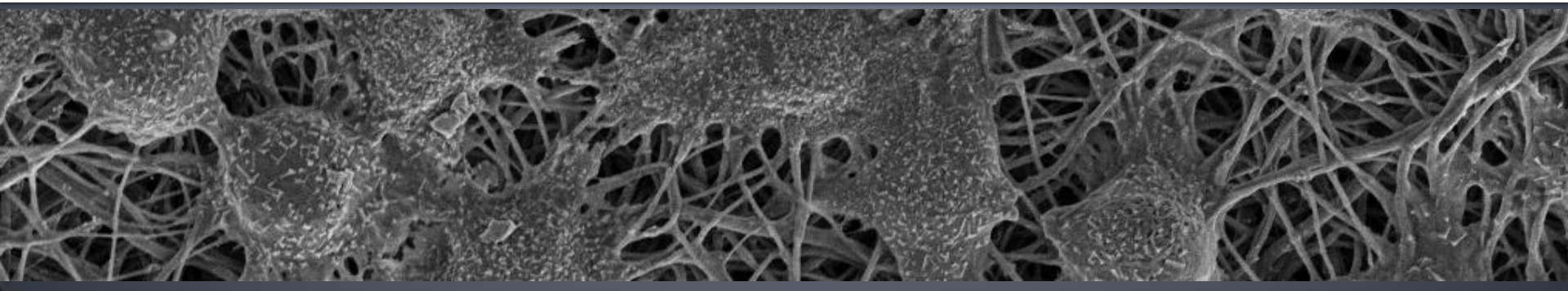
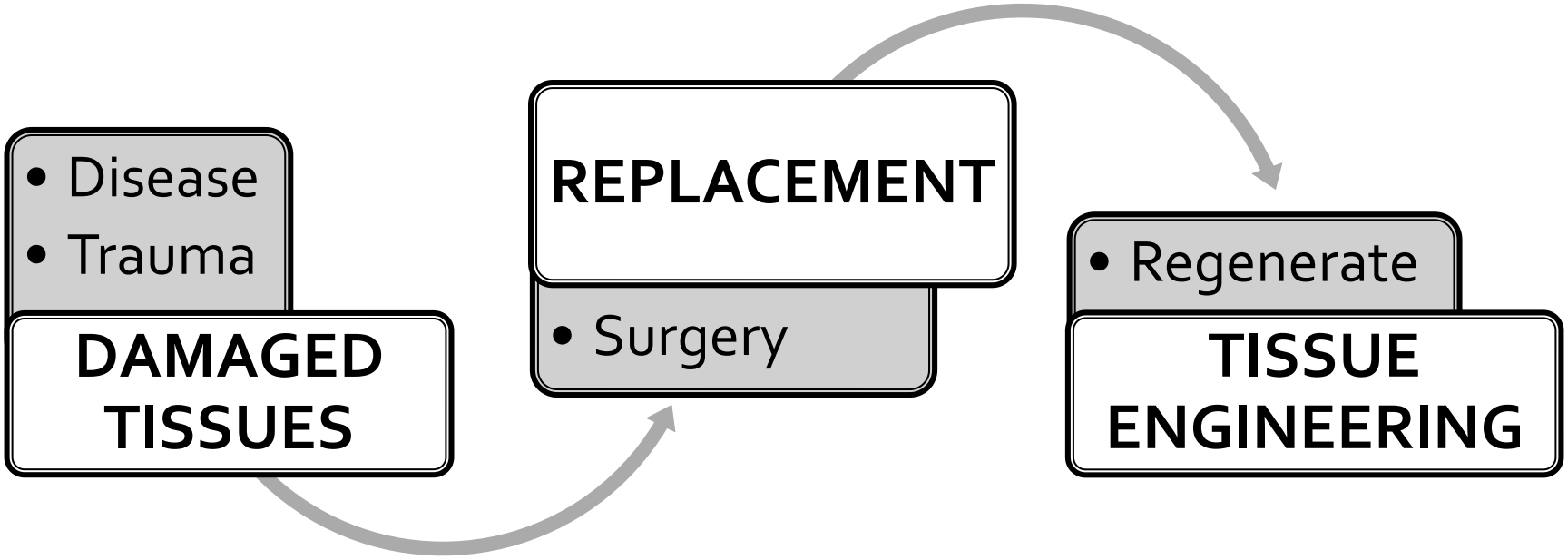
BEST Programme
2016

