

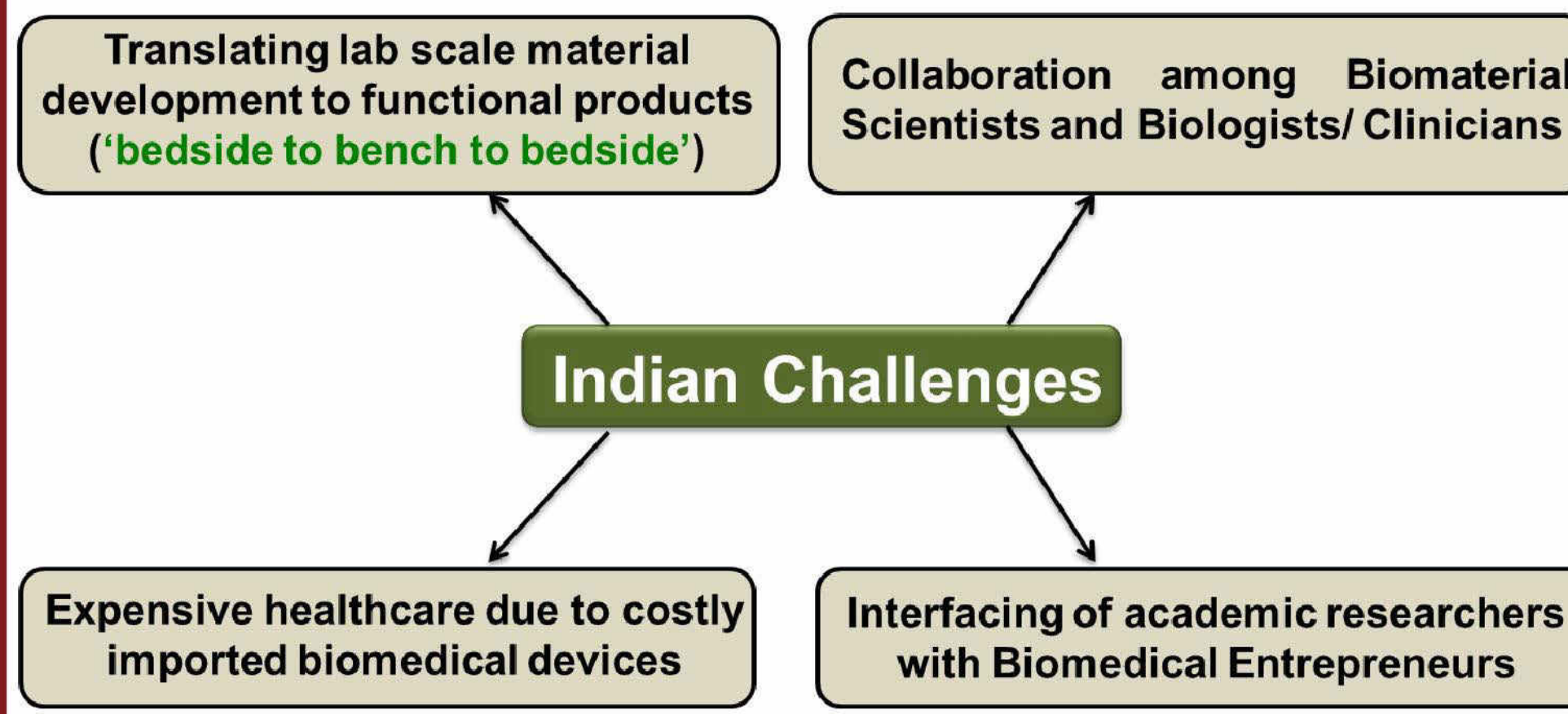
Translational Center on Biomaterials for Orthopedic and Dental applications

