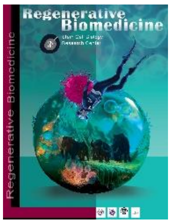

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Workshop Report

Electrospinning Technology Application in Reproductive Sciences: Report of a one- day workshop held at Stem Cell Biology Research Center, Yazd, 12th May 2025

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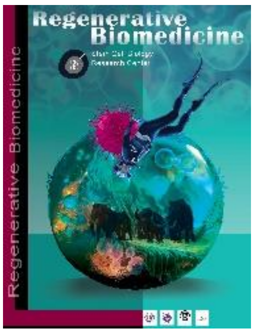
Abstract

A one-day workshop with the title "Electrospinning Technology Application in Reproductive Sciences" was held on May 12, 2025, at the initiative of the Stem Cell Biology Research Center, which is based in the Yazd Reproductive Sciences Institute at Shahid Sadoughi University of Medical Sciences in Yazd, Iran. The purpose of this report is to provide a concise summary of the workshop. During this workshop, participants were given an introduction to the subject of tissue engineering, as well as an explanation of the significance of this field in relation to the reproductive system. Additionally, participants formulated solutions with suitable concentrations of chitosan and polycaprolactone and fabricated nanofiber scaffolds utilizing an electrospinning apparatus. Then, methods for sterilizing and crosslinking nanofiber scaffolds for use in in vitro and in vivo studies are detailed here. Also, they acquired information on how to utilize the ImageJ software to determine the diameter of the generated nanofibers.

Keywords: Electrospinning, ImageJ Software, Nanofiber, Reproductive system, Scaffold



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Introduction

The workshop comprised three components: theoretical, practical, and the utilization of ImageJ software. This particular session was the first time that the field of tissue engineering was presented to the audience. Three primary elements make up the field of tissue engineering: Scaffolds, cells, and growth factors. When these three parameters are adhered to, it is possible to build structures that aid in the regeneration and healing of tissue (1). The scaffolds used in tissue engineering can be made of a variety of materials, including polymers, metals, ceramics, or composites (2). In order for these scaffolds to function properly, they need to possess a number of characteristics. These characteristics include biocompatibility, bioactivity, biodegradability, suitable pore structures for the transport of nutrients and oxygen, as well as the removal of waste, and the ability to support cell adhesion, proliferation, migration, or differentiation (3, 4). The creation of scaffolds for tissue engineering can be accomplished through the use of a wide range of methods, including gas foaming, casting,freeze-drying,electrospinning, and 3D printing, among others (5). Stem cells, adult cells, and even induced pluripotent stem cells are all examples of the varied types of cells that can be exploited in the process of tissue engineering (6).

On the other hand, if growth factors are present in the scaffold, cells will be able to develop and differentiate into the appropriate tissue more efficiently (7).

The purpose of this workshop was to present nanofiber scaffolds and to construct them through the use of electrospinning. A voltage source, a syringe pump, a spinneret, and a fiber collector are the four primary components that make up the electrospinning method. Key elements influencing nanofiber formation include: solution parameters such as polymer molecular weight, polymer concentration, solution conductivity, solution surface tension, and solvent type. Process parameters include flow rate, applied voltage, distance between the needle and collector, needle diameter, and collector type (fixed or movable). Environmental parameters: temperature, humidity level, and velocity of air (8-10). Following an introduction to the electrospinning process, the various uses in the reproductive system were reviewed. Among these applications, we can note the therapy of polycystic ovarian syndrome, promote the growth of ovarian somatic cells and follicles. Endometrial healing, vaginal repair, ovarian, cervical, and prostate cancer, targeted delivery of drugs (11-17). After to the introduction of the operational methodology and various components of the electrospinning apparatus, in the second section, each participant made solutions of chitosan and polycaprolactone at a particular concentration and stirred them to produce a homogenous mixture. The prepared solutions were drawn with a syringe and deposited in an electrospinning machine to produce nanofiber scaffolds. Subsequently, the procedure for crosslinking the scaffolds and sterilizing them for scaffold evaluation testing was elucidated. Crosslinkers can be chemical, physical, or enzymatic. Glutaraldehyde, genipin and formaldehyde can be mentioned as chemical crosslinkers. Gamma radiation, plasma, and dehydrothermal treatment are all examples of physical crosslinking agents. Microbial transglutaminase functions as an enzyme crosslinker (18). Sterilization methods are required to inactivate microscopic pathogens. Heat, chemicals, and radiation are some of the methods that can be employed to sterilize scaffolds (19).

In the final part, the participants were introduced to the ImageJ software. Following the acquisition of electron microscope pictures, this software can be used to calculate the diameter of nanofibers. In this approach, the diameter of a number of nanofibers is measured at random, and the average diameter of the nanofibers is obtained. The resulting data can be reported for the size of the nanofiber diameter.

Conclusion and Future outlook

Participants in this workshop were able to learn about electrospinning technology and its use in the reproductive sciences through an instructive and scientific platform. The scientific value of this session was enhanced by participant collaboration and viewpoint sharing. Considering these results, holding such workshops can pave the way for the expansion of interdisciplinary research and collaboration.

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Declaration of competing interest

There are no declared competing interests.

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