Magnetically Actuated Smart Textured Fibrous System as a Cell Carrier

Purvi Agiwal
Shilpee Jain



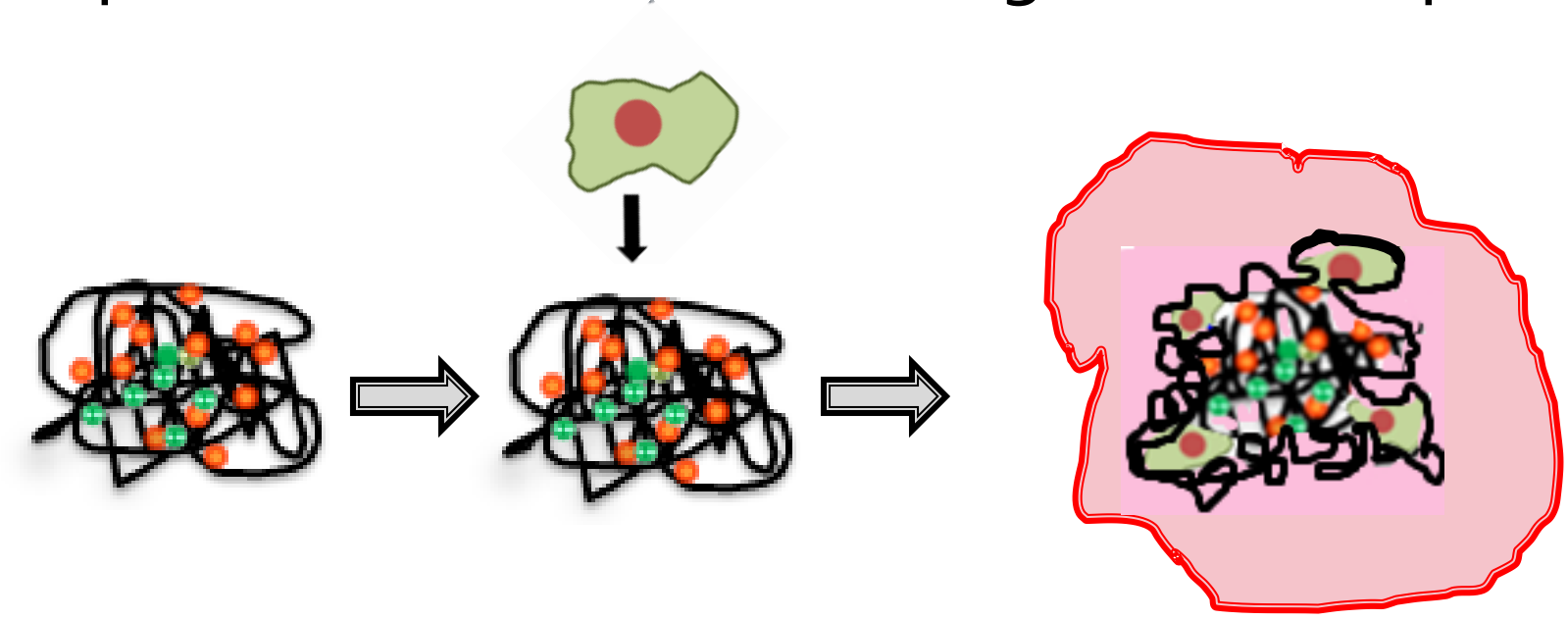
INTRODUCTION



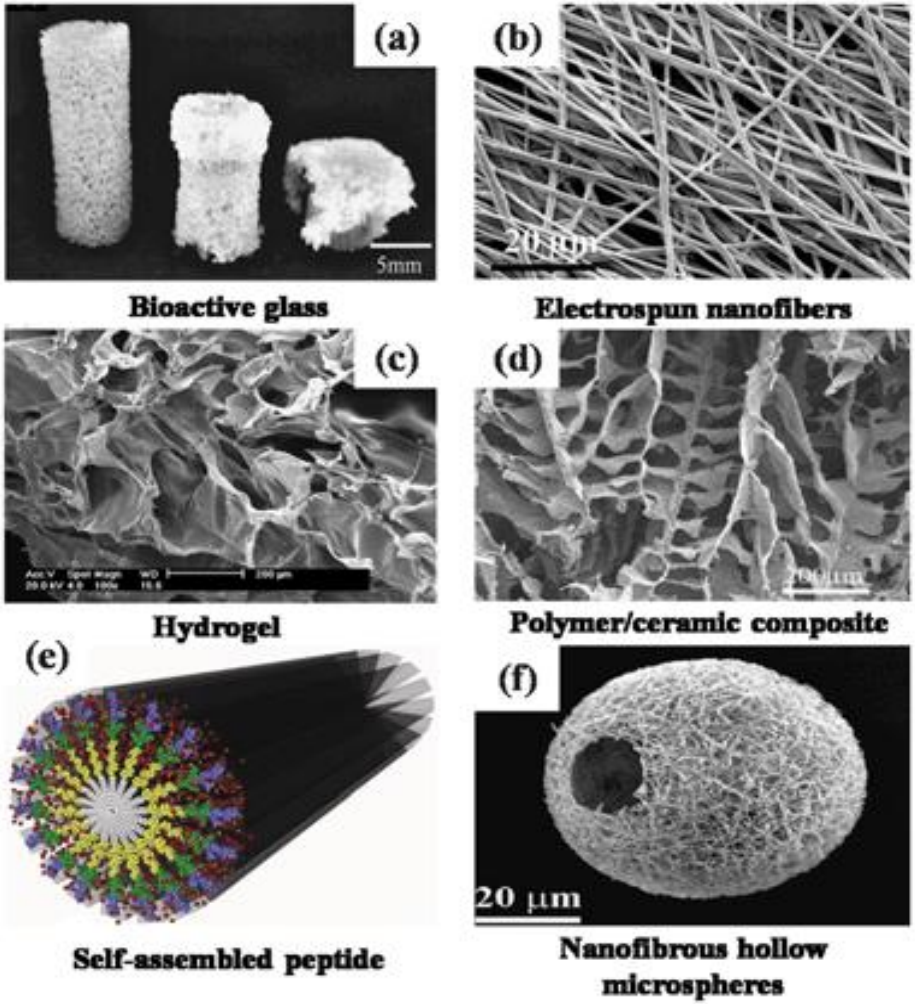
- Develop a carrier scaffold for tissue engineering.
- Overcome the existing limitations constraining classical approaches used in plastic and reconstructive surgery.

OBJECTIVE

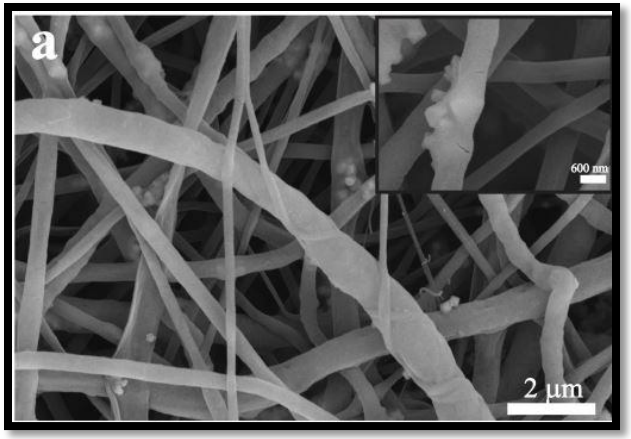
We aim to create a biocompatible scaffold which promotes cell growth and can be implanted with minimum surgical techniques.