Broad Objectives

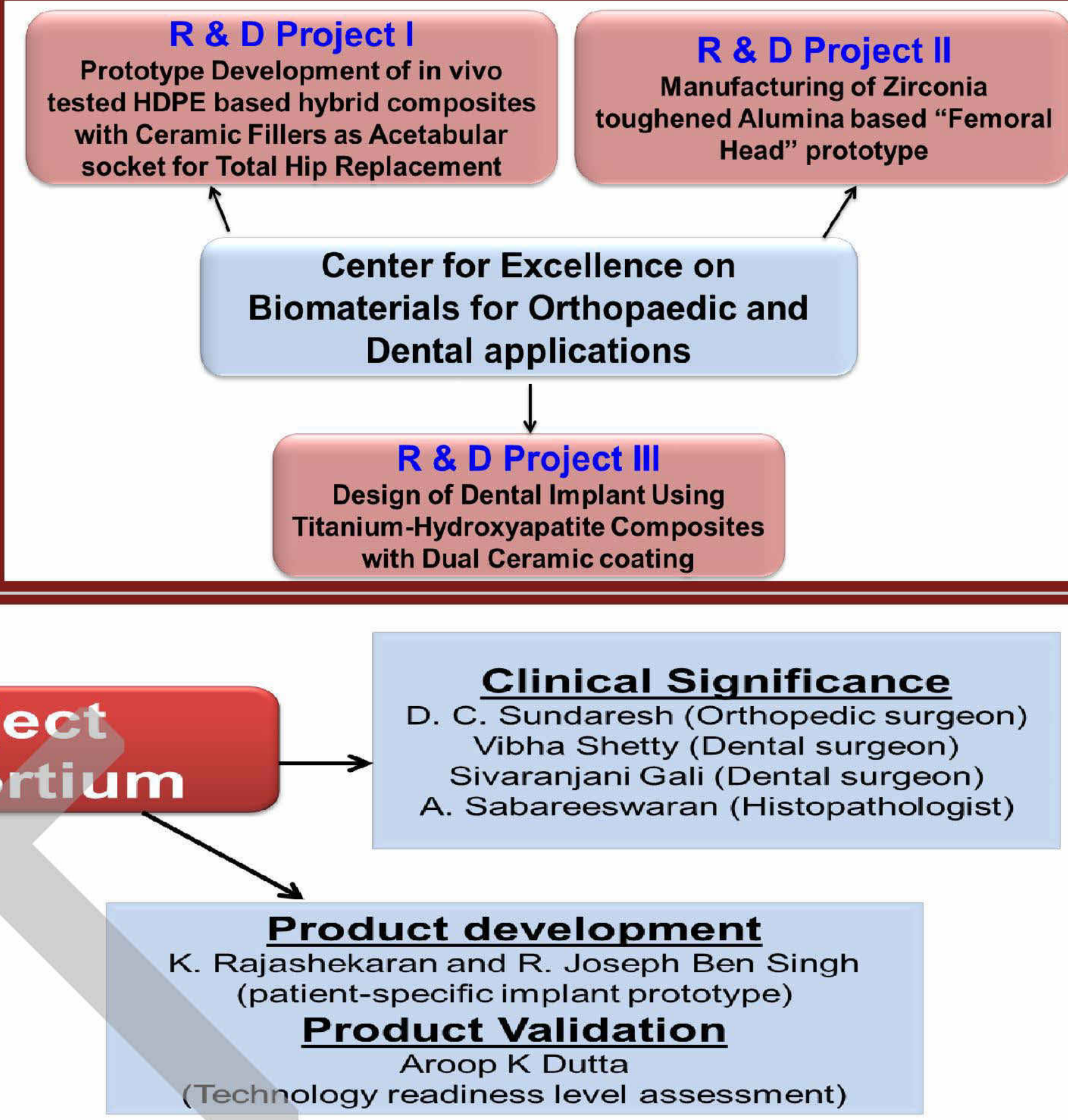
This Center of Excellence envisages to meet the following objectives:

- To adopt integrated manufacturing approaches while developing patient-specific implant prototypes
- To demonstrate an integration of ideas drawn from multidisciplinary researchers (Engineers, Clinicians