Summary Report

About Department/Center/School: In the year of its Golden Jubilee in 2001, the School of Medical Science & Technology was started at IIT Kharagpur with the objective to provide a platform of interdisciplinary teaching and research in diverse areas of medical science and technology.

The school provides training to Medical graduates and Engineering and Science graduates through the two programs, namely, Masters in Medical Science and Technology (MMST) for medical graduates and M.Tech for Engineering and Science graduates.

Our vision is to have a medical academic institute with a multi-specialty research centre at its core with the motto of education and collaboration for biomedical research and development alongside treatment and healthcare delivery to the patients.

The department has achieved a three fold increase in both academic and sponsored research in 2008-2013 and posed to take a bigger role in clinical research and development.

1. **Academic Programs (Range of Degrees and Disciplines):**
   - **(i) 3 years Masters in Medical Science and Technology (MMST)**
   - **(ii) Joint M.Tech-Ph.D in Medical Imaging and Informatics**
   - **(iii) MS by research**
   - **(iv) Ph.D.**

2. **Major 4-5 Thrust Areas of Research:** (i) Medical Imaging and Informatics, (ii) Biomarker & Drug Discovery in Cancer, HIV, Influenza, Endometriosis etc. (iii) Medical Instrumentation, Devices & Sensors, (iv) Biomaterial, Tissue Engineering & Regenerative Medicine.

3. **Curriculum and Courses & Teaching Environment**

Items	**Ratio/ Number**	**Items**	**Number/%**
Teacher-student Ratio (including 2nd yr. teaching share of SCIENCE OF LIVING SYSTEM)	1:12	Average No. of students motivated (%) to opt of careers Eng/ Tech/Healthcare. Sectors PG/PhD	**30/30**
No. of Faculty members as on today	9	Average No. of students motivated (%) to opt of careers in Science sectors /PG/PhD	**40**
Average No. of Tutorial Assistants	40	No. of teaching labs	**4**
No. of UG students (2nd year shared load)	70	Average No. of students per experiments in core courses	**4**
No. of PG students/PhD students	30/60	No. of Students' workshops/``Tinkering'' Labs	**1**
Average no. of tutors with more than 100 students	2	No. of new courses introduced	**6**
Average Students placements (%) (PG)	90	No. of New program introduced	**1**
No of major curriculum review in both PG level	1	PGVs PhD strength expressed as Percentage	**1:2**
No of PG lab (teaching labs) developed/set-ups	2	No of PG/research labs developed/new set up	**5**

No of E class rooms	2	No. of lab classes per week	**5**
Average No. of Course done per student for MMST /M. Tech/Ph.D	20/5	No. of core/elective/seminar/projects subjects taken for MMST and M. Tech respectively	**8/7/2/2** **5/4/1/2**

4. Research and Development & its Environment

Items	**Number**	**Items**	**Number**	**Items**	**No.**
Total No. of Publications in Journals (2008-13)	247	Average no. of citation per paper	**6.5**	No of large interdisciplinary research projects	**6**
Total No. of Publications in Conference & Symposium	97	Average Journal publication per year	**60**	Number of Int. conf./workshops attended by students	**30**
Total No of Books & e-books published	1	h-Index of the department since 2008/overall h-index in Scopus	**18/18**	No. of PDF hired in the Institute	**-**
Total No of Edited Conference Proceedings/book chapters	2/3	Number of papers with citation more that the average no. of citation of the Journals	**127**	No. of international Students as PhDs/PDFs	**-**
Total No. of Technology Developed/transferred	*4/1*	No. of recognitions & Awards, fellows etc to faculty/students (provide break up if necessary)	5/4	No. of International visiting researchers/adjunct faculty stayed here for at least a week	*5*
Total No. of Patents Filed/Obtained	*9/2*	Average Retention(%) of Young faculty for at least 10 years	100	No. of short courses/workshops /conf. organized with international participations	*2/4/1*
Total No. of Copyright Filed/Obtained	-	No. of Sponsored research Project /fund(lakh) generated from non-internal source	38/1900	Average No. of PhD granted per year	*6*
No. of Publications per Faculty/Masters/PhD students	**42/30/350**	No. of Consultancy /fund (lakh) generated from non-internal source	-	Average No. of PhD Granted per year per faculty	*0.6*
No. of Publications per Faculty/Masters/PhD students in Top Ten Journals as Identified by the department	**4/4/20**	No of Internal and external Collaborations research papers/research projects/PhD students	105/38/14	Patent granted per faculty	*0.3*
Average No. of Citation per faculty per year	**30**	No of M. Tech students motivated into pursuing PhD/PhD graduates motivated to pursue career in Academics(abroad or IIT etc)	15/10	Number of articles in collaborations with Ten countries*	*18*

