Oriented Cell Growth on a Bio-Inspired Carbon Scaffold from Marine Precursors
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Introduction
Recently, considerable efforts have been made on patterning surfaces of different materials, with controlled dimensions and specific shapes, to promote the oriented growth of cells. These efforts are directed to restore the function of different damaged tissues, as nerve and bone tissue. Particularly, in the case of bone tissue, biological or synthetic tubular constructs with highly aligned architecture pretend to provide the bridge needed for bone regeneration or for improving the distribution of forces on weight-bearing implants1,2. Carbon scaffold produced from the marine plant Juncus maritimus L meets several of the requirements for an ideal cell-oriented conduit as the patterning and the porosity, needed for the nutrient exchange1. The objectives of this work were to test both the cytocompatibility of this marine bio-inspired carbon scaffold and the orientation of the growing cells.

Materials and Methods
Juncus maritimus L was dried and subjected to the pyrolysis process in a furnace up to 500ºC, with well-controlled heating and cooling ramps, to obtain the carbonaceous scaffold. To test the cytotoxicity MC3T3-E1 cells were cultured with the extracts from the material. The cellular orientation was assessed by culturing this cell line directly on the scaffold patterned surface. Scanning Electron Microscopy (SEM), Interferometric Profilometry and Confocal Laser Scanning Microscopy (CLSM) were some of the characterization techniques used.

Results
In Fig.1 SEM micrographs of the patterned surface of the material are shown. The surface patterning for physical guidance consists on a double longitudinally-oriented pattern formed by macro channels of about 60-80 µm in width (A, B) and a secondary micro-channeled structure of 6-8 µm in width (D). Lateral intercalary porosity of 20 µm in diameter (B, C) was also observed.

Fig. 1. SEM micrographs of the patterned surface at different magnifications.

The cell growth after 3 and 2 days of incubation, presented in SEM and CLSM micrographs respectively, is shown in Fig.2. It was observed that cells were contact-guided by the longitudinal patterning, extending their filopodia to the desired direction.

Fig. 2. Incubation of MC3T3-E1 cells on the patterned surface in SEM (A) and CLSM (B).

Conclusions
Bio-inspired carbon scaffold derived from a marine plant was shown to be non-cytotoxic. An oriented growth of MC3T3-E1 cells on its patterned surface was observed.

References

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