and Materials Scientists) to address healthcare problems
- To establish translational approaches to take lab-scale research to product prototype development
- To train and educate next generation biomaterials researchers

Background

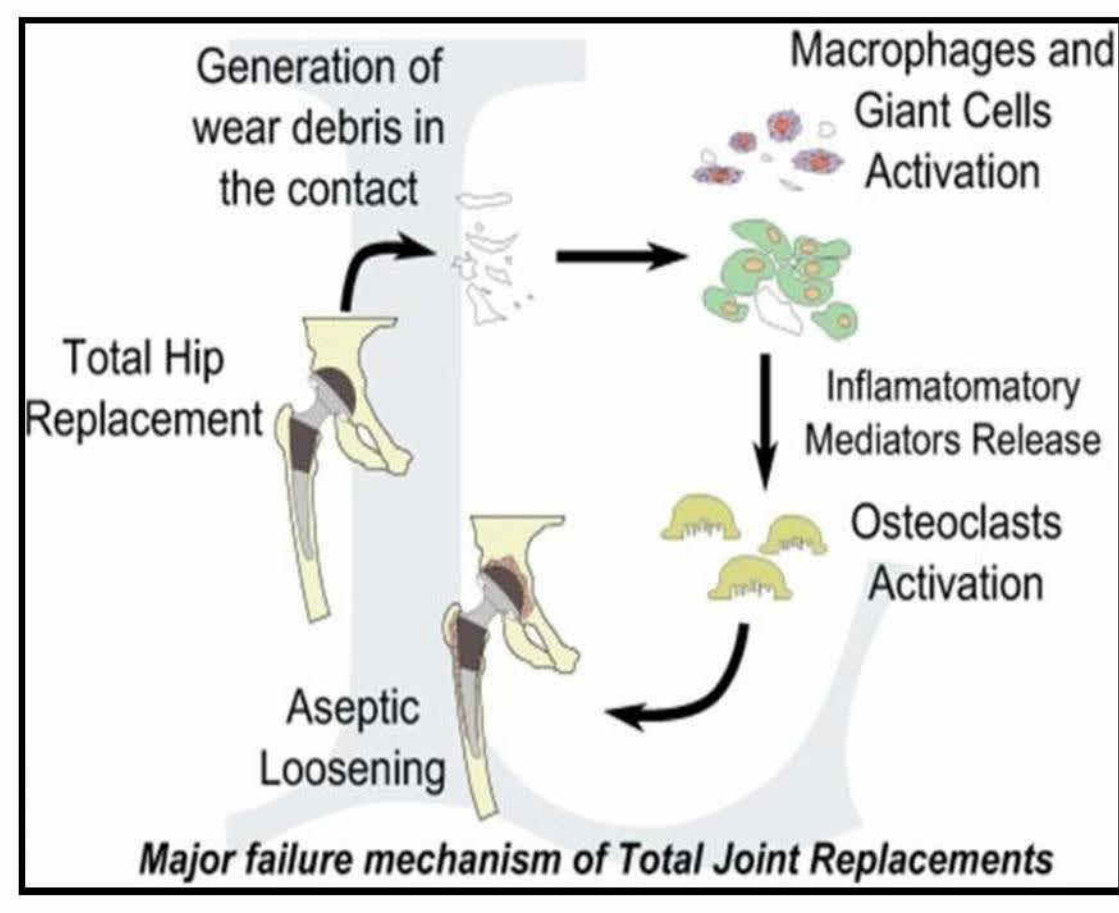
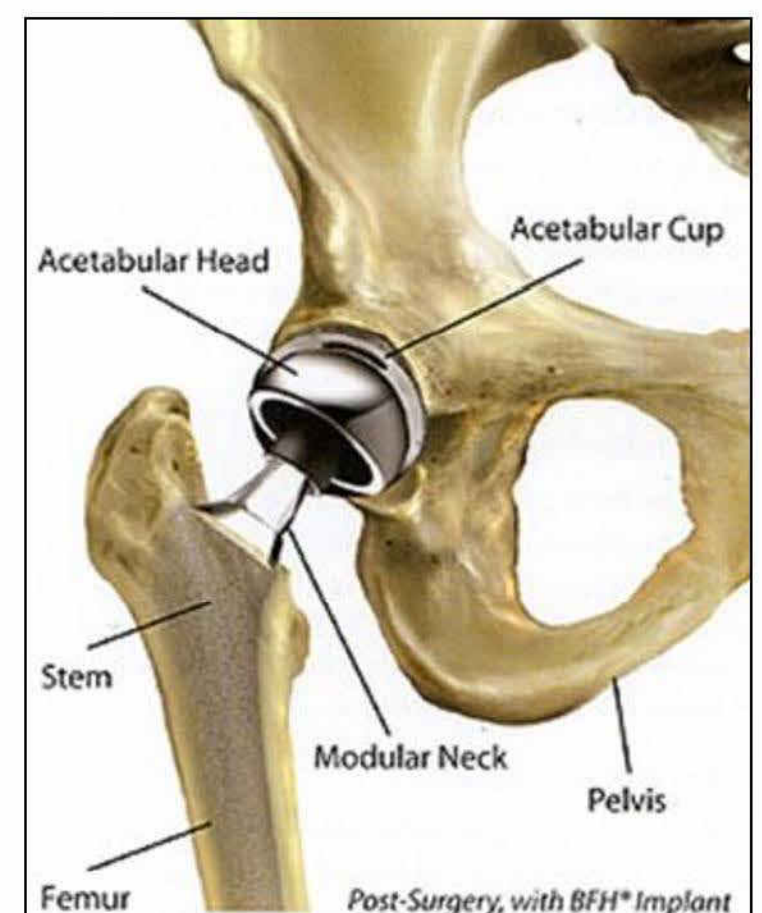