Ranking of the department in terms of average citations per paper within the Institute	**9 to 14**	Ranking of the department in terms of total number of Journal publications within the Institute/publications per faculty	18-20/5-7	No of articles of the dept. contributing towards h-index of the Institute since 2008	*2*

5.External Stakeholder Engagement and others

Items	**Number**	**Amount Lakh**
No. of PhD/Master students' thesis funded by Industries	4/12	-
Total number of Industry sponsored projects and its income (Lakh)	4	130
No. of Curriculum Development Initiative for Industries	-	
No of Technology transfer/adopted by Industry/Labs	6/2/2	
No. of Nationally relevant research projects	20	
No of Policy inputs/consultancies provided	1	
No. of Research grant and seed money from internal savings of the Institute per young faculty of the department and its total fund	7	21
No. of Community Relevant projects	2	50

6. Vision for the Future (in brief):

(a) Departments/centers/schools should spell out its Mission and Vision Statements, (b) Plans for future to achieve the projected goals and (c) measures adopted towards above.

- Our vision is to have a medical academic institute with a multi-specialty research centre at its core with the motto of education and collaboration for biomedical research and development alongside treatment and healthcare delivery to the patients.
- IIT is planning a super-speciality hospital in the next 3 years with an active clinical research component embedded in it. This will provide the necessary impetus for the translational health research activities to flourish.
- School of Medical Science and Technology is currently revising the curriculum for greater clinical component in the program while the depths in science and technology enhanced further with induction of new faculty members and new laboratories in clinical research.
- The Institute is planning state of the art large Animal house as a central facility for giving a big boost to the translational activity through preclinical trial. State of the art laboratory facilities with specialized laboratories of BSL II, III and IV and world class charac terization and fabrication facility have been planned at IIT Kharagpur for Bio-Science, Medical Science and Nano and Micro Science. This will enrich both fundamental and applied Bio-Science, BioTechnology and Medical Science and Technology to take the School and the Institute as well to the next level. Provisions of state of the art preclinical and clinical research facility in a premier technological institute like Indian Institute of Technology, Kharagpur will make it a prominent medical research hub in the next decade.
- SMST will target to publish 10 papers per year in the top 10 listed journals, currently it is 3-4 per year.
- SMST will target to file 4 patents per year, currently it is 1-2 per year
- SMST will involve more clinical faculty and increase translational research component.

7. External peer review of the Dept./centre/schools (in brief):

SMST has gone through several review process through workshops and brainstorming sessions, though not in quantitative manner. Some important ones are carried out in 2000, 2006, 2008 and 2010.

The themes and mottos of SMST were formulated in 2000 with a galaxy of stalwarts from the field of Medicine, to name a few:
Dr. N. K. Ganguly, Director General, ICMR
Dr. R. J. Korula, Principlan, Cristian Medical College, Vellore
Prof. V. I. Mathan, CMC, Vellore
Dr. P. K. Dave, Director, AIIMS, New Delhi
Dr. M. V.S. Valiathan
Dr. P. N. Tandon, Ex-Director, AIIMS
Dr. R. C. Mahajan, PGI Chandigarh

Major recommendations include

- Development of Post-graduate and Research programme in the areas of Bio-sensors and Drug delivery, Telemedicine, Artificial limbs and organs with special emphasis on materials research, development of Diagnostic instruments etc.
- Tie-up with accredited hospitals and industry

All subsequent workshops and seminars in 2006 (IIT Kharagpur), 2008 (IIT Kharagpur) and 2010 (New Delhi) strongly recommended for a research hospital at IIT Kharagpur itself keeping in mind the location of IIT Kharagpur and limited access to other medical institutes.

