Laser Assisted Bioprinting on PCL Electrospun Biopapers
Sylvain Catros¹, Sophia Ziane¹, Anandkumar Nandakumar², Bertrand Guillotin¹, Lorenzo Moroni³, Clemens A. Van Blitterswijk², Olivier Chassande¹, Benoit Rousseau³, Reine Bareille¹, Charlotte Lalande¹, Joëlle Amédée¹, Jean-Christophe Fricain¹, Fabien Guillemot¹
Corresponding Author: sylvaincatros@hotmail.com
¹Inserm U577 “Biomaterials and Tissue Repair”, Victor Segalen Bordeaux 2 University, Bordeaux, France
²Institute for BioMedical Technology (BMTI), University of Twente, Enschede, The Netherlands
³A2 Animal Facility, Victor Segalen Bordeaux 2 University, Bordeaux, France

Introduction
Bioprinting was defined as the layer-by-layer deposit of biologically relevant materials for tissue engineering applications [1]. Laser Assisted Bioprinting (LAB) is an effective bioprinting technology for patterning cells, biomolecules and biomaterials in two dimensions [2,3]. The use of “biopapers”, made of thin matrices or scaffolds, is required to achieve three-dimensional constructs and to reinforce mechanical properties of printed materials [4]. The aim of this study is to produce 3-dimensional composite materials for bone tissue engineering through the combination of PCL electrospun scaffold and Human ADSCs or MG63 cells.

Materials and Methods
The experimental setup for LAB consisted in an infra red laser (Nd:YAG 1064 nm, 30 ns) controlled by a scanner and focused onto a glass ribbon coated with an absorbing layer of titanium (30 nm). Space between ribbon and substrate was 400 µm. The substrate was a Polycaprolactone (PCL) electrospun scaffold: PCL solution (20% w/v in CHCl₃) was loaded into a syringe and electrospun, using a pump and a high voltage generator. Adipose Derived Stromal Cells (ADSC) and MG63 cells lineup were used for LAB experiments. Cells were transfected with Luciferase for cell tracking after printing. The building sequence comprised sequential layers of cells and PCL scaffolds stacked. Then, composite materials were kept in culture for 3 weeks. Live-Dead assays were performed and photon imager analyses were done for cell proliferation quantification.

Results
The results revealed that cells survived the printing process and proliferate in the PCL scaffolds. Cell Pattern was maintained during the first week (Fig 1) but was no more observable after 2 weeks, due to cell proliferation. PCL sheets acted as a shock-absorbing mattress and were easily stacked together.

Discussion and Conclusions
One of the goals of bioprinting-based approach for tissue engineering is to deal with anisotropy and complexity of biological tissue through layer-by-layer deposition. Our general objective is to design original 3-dimensionnal pattern of cells and biomaterials that will reach to a functional tissue. This study has shown that using PCL allows cell patterning by LAB and provides an effective scaffold for cell proliferation.

References

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Disclosures
The authors have no commercial conflict of interest to disclose.