Overview



R & D Project I

Clinical Perspective

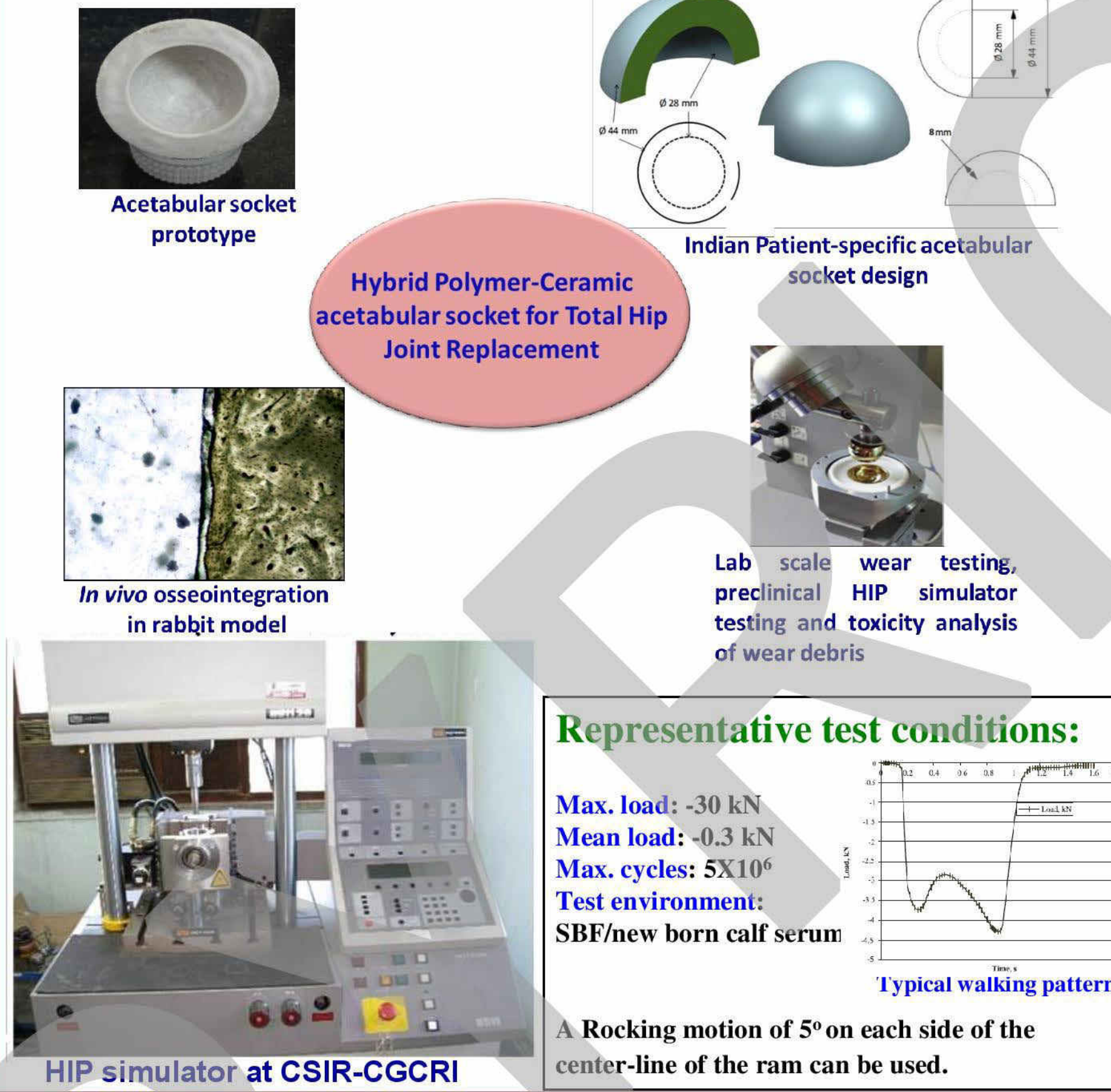


Acetabular socket in THR implants are conventionally made of ultrahigh molecular weight polyethylene (UHMWPE: low fracture toughness), which releases finer wear debris particles due to articulating motion, causing inflammation (revision surgery).

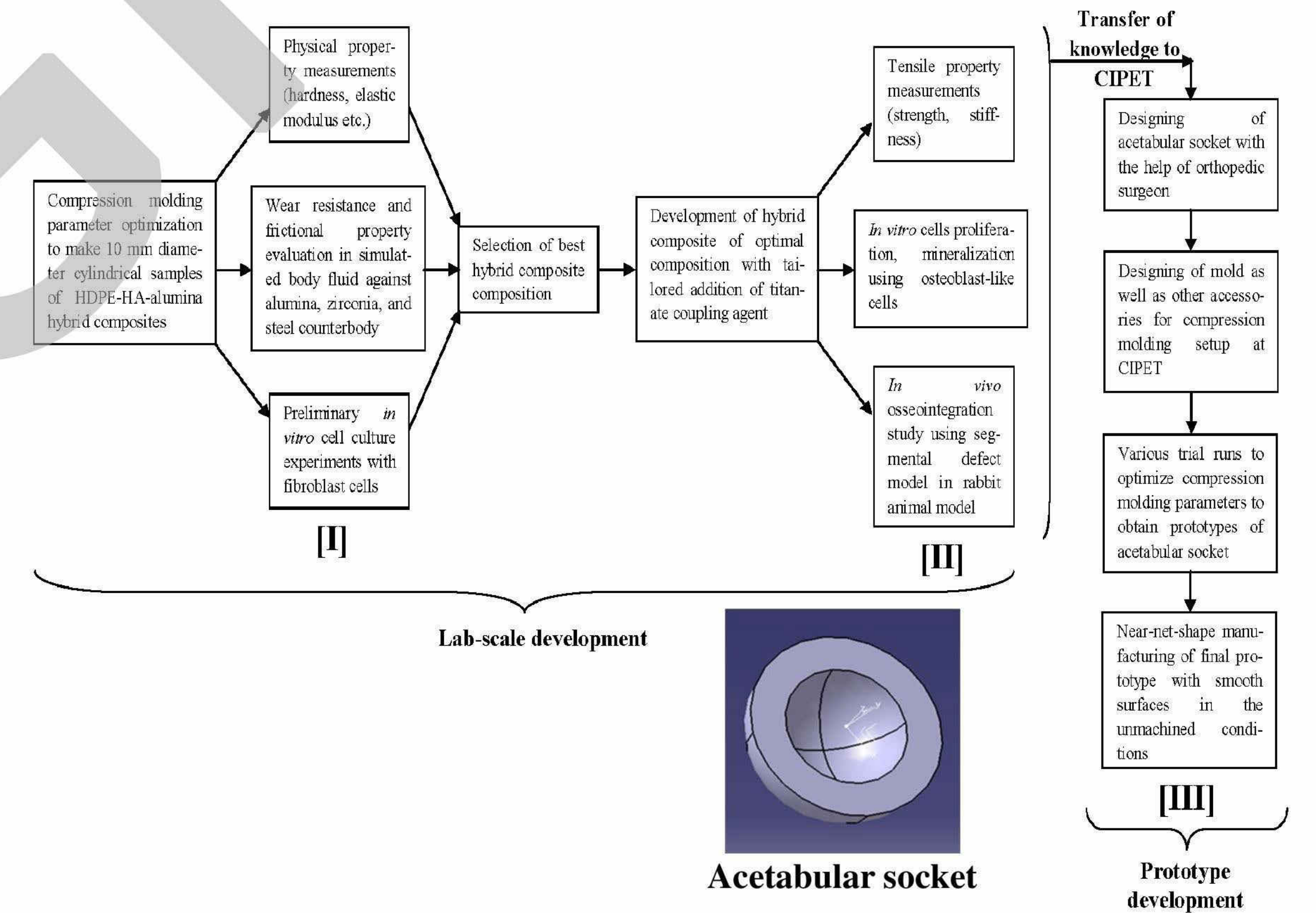
Annual Indian Total arthroplasty joint statistics: 6,00,000 total knee (TKR), 3,00,000 total hip replacement (THR) with financial implication of 600 Crore business.

Recent research established that incorporation of tailored amount of ceramic fillers in polymer significantly reduces wear, leading to durable acetabular components.