SCAFFOLDING



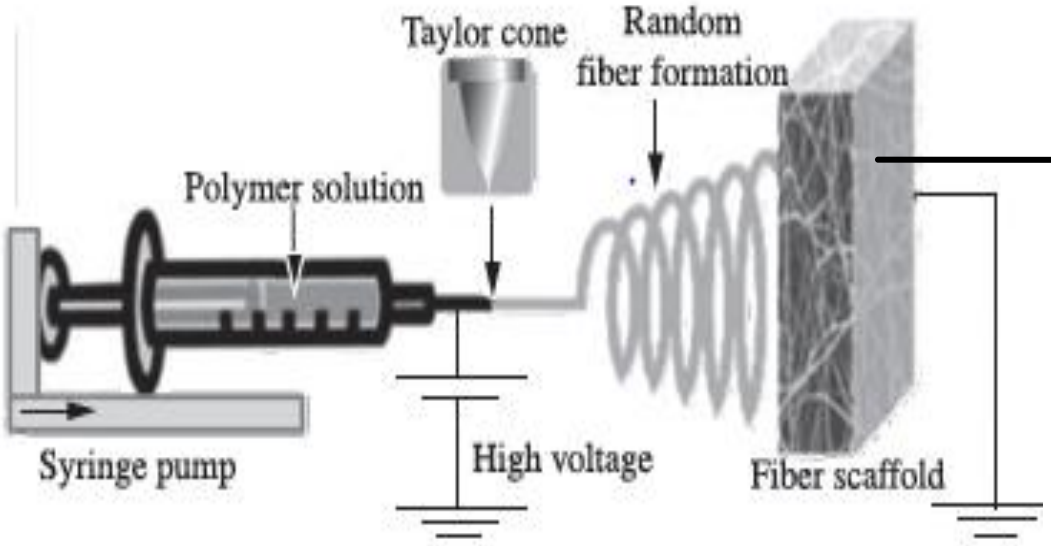
Mitra et al. RSC Adv., 2013, 3, 11073



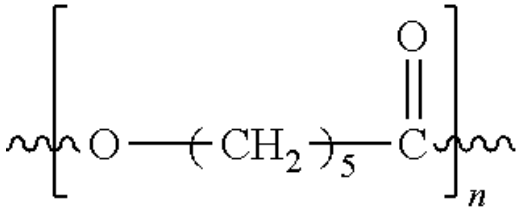
MAST FIBERS

- **BIOCOMPATIBLE**
- **SIMILAR TO 3D ECM**
- **APPLICATION SPECIFIC TEXTURE**

ELECTROSPINNING

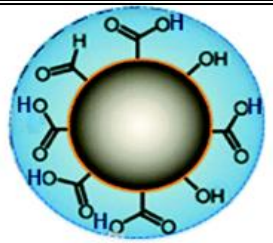


CONSTITUENTS OF THE POLYMER



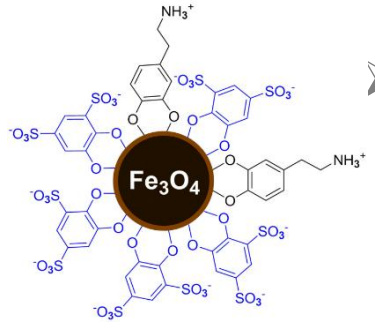
PolyCaprolactone

- Biodegradable polyester
- Ability to promote cell attachment and proliferation



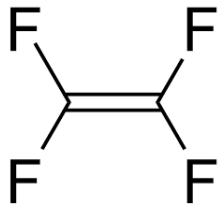
Carbon quantum dots (CQDs)

