terms of effective loading and controlled release. In vitro drug release studies on PLGA meshes loaded with retinoic acid displayed a prolonged release of the active agent, which reached about 50% of cumulative release in three weeks. Finally, in order to evaluate the influence of different cell culture conditions on the tissue engineered constructs, a home made bioreactor system allowing for the employment of either a perfusion or a rotating wall chamber was designed and is currently under validation.

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Polycaprolactone scaffolds for tissue engineering applications fabricated via Bioextrusion

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Tissue engineering represents an emerging, multidisciplinary scientific field, where a broad range of experts combine their knowledge and efforts in order to produce biological substitutes to restore, maintain or improve tissue function. The most promising approach in tissue engineering involves the seeding of porous, biocompatible/biodegradable 3D scaffolds, with donor cells to promote tissue regeneration. This approach appears to be the dominant method used in tissue engineering because it allows experimental manipulation at three levels to achieve optimal construct: the cells, the polymer scaffolds and the construction method. Scaffolds play a major role in this process, as they represent the initial support for cell attachment, differentiation and proliferation.

The physical/biological characteristics of the scaffolds are mainly tailored by the fabrication techniques. Conventional techniques have been used for a long time to fabricate support structures for tissue engineering, but they present several drawbacks, including a poor control over the pore size, pore interconnection and spatial distribution, the use of toxic solvents and time-consuming manufacturing periods. The combination of Computer Aided Design (CAD) and Additive Fabrication Techniques (AFT) to design and fabricate 3D scaffolds with optimal internal and external architecture to suit different type of cells have shown great potential until now. Nevertheless, the integration of biological requirements in the automated design of scaffolds remains as a major challenge.

In this study, we have applied a novel extrusion based technology called Bioextruder, to produce poly(e-caprolactone) (PCL) porous scaffolds, made by layers of directionally aligned microfilaments. The PCL scaffolds were produced with an approximate channel size of 650µm, filament diameter 250µm and regular geometrical square pores. Disc shape geometry scaffolds, with 25mm diameter were produced exclusively to perform dynamic analysis with a perfusion bioreactor. Some preliminary results, in terms of scaffold physical integrity and biological activity, are presented within this paper.

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Preparation of small diameter vascular grafts by electrospinning of biodegradable/biodegradable polymers

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Conventional vascular prostheses in Poly(ethylene terephthalate) (PET) and Polytetrafluoroethylene (PTFE) are functional for replacement of medium and large calibre vessels (diameter>5mm) but not when employed as small diameter grafts, because of thrombogenicity and compliance mismatch [1,2]. Recently, tissue engineering has emerged as a promising approach to address the shortcomings of current therapies and several opportunities for scaffolds production are arising due to the development of different techniques. In particular, electrospun polymeric meshes are well known for their interconnected, three dimensional porous structure, representing a class of ideal materials to mimic the characteristics of the extracellular matrix [3,4]. This research project aims at the production of arterial small-diameter polymeric grafts through electrospinning, as possible candidates in vascular tissue engineering. For the production of electrospun tubes (4mm diameter) a roto-translating cylindrical collector was specifically designed and employed. A commercial polyurethane (Tecoflex™) and other polymeric systems were electrospun and their mechanical properties analyzed in order to evaluate their suitability as vascular substitutes. Extensibility and compliance of the fibrous meshes were carefully investigated as they were thought to be the main factors determining the performance of the tubular devices, influencing mechanical matching with native arteries at anastomosis. To evaluate the compliance of the electrospun grafts, pressure-volume curves of the produced tubes were obtained by employment of a specific apparatus and compared to those of native arteries and commercial synthetic vascular replacement materials. The slow biodegradation/bioerosion of the commercial polyurethane was thought to be favorable for vascular tissue replacement due to the strong mechanical demands these scaffolds should possess (be perfectly functional right after implantation and provide mechanical support as long as required by new tissue remodeling completion). Scanning electron microscopy (SEM) evaluation of the tubular constructs was also carried out to morphologically characterize the scaffolds both in static and under loading conditions by using a specific SEM apparatus provided with a tensile tester. Citocompatibility essays are