'Bedside to Bench to Bedside'



Lab-scale research to Prototype Development



R & D Project II

Project Summary

Material Aspect

- Compositional design to optimize both fracture toughness and strength reliability
- Lab scale wear resistance assessment

Manufacturing Aspect

- Optimisation of near-net shape green processing
- Uniaxial pressing - Sintering
- Machining and polishing to obtain smooth surfaces

Zirconia Toughened Alumina (ZTA) based Femoral Head for Total HIP joint Replacement (THR)

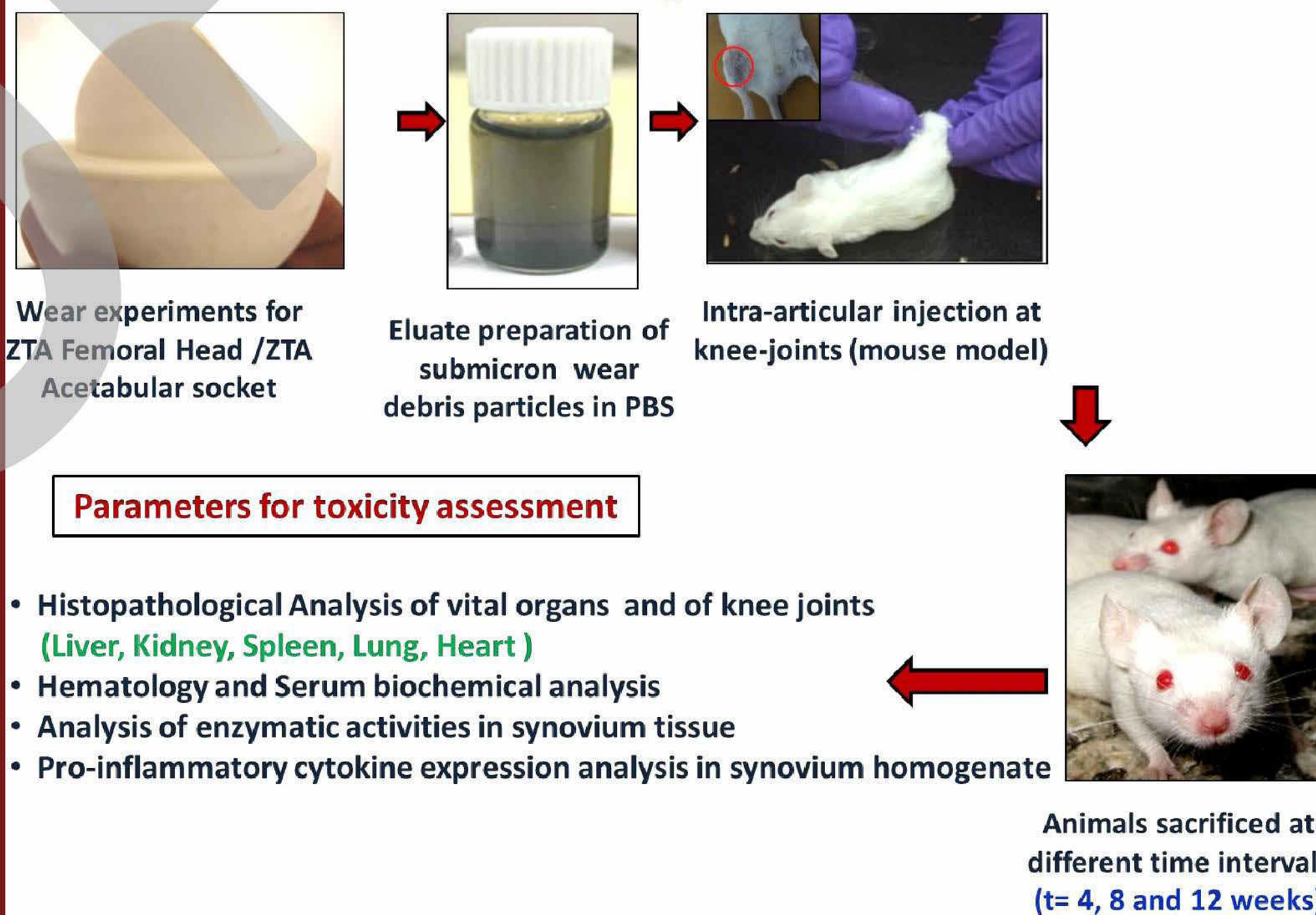
Performance Assessment

- Mechanical response assessment
- HIP simulator study against highly cross linked UHMWPE/ZTA acetabular sockets