- Fluorescence Imaging



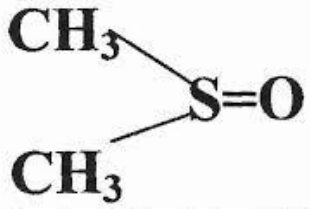
- Navigable in magnetic field

SOLVENTS



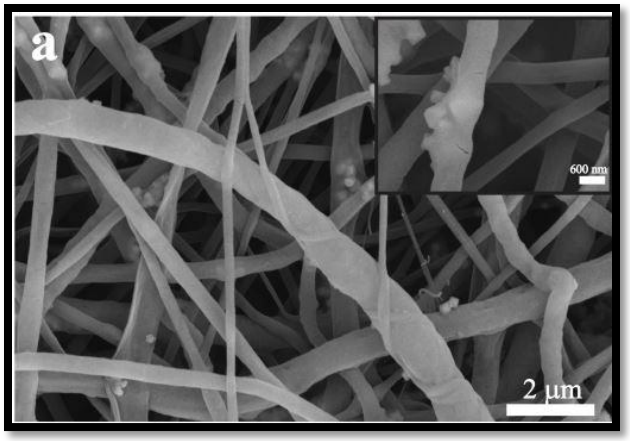
Tetrafluoroethylene

Tetrahydrofuran

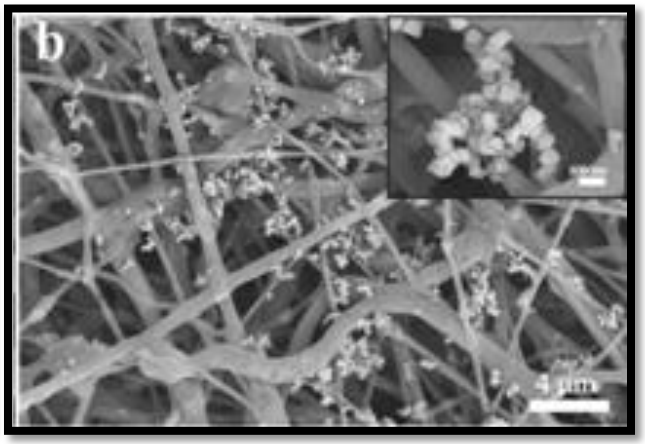


Dimethylsulfoxide

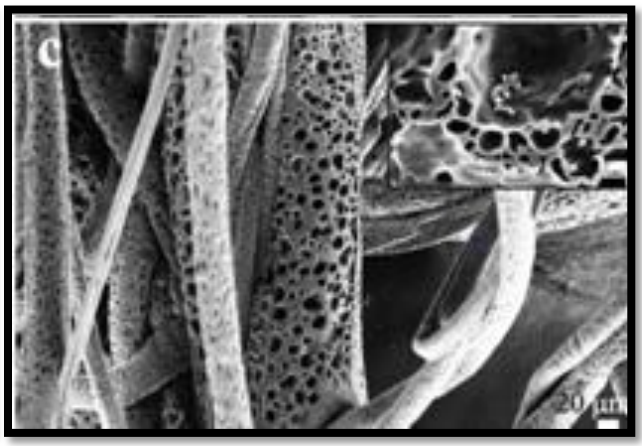
CHARACTERIZATION



SMOOTH



ROUGH



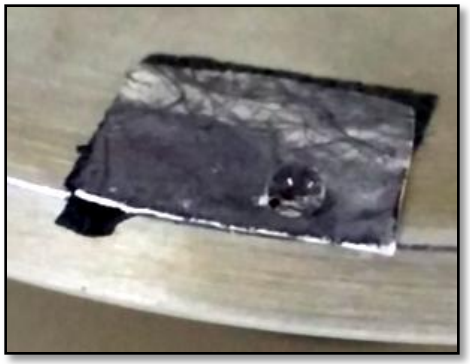
POROUS

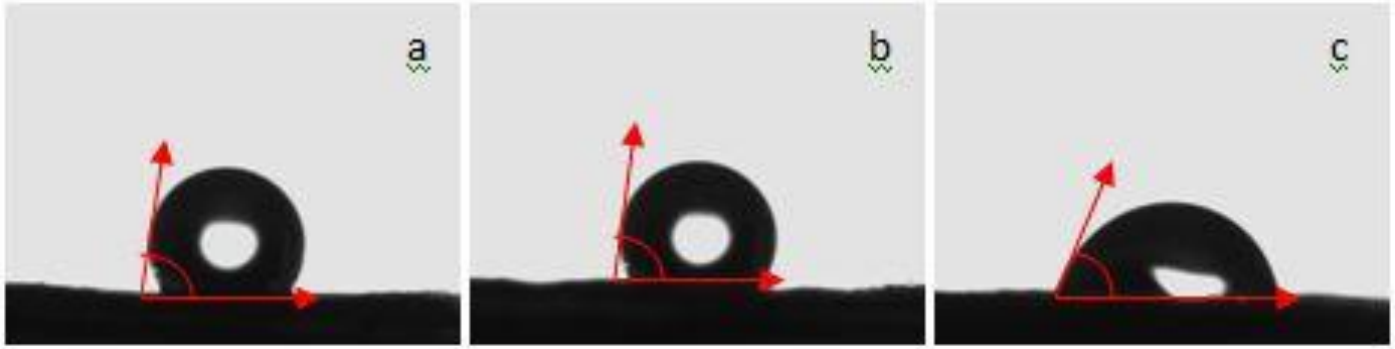
TOTAL PARTICLE CONCENTRATION				SOLVENTS		
	PCL	QDs	MNPs	TFE	THF	DMSO
SMOOTH	0.144g	0.003 g	0.036 g	800 µL	_	_
ROUGH				900 µL	_	100 µL
POROUS				450 µL	450 µL	100 µL

Table 1. Table showing the different concentrations of solvents used to make **1 ml** solution for the fabrication of smooth, rough and porous fibres.

CHECK FOR HYDROPHOBICITY

Water contact angle made with the fibrous mats.