8. **Strengths, Weaknesses, Opportunities & Threats (SWOT) Analysis of the Department**

STRENGTHS	**OPPORTUNITIES**
√ Adequate and Quality Research outputs √ Interdisciplinary and community based research In the clinical domain with active collaboration with experts from medicine √ good quality students √ Conducive ambiance and well endowed computational and academic infrastructure facilities √ Good placement record √ Periodic updating of curriculum √ Conferences and continuing education programmes organized on regular basis √ Periodic feedback of the students	√ Boom in industrial development and challenges in Healthcare fields put demand for quality technical manpower √ Establishment of research Hospital at IIT Kharagpur √ To increase quality of research activities: PhD and sponsored research √ Establishment of centres of excellence and advanced studies √ To innovate new products/processes/designs and acquire patents √ Possibility of more international and national collaborations and joint ventures
WEAKNESSES	**THREATS**
√ Lower space √ Nonavailability of good animal house √ No research hospital nearby √ Low teacher-staff especially technical staff ratio √ Inadequate and insufficiently trained supporting staff √ Low consultancy output √ Low national and international awards √ In-adequate sophisticated equipment and labs in the areas of emerging technologies & cutting edge disciplines for post graduate teaching and research √ Less Clinical faculty	√ More attractive opportunities outside IIT Kharagpur pose greatest threat to attract and retain good quality faculty and technical staff √ Competition with the Indian campuses of foreign universities √ Boom in self financing institutions √ Lack of good quality faculty may permit mediocrity to overtake excellence

9. Additional Information, if any

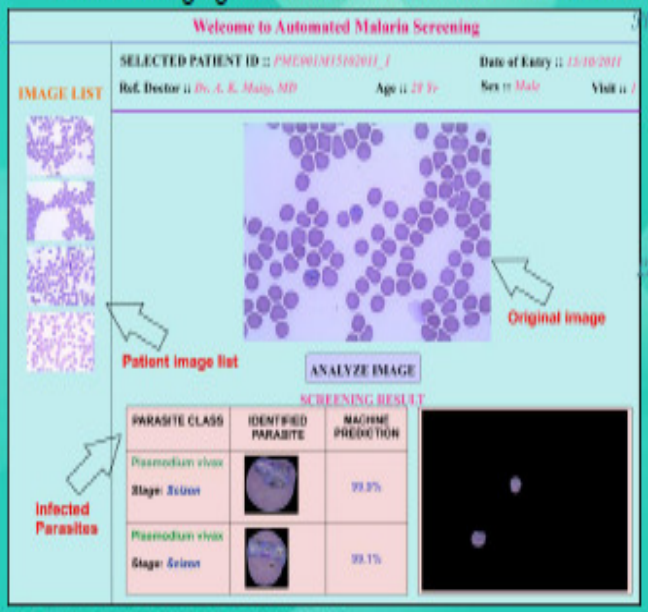
***Note: Ten countries: US, UK, Germany, Japan, Canada, France, Italy, Australia, Singapore, South Korea （ optional :China may be replaced with anyone if department wants)**

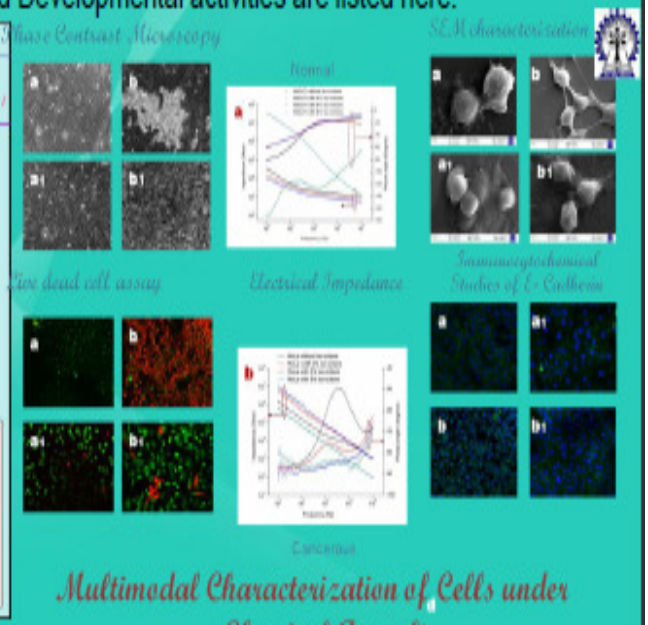
Important Highlights

SMST has an unique set of faculty from Science, Engineering and Medicine:

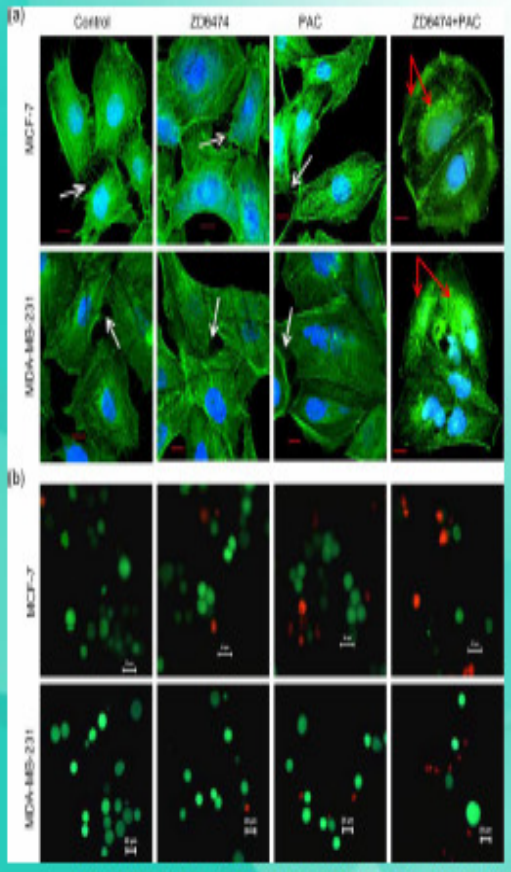
- Pranab K Dutta, Head- - Biomedical Image Processing , Optical Tomography
- Koel Chaudhury - Reproductive Biomedicine, Women's Health
- Mahitosh Mondal- Cancer Biology, Signalling pathway
- SoumenDas - Bio-MEMS, Biosensors
- Analava Mitra, - Nutraceuticals & Plant based Medicine
- Jyotirmoy Chatterjee - Medical Imaging, Wound & Cancer Biology
- Manjunatha M- - Retinal prosthesis / neural prosthesis, Implantable electrical System (FES devices)
- Santanu Dhara- Bio-materials, Near Net Shape Fabrication of Ceramics
- Chandan Chakraborty, Medical Statistics, Medical Expert System , Pattern Recognition in Medicine
- Sangeeta Das Bhattacharya - Internal Medicine , Pediatrics
- Sujoy Guha, Emeritus Professor: - Novel Male and Female Contraceptive, Application of Biomedical Engineering to Reproductive Medicine

Current Research- Medical Science and Technology being the most exciting field of research of this century School of Medical Science and Technology has taken many interesting and challenging activities. Some of the Research and Developmental activities are listed here.

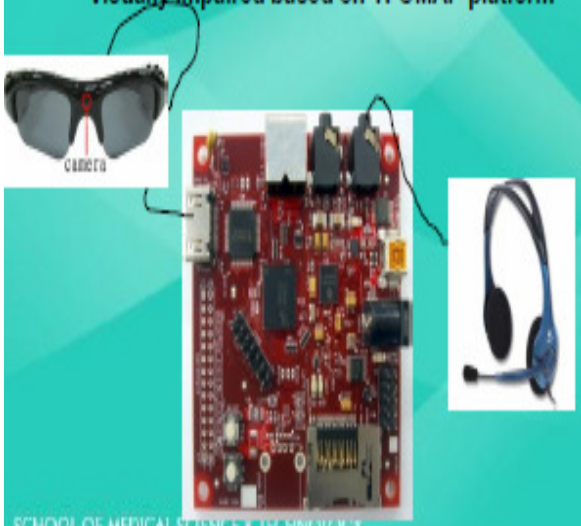




SCHOOL OF MEDICAL SCIENCE & TECHNOLOGY



An Embedded Computer Vision System for Navigation of Visually Impaired based on TI-OMAP platform



Cancer Biology-

•Identification of specific genes and their biological significance in normal and cancer cells. One of the findings showed that inhibition of phosphorylation of EGFR and VEGFR by ZD6474 would inhibit breast cancer cell proliferation and induce apoptosis.