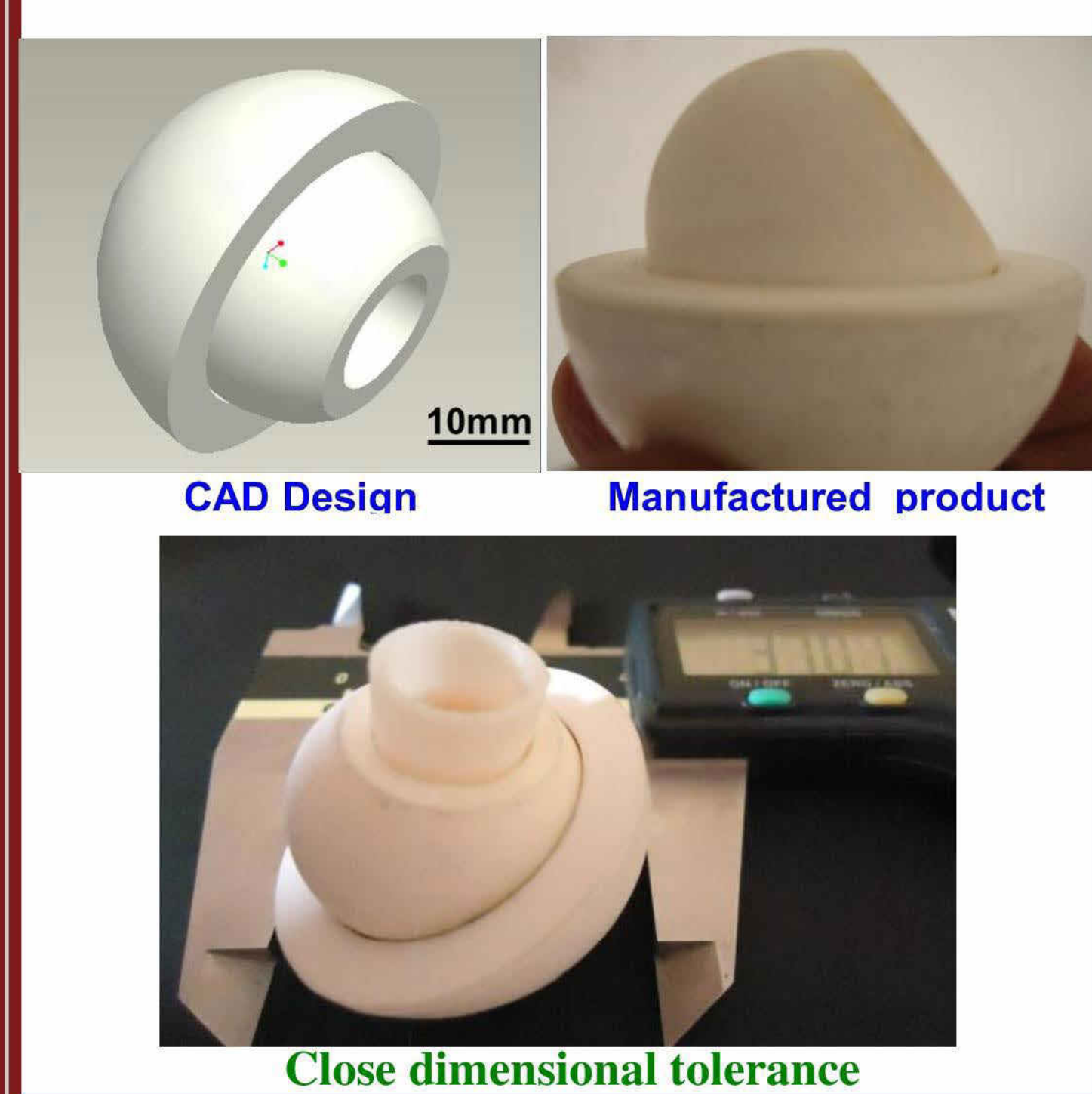
Biocompatibility Evaluation

- In vitro cytocompatibility assessment using bone cells
- In vivo biocompatibility assessment in rabbit model for upto 26 weeks