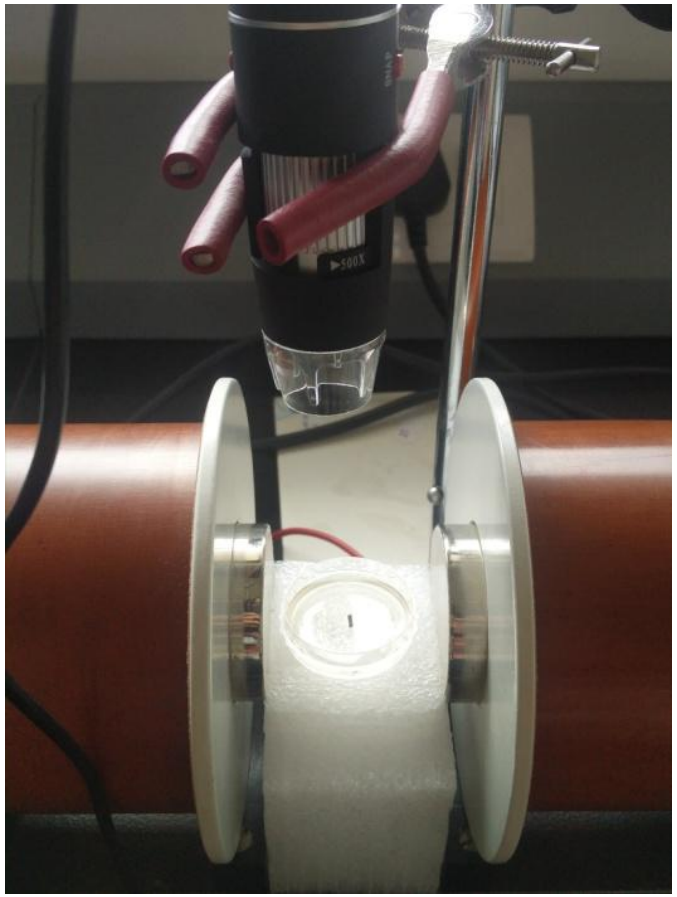




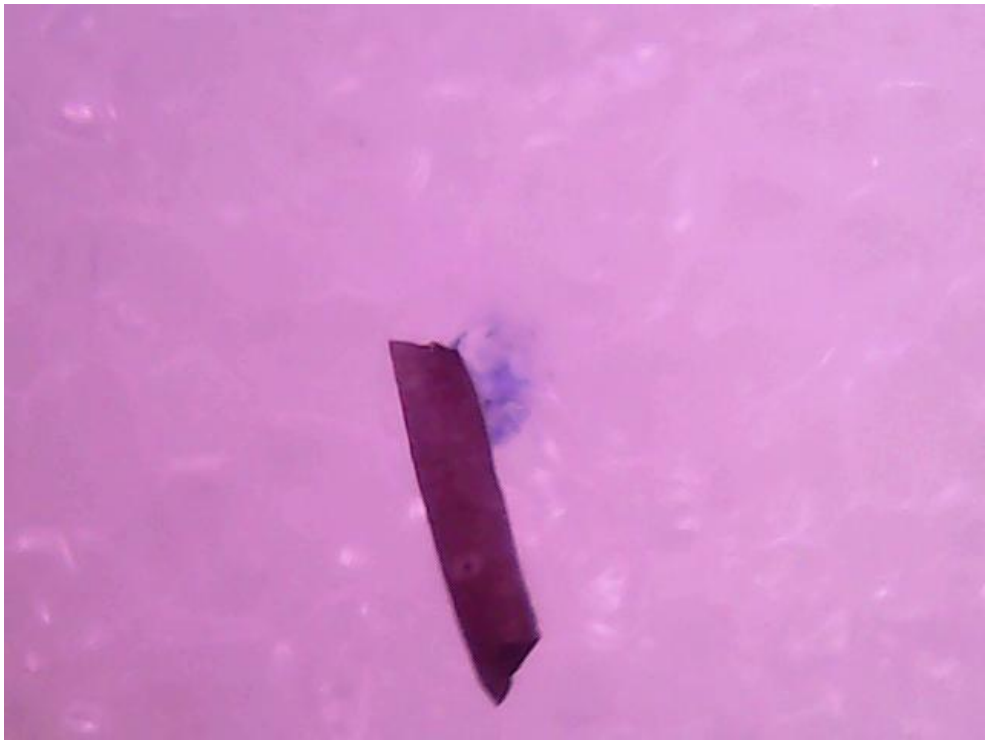
(a) Porous (b) Rough (c) Smooth

At 0 seconds	124°	125°8	112.8°
At 15 seconds	124.8°	125.6°	72 °

MOVEMENT IN MAGNETIC FIELD



Electromagnet setup.



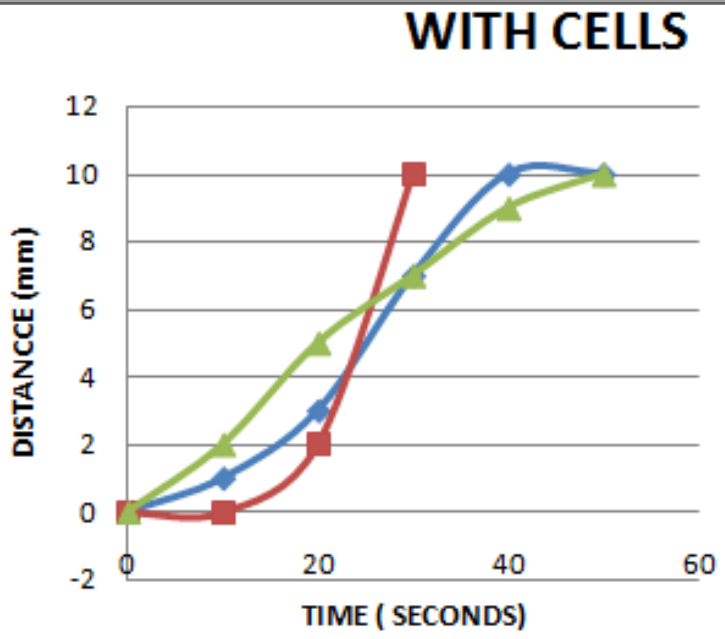
Size : 0.5 **cm**
Speed : 0.416 **mm/s**
Mag Field Gradient : 21 **G/mm**

SPEED OF THE FIBERS IN DIFFERENT MEDIUMS

MEDIUM	FIELD GRADIENT	SMOOTH (mm/s)	ROUGH (mm/s)	POROUS (mm/s)
1 X PBS	25 G/mm	0.324	0.217	0.390
50% FBS	20 G/mm	0.185	0.159	0.21
FBS	22 G/mm	0.11	0.078	0.064
MEDIA	21 G/mm	0.416	0.104	0.153

