National Institute of Technology Rourkela

Registration Seminar

Seminar Title	: DEVELOPMENT OF PHOTOCURABLE BIOINK FOR REGENERATION OF CARTILAGINOUS TISSUE
Speaker	: Pratyusa Sar (Rollno : 523bm1001)
Supervisor	: Prof. Devendra Verma
Venue	: Seminar Hall, BM Department
Date and Time	: 27 Jan 2025 (4:30 PM)
Abstract	: Osteoarthritis (OA) is a condition that affects people worldwide, has serious socioeconomic consequences, frequently results in cartilage abnormalities. Till date there is no permanent cure for degenerated cartilage. Solutions like autograft and allograft techniques face challenges as the patient has to go through the surgical procedure twice in autografting whereas allograft faces the problem of immunorejection. Although some surgical procedures like microfracture techniques, cell homing, autologous chondrocyte implantation (ACI) can provide relief to the patients, but these all are temporary solutions. Moreover, the complex gradient structure of cartilage specially in cartilaginous joints, makes it more challenging for regeneration purpose. This often leads to formation of mechanically weaker fibrocartilage or small bony structure instead of healing of healthy articular cartilage. Hence, regeneration of articular cartilage still remains a major problem in medical ground. 3D bioprinting can act as a better alternative to these previously mentioned surgical procedures by providing biomaterials-based 3D scaffolds. Hydrogels are promising delivery systems having good elastic property along with cell encapsulation ability. Therefore, cell-laden hydrogels directly bioprinted on defects can provide better tissue mimicking functionalities. Several studies show that the natural process of cartilage formation in human body follow specific pathways which control certain downregulation of specific genes leading to hypoxic condition which facilitate the chondrocytes proliferation. This study aims to develop photocurable bioink incorporated with drug molecules which should help to achieve the natural healing process by suppressing chondrocyte degradation and enhancing cartilage regeneration. Drug molecules will help to create hypoxic condition in the area, providing cues to the natural cartilage formation process in the body. The mechanical strength of the hydrogel based bioink is another important contributing factor for cellular microenvironment in lineage specific differentiation to chondrocytes and osteocytes. The regenerative property of these cell-encapsulated hydrogel systems will finally be tested in vivo models for establishment of the proof of concept. Overall, this study hypothesises that mimicking natural phenomenon of cartilage formation and providing hypoxic condition by downregulating specific gene, it will be able to effectively help differentiating bone marrow-derived stem cells into chondrocytes leading towards formation of healthy articular cartilaginous tissue.