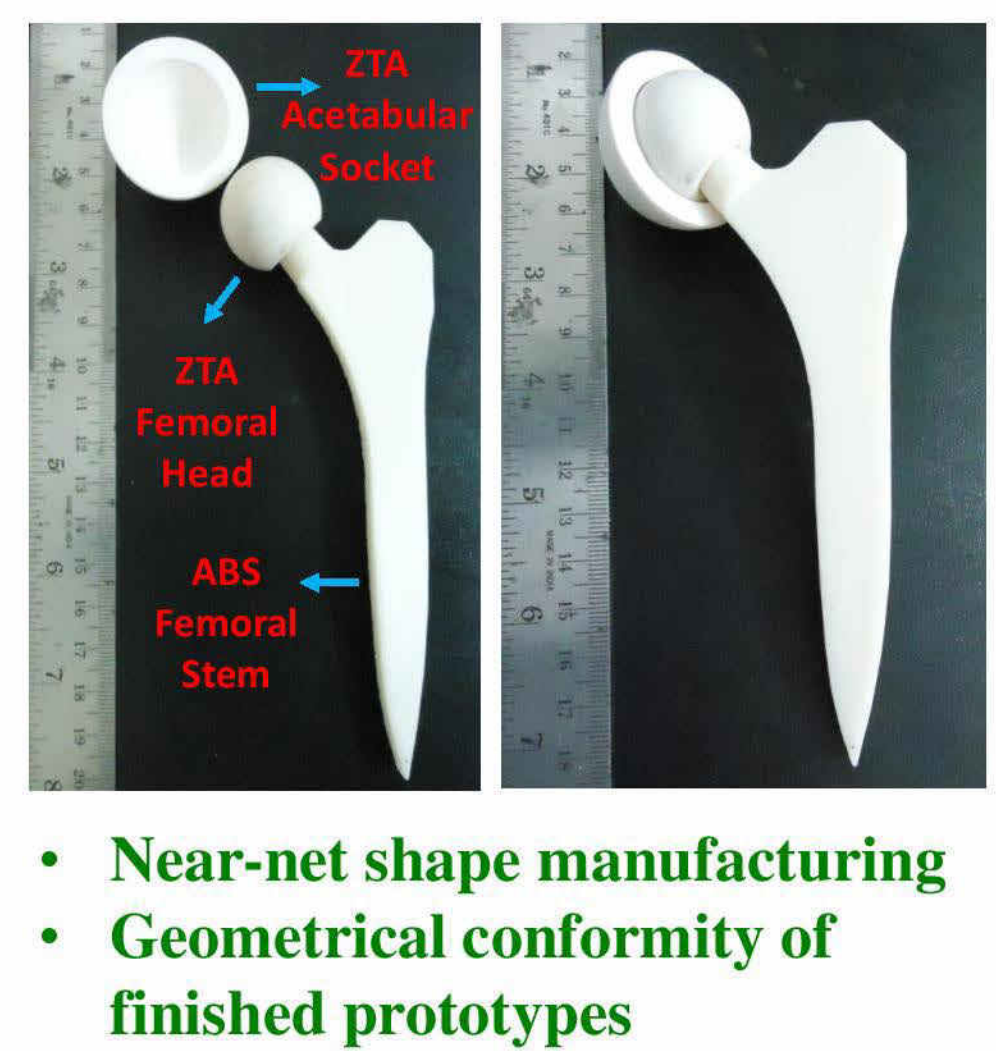
In vivo Toxicity Assessment



Targeted Product Development

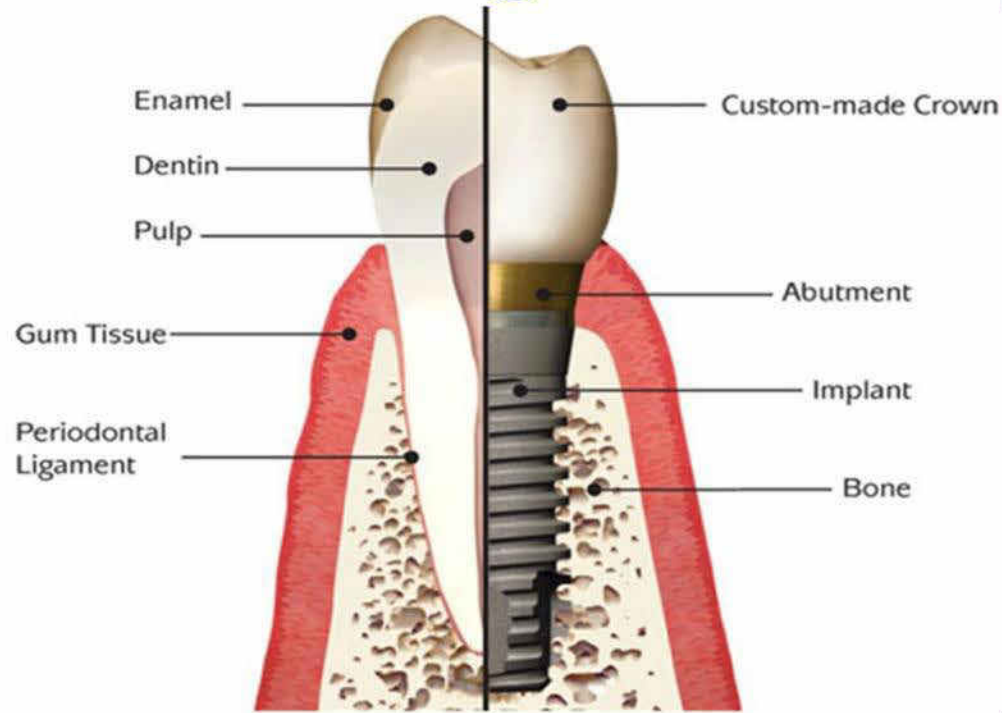


Biomedical device assembly for Total Hip joint Replacement (THR)



R & D Project III

Background



Dental Implant Design



Project Summary

Material Aspect

- Ti HA composition preparation & preparation of coatings
- Material characterisation of implant
- Testing the efficacy of coatings