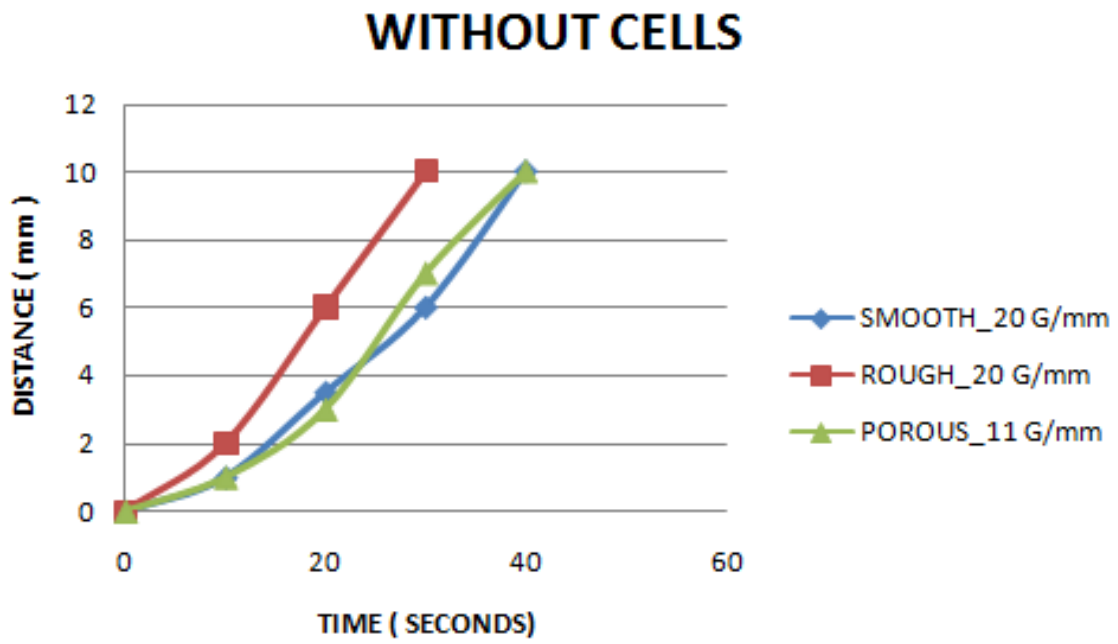
PBS : Phosphate-buffered saline
FBS : Fetal Bovine Serum
MEDIA : DMEM – 10%FBS and 1% antibiotic
SIZE : 0.5 cm

MOVEMENT IN MAGNETIC FIELD



Size if the fibrous mat used :

