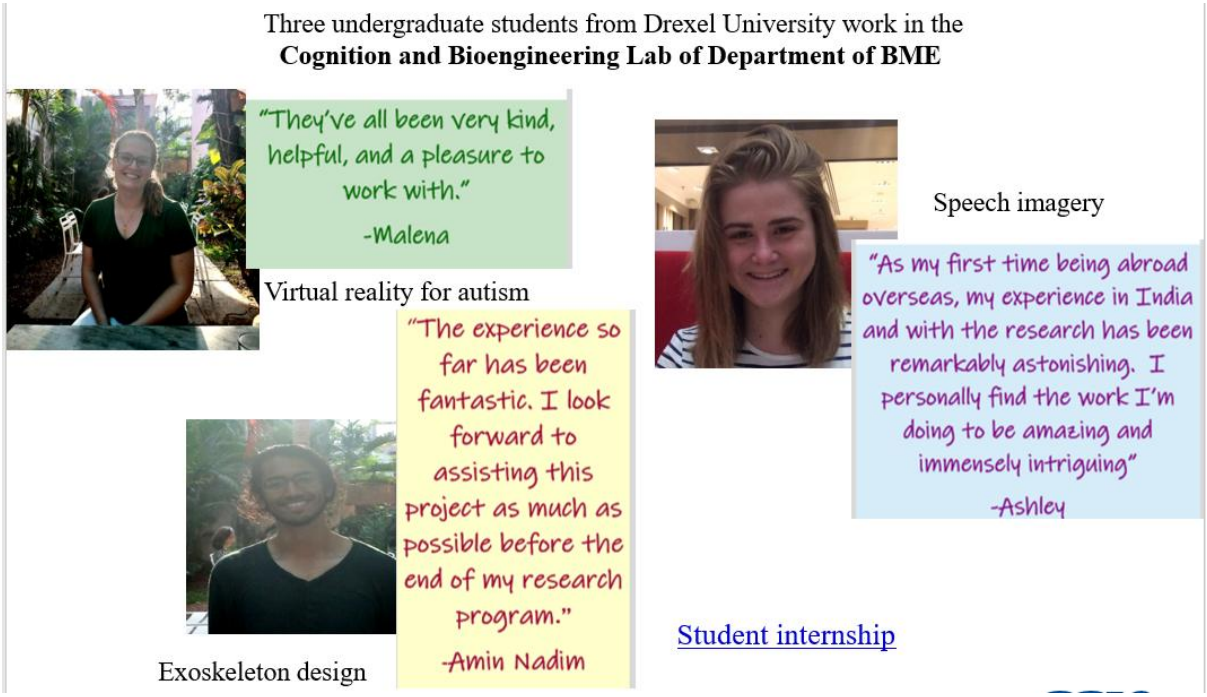
One of the key area of biomedical research is to develop some socially relevant works which will help, improve the life style of people. CHT has done many works which are socially relevant. List of some of the works are given below

- ✓ Cerebral palsy head support
- ✓ Orthopedic belt using sodium acetate crystals
- ✓ Mass screening device for Osteoarthritis

- ✓ 3D printed Prosthetic limbs
- ✓ Non invasive glucose measurement
- ✓ Electronic nose for diagnosis of tuberculosis
- ✓ Assistive devices for differently abled
- ✓ Sign language converter using sEMG
- ✓ Braille for visually impaired
- ✓ Exoskeletons for assistive and rehabilitative purposes
- ✓ Low cost dialysis machine
- ✓ Noninvasive Jugular Venous pressure measurement
- ✓ Outdoor obstacle detection module to assist visually challenged
- ✓ Virtual reality for learning disorders

CHT is offering an internship opportunities to students from Drexel University. Totally five undergraduates from Drexel University have completed their internship at different labs of CHT . Feedback from some of the students are below.

Interns from Drexel-2018



Interns form Drexel-2019

Two students from Drexel University, USA completed their summer internship at SSN, between 18th June 2019 and 24th August 2019. The details are given below:

1. Ms. Rheya Jain, completed her summer internship on synthetic larynx fabrication using 3D printing, Mentor: Dr. S. Pravin Kumar Asso.Prof /BME, Co-mentor: Ms. R. Nithya AP/BME.

2. Ms. Anna Masciantonio, completed her summer internship on "Virtual Reality as a Training Tool for Children with Neurodevelopmental Disorders", Mentor: Dr. A. Kavitha, HoD/BME, Co-mentor: Ms.B.Divya AP/BME, Ms.S.Vidhusha, AP/IT.

Dr.A.Kavitha and BME faculty with the Interns from Drexel University

RHEA JAIN

School of Biomedical Engineering, Science, & Health Systems
Biomedical Engineering

Faculty Mentor: **DR. S. PRAVIN KUMAR**
Department of Biomedical Engineering

SYNTHETIC LARYNX DESIGN AND FABRICATION

In the evolving world of biomedical engineering, 3D Modeling has become a useful tool to understand the functioning of the human body. The causation and development of various speech impediments can be examined using a 3D model of the larynx. This work used MATLAB and 3D printing to create and analyze synthetic vocal folds for various vibratory patterns. This began through MATLAB where a code was created to understand the shape of three vocal fold degrees based on the M5 Model design: -10, 0 and 10. Then, using the findings, molds of the folds were developed using Creo Parametric and were 3D printed. Next, five 3D models of vocal tracts were created that represented the vowels"a", "e", "i", "o", "u". This was later combined with a lung model to show a full synthetic design of the way voice is projected in the human body. Finally, the model was tested for various acoustic parameters to understand the changes that occur when the degree of the vocal folds change. The testing was done perceptually, where sound was analyzed, and acoustically, where frequencies were analyzed. This work is crucial as if the model proves successful, it can be further manipulated to model and provide more information on various pathological cases.

ANNA MASCIANTONIO

School of Biomedical Engineering, Science, & Health Systems
Biomedical Engineering

Faculty Mentor: **DR. A. KAVITHA**
Biomedical Engineering

Co-Mentor: B. Divya, S. Vidhusha

VIRTUAL REALITY AS A TRAINING TOOL FOR CHILDREN WITH NEURODEVELOPMENTAL DISORDERS

Virtual Reality (VR) has shown potential in various disciplines ranging from therapy to education and training. Previous research suggests that VR has been successful in helping people overcome phobias, social anxiety, post-traumatic stress disorder, and other conditions. This project seeks to explore the efficacy of virtual reality as a training tool for children with Neurodevelopmental Disorders (NDD's), specifically Autism, Attention Deficit Hyperactivity Disorder, and Dyslexia. Several VR environments teaching colors, words, shapes, and counting were created and converted to a mobile device compatible with a VR head-mounted display. EEG signals from NDD children exposed to the VR tasks were acquired and compared to EEG signals from NDD children trained with traditional methods, like flashcards. Using a combination of MATLAB and EEGLAB, the acquired signals were separated into alpha, beta, theta, delta, and gamma bands and extraneous noise, including eye blinks and head movement, were removed. The EEG signals were processed, and various features were acquired. The analysis of the comparison between VR and non-VR exposure serves as the method in which the effectiveness of VR as a training tool can be quantitatively examined.