REPORT

Report on participation of the ICMR International Fellow (ICMR-IF) in Training/Research abroad.

1.	Name and designation of ICMR- IF :		Rajesh Vasita, Assistant Professor,
2.	Address	:	School of Life Sciences, Central University of Gujarat
3.	Frontline area of research in which training/research was carried out	:	Tissue Engineering
4.	Name & address of Professor and host institute	:	Dr. Fabrizio Gelain, Director, Centre for Nanomedicine and tissue engineering, Niguarda Hospital, Milan, Italy
5.	Duration of fellowship with exact date	:	02 October 2023 -17 March 2024
6.	Highlights of work conducted	:	

i) Technique/expertise acquired

PI was trained for reconstitution and characterization of peptide-based scaffold for tissue engineering application. The scaffold was characterized for its morphology by scanning electron and atomic force microscope. The scaffold was biologically characterized for neural tissue engineering application. Mouse neural stem cells were cultured on these scaffolds for their differentiation and proliferation potential.

ii) Research results, including any papers, prepared/submitted for publication

Extra cellular matrix consists of multiple fibrous proteins including collagen, fibronectin, elastin and laminin. The fibronectin (Fn) is one of major cell adhesive proteins responsible for cell adhesion and migration during cell fate process. Fn is subdivided into modulus and modulus contain specific peptide motifs. The type I Fn module contains IGD motif (Q or S), which are motogenic can activate integrins and induce cell migration. Whereas type II & III Fn module mostly participates in cell adhesion to ECM. It contains the RGD motif which promotes cell proliferation and adhesion by triggering specific integrin activation and cell signaling cascade response, through focal adhesion formation. In the present study, IGDQ has been considered as functional motif for design and fabrication of nanofibrous scaffold. A self-assembled peptide sequence Ac-$(LDLK)_3$-NH_2 was selected for fabrication of nanofiber and functionalized with

IGDQ motif. -Whereas RGD functionalized Ac-$(LDLK)_3$-NH_2 sequence was considered as control. The final sequences are H-IGDQ-$(LDLK)_3$-NH_2, H-RGD-$(LDLK)_3$-NH_2 , Ac-$(LDLK)_3$-NH_2.

The self-assembled peptide (SAP) based scaffold was synthesized by solid phase synthesis method, purified and ion-exchanged by the host team. The molecular weight of peptide was characterized by LC-MS. The morphology of nanofiber and scaffold was characterized by scanning electron microscope and atomic force microscope. Murine neural stem cells were cultured on these scaffolds and studied for their migration and differentiation potential.

Development of 3D printed scaffold: TPMS based 3D scaffold was designed and printed for bone tissue engineering application. Three different pore size and pore orientation were selected for design purpose. PI has been trained by Nemo Lab for design and fabrication of TPMS based scaffold bone bone tissue engineering.

Future Studies @ CUG

Due to time constrain remaining biological studies will be executed at CUG. The list of studies involves.

a. Invasion potential of SAP scaffold for cancer cells
b. Utilization of scaffold as an alternative of Matrigel

Conclusion:

This training allowed PI to gather complete theoretical and practical knowledge of peptide-based scaffold and develop analytical skills which will help him a lot in establishing tissue engineering for bone in India. Furthermore, he was trained for advance imaging and handling of stem cells which are unique skill set of our institute and entire western India region.

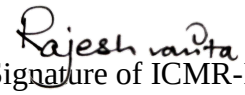
Achievements:

1. Publication: PI is expecting to publish atleast one research article as lead author in near future.
2. MOU with Nemo Lab for development of 3D printed scaffold for bone tissue engineering (Approved by Nemo Lab and pending with CUG for signature). This MOU will enable PI to explore the development of new designs (Artificial intelligence based) of scaffold bone tissue engineering application. Furthermore, it will also allow PI and his student to access the host institute facilities for research purpose.

iii) Proposed utilization of the experience in India :

Since PI laboratory/University has most of the required facility for fabrication and characterization (electrospinning, SEM, AFM, DSC etc) of scaffold, PI will require minimum efforts to extend his training at CUG. The bioprinting, handling and implantation training at host institute helped me to

initiate the new grant writing and collaboration with neighbouring Institutes. The PI will be able to provide consultancy to medical implant industry and clinician who are involved in 3D scaffolding.



Signature of ICMR-IF

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