0.5 cm

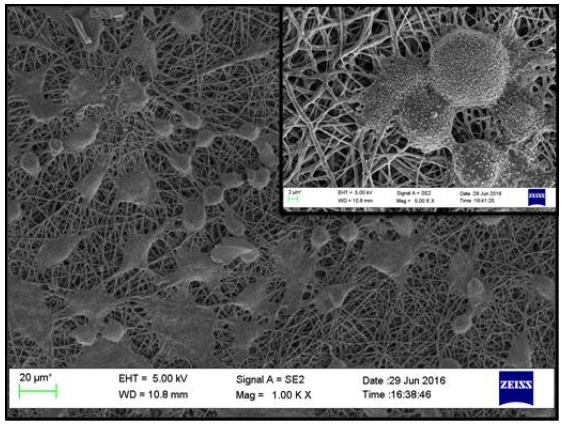


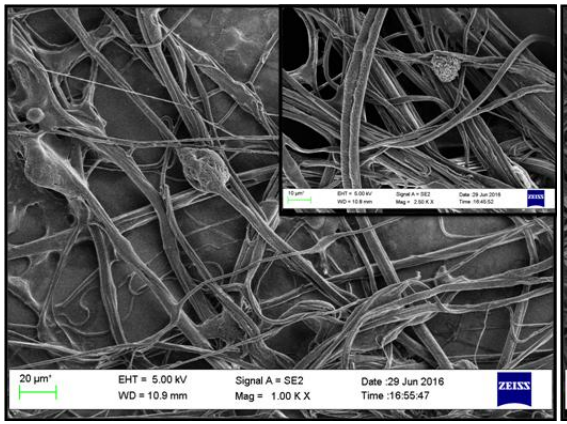
SMOOTH

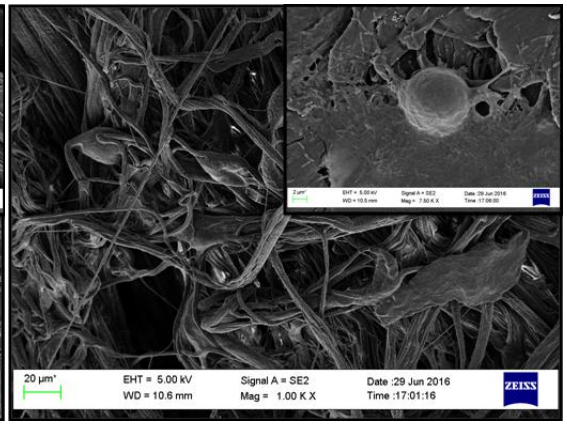
POROUS

ROUGH

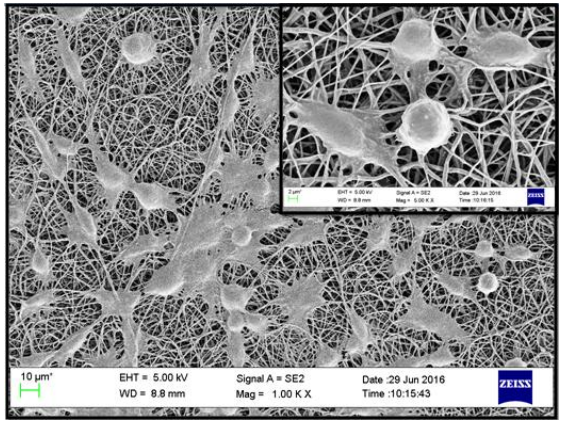
0 Gauss

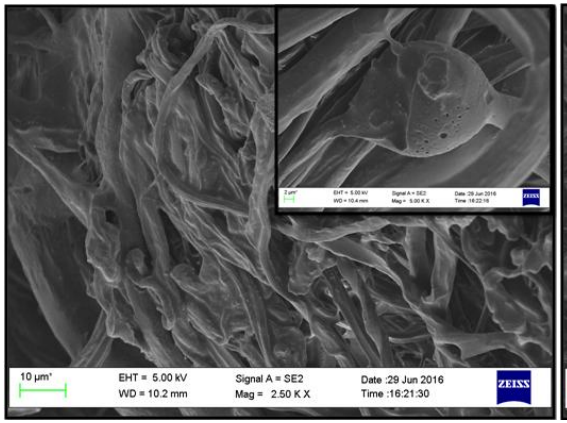


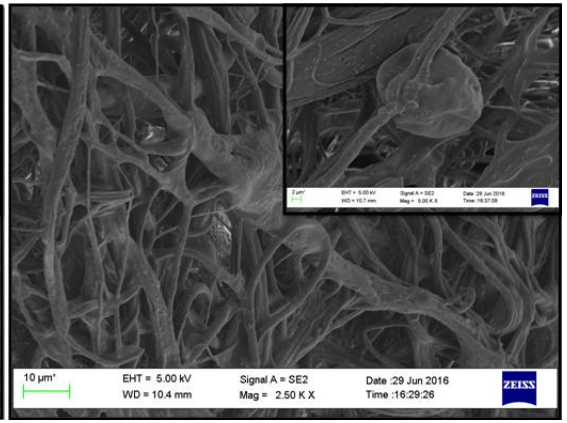




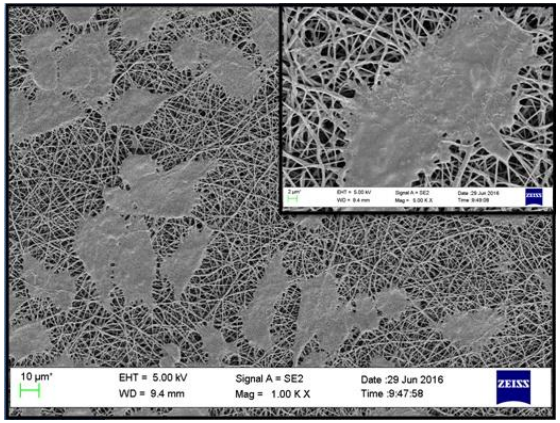
150 Gauss

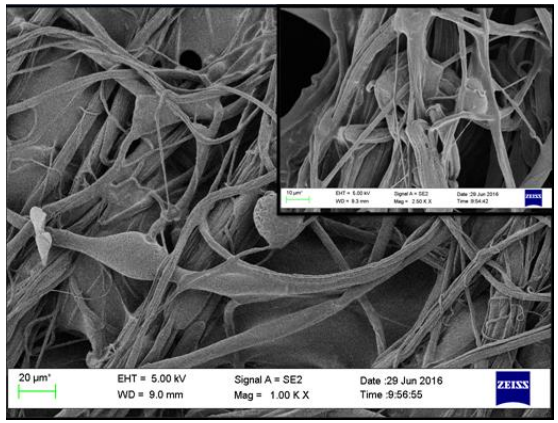


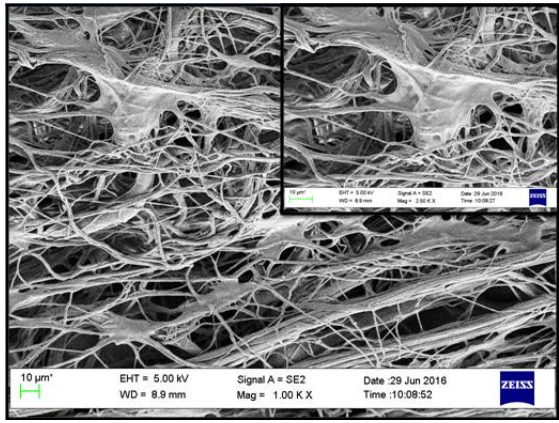




1875 Gauss

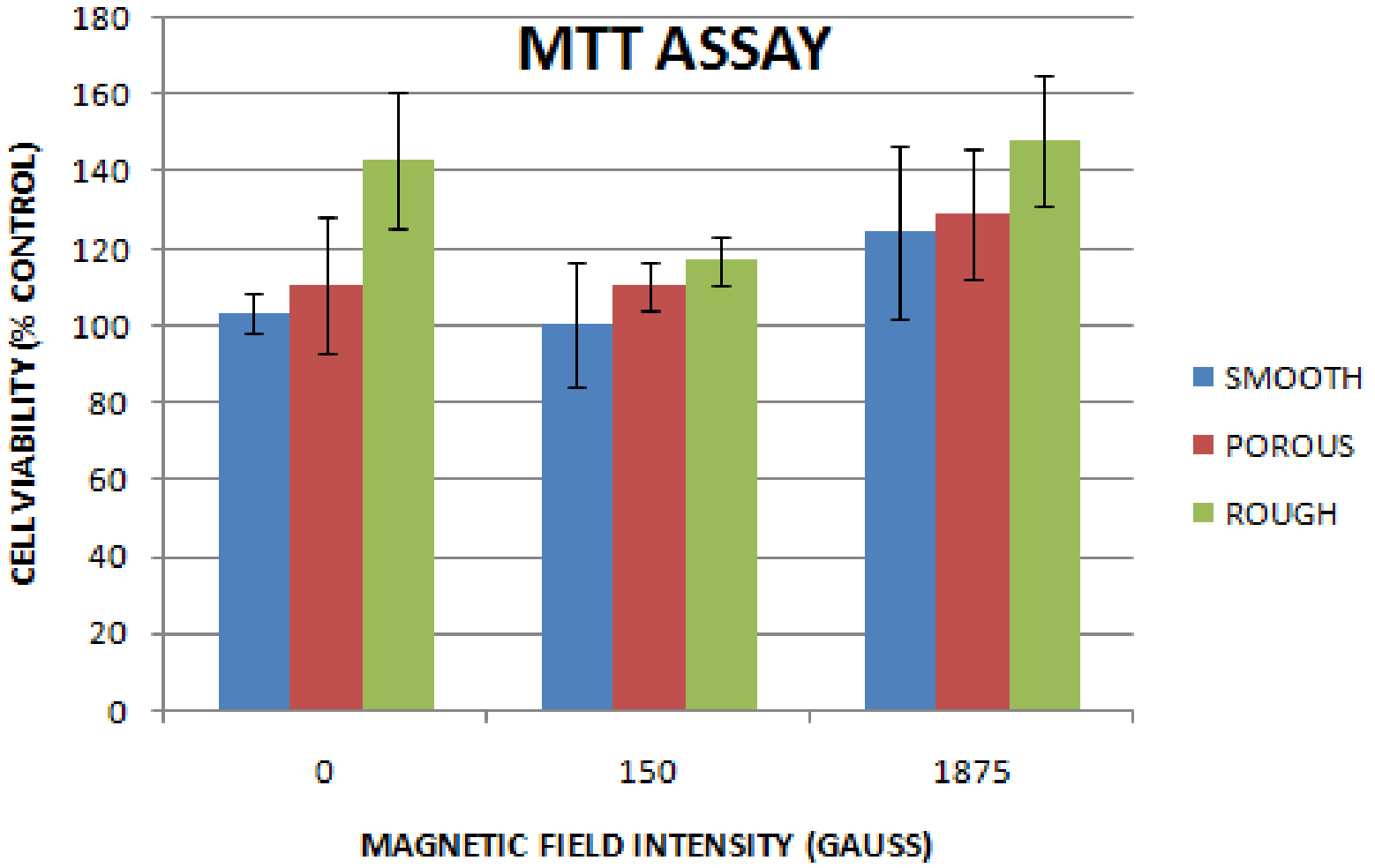