Manufacturing Aspect

- 3D printing technology
- PEVCD & PLD technique for coatings

Hydroxyapatite coated based Titanium Dental Implant

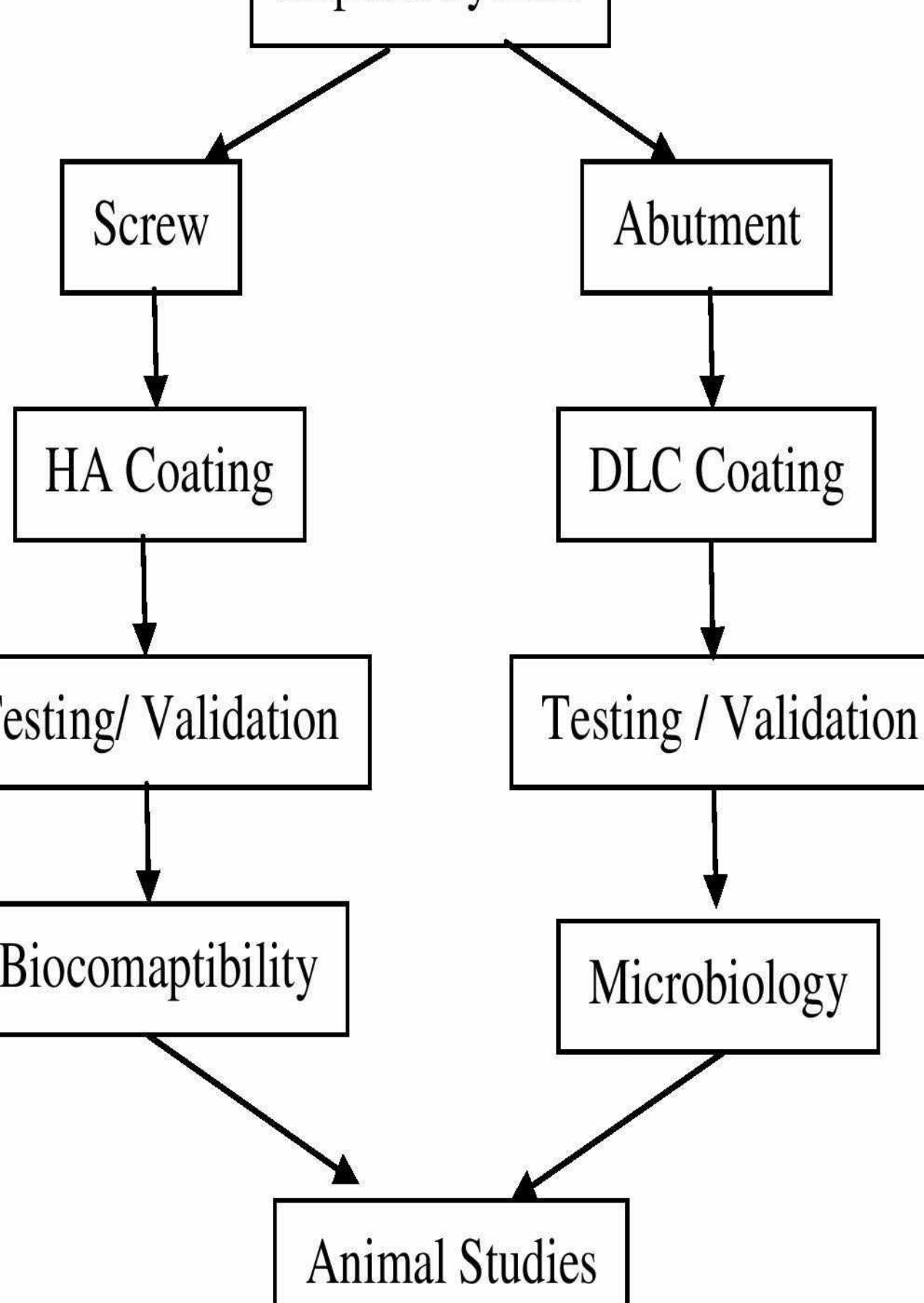
Product validation

- Ethical clearance from Institutional Review Board
- Conduct of Randomised Controlled Clinical trials in humans.

Biocompatibility Evaluation

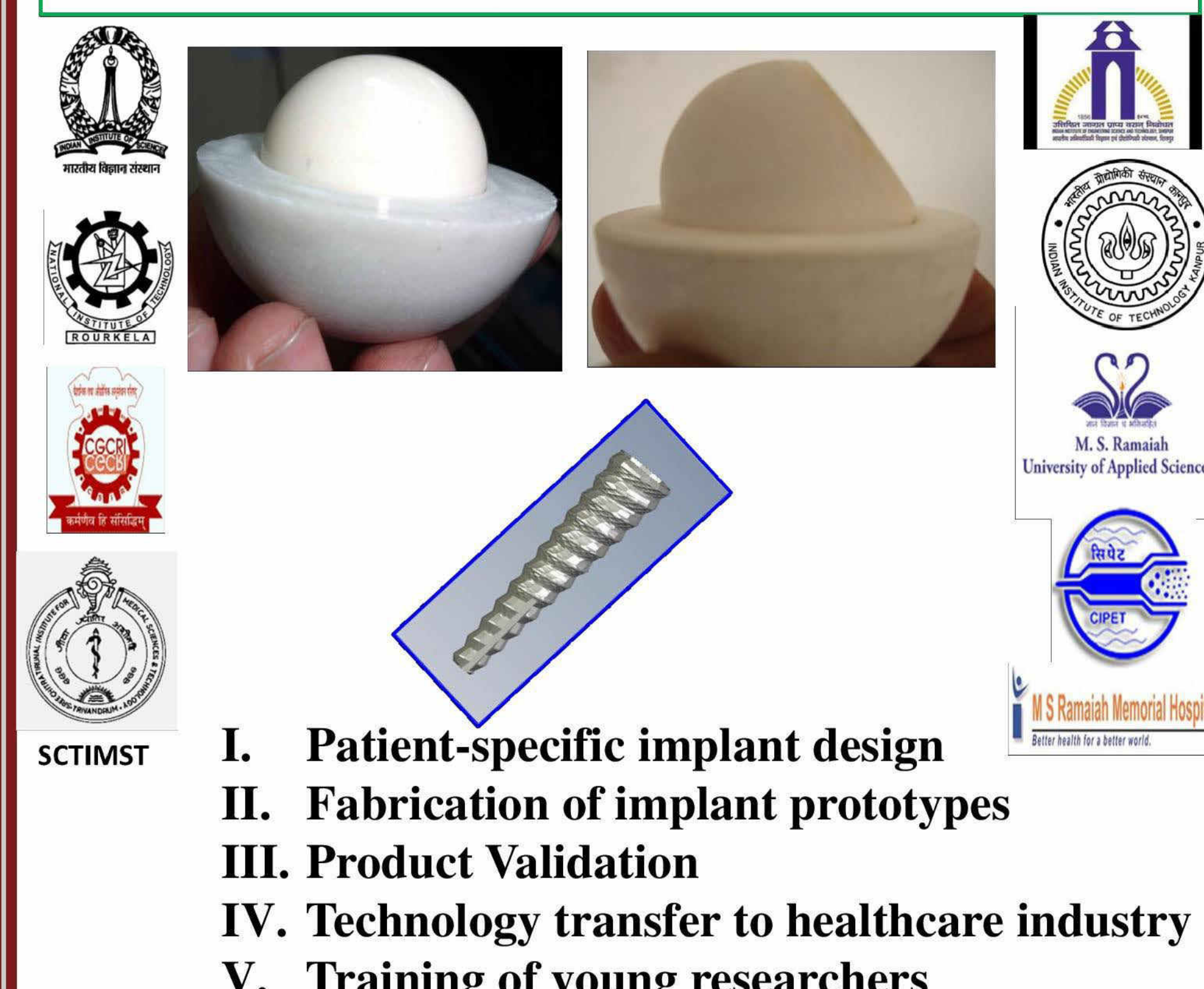
- In vitro cytocompatibility assessment
- In vivo cytocompatibility assessment in rabbit model

Implant System



Expected Outcome

Make in INDIA Concept



Acknowledgment: 'Translational Center of Biomaterials for Orthopedic and Dental Applications' has been established with funding from Department of Biotechnology (DBT), Government of India under 'Centers of Excellence and Innovation in Biotechnology' scheme.