• Celecoxib-loaded Hap- Cht nanoparticles as promising, effective and safe means of delivering celecoxib, and other potential therapeutic agents for colon cancer therapy.

Biomedical Instrumentation and Rehabilitation-

•Dual-channel multi-pattern FES system using embedded technology to correct foot-drop in stroke patients with tibialis anterior (TA) electromyography (EMG) pattern stimulation in clinical motor rehabilitation.

• Development of a low-power, portable Electronic Travel Aid (ETA) device to aid in the mobility of the visually impaired persons.

Pediatric HIV and Public Health-

•Started a project on pneumonia prevention in children with HIV infection as a multi-institute endeavor between NICED, Midnapore Medical College and CMC Vellore.

•Joined the ASIP- study network for national surveillance study of invasive pneumoccal disease.

Medical Informatics-

•Quantitative diagnostic marker development for malaria, anemia and leukemia using light microscopic images of peripheral blood smears.

•Development of an expert system for early detection of malaria, anemia and leukemia

Medical Imaging-

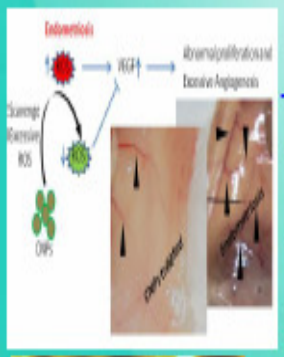
•Multimodal Characterization of Cells under Chemical Assault

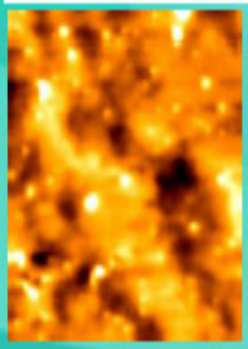
•Screening system for Cervical Cancer

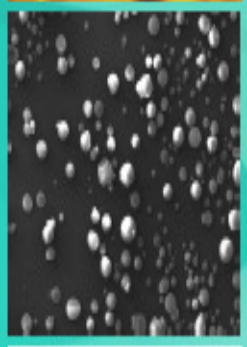
• Tissue characterization and classificationby backscattering statistical physics

Reproductive Biology :

- Novel biodegradable metallo curcumin nanoparticles: a new hope for endometriosis therapy?
- Possible causes of implantation failure in idiopathic recurrent spontaneous miscarriage
- Role of long-term doxycycline as matrix metalloproteinase (mmp-2 and mmp-9) inhibitor in chronic obstructive pulmonary disease
- Development of biodegradable polymer encapsulated besifloxacin nanaoparticles: a novel therapeutic approach for endophthalmitis







MEMS and Biosensor-

•Process development for fabrication various metal thin film structures on flexible polymer substrate by microfabrication technology.

•Design and fabrication of microfluidic device integrated with planner metal electrodes and its use for cell manipulation using DEP technique.

•Development of functional MEMS VLM and MnO_2 nanoparticle embedded monopropellant microthruster.

Biomaterials-

•Development of scaffolds for soft and hard tissues through regenerative medicine approach.

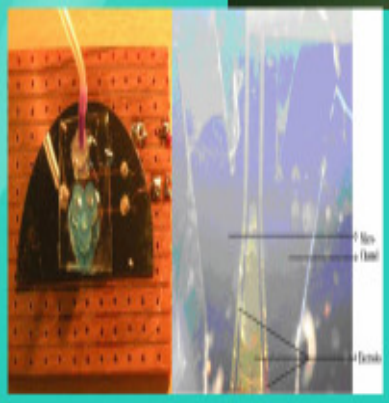
•Studying the interaction of stem cells with the Scaffolds developed in our laboratory.

•Designing small scale bioreactor for application l in continuous stem cell culture.

Herbal Medicine

•Therapeutic efficacy and bioavailability of various polyphenolics in tea

•Nutritional Intervention in diabetics



Fabricated DEP device for cell manipulation