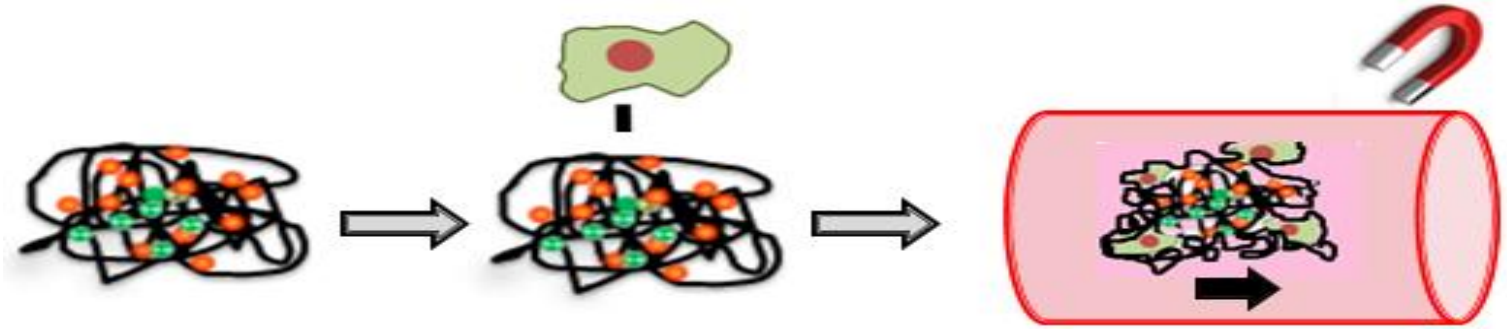
HeLa CELLS WERE EXPOSED FOR 30 MINUTES IN MAGNETIC FIELD

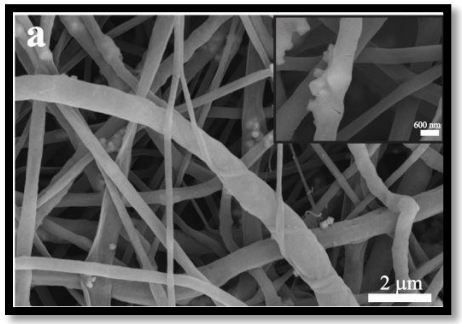
CELL VIABILITY ON FIBERS

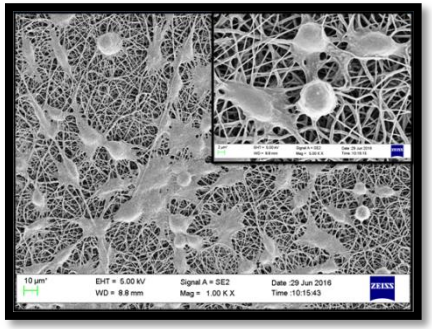


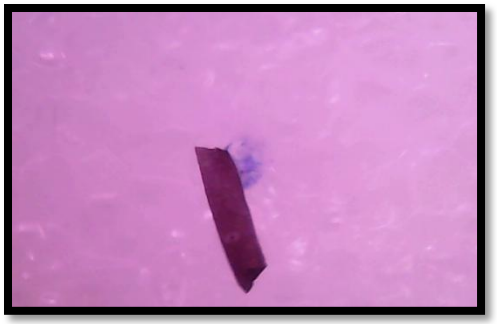
SUMMARY AND FUTURE SCOPE

- Biocompatible
- Supports cell growth
- Navigable with external magnetic field
- Stem Cell delivery









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THANK YOU !