CELL TRACKING WITH POLYSILICON BARCODES

E. Fernández[1 2], R. Gómez[2], E. Ibañez[1], L. Barrios[1], JA. Plaza[2], J. Esteve[2], M. Duch[2], C. Nogués[1]

[1] Dept. Biologia Cel·lular, Fisiologia i Immunologia, Universitat Autònoma de Barcelona,
[2] Instituto de Microelectrónica de Barcelona, IMB- CNM (CSIC). Campus UAB. Spain
E-mail: carme.nogues@uab.es

KEY WORDS: barcodes, polysilicon, cell tracking, in vivo labelling, optical microscope.

In the last years, particles from different materials and patterns have been proposed to adhere cells and track them in culture. At present, to act as a barcode, devices are composed of two or more different materials [1] or are attached to fluorochromes [2] [3], making their design difficult and expensive.

To be used in cell labelling and tracking studies the design of barcodes should accomplish some requirements such as biocompatibility, smallest size as possible, and an easy identifiability under a light microscope. In this work we present an easily reproducible and low-cost design of polysilicon barcodes that accomplish the requirements aforementioned. The codification is a matrix divided into a regular 4 x 2 grid that contains a total of 8 bits (1 or 0) to give a binary data.

Barcodes were added to a culture of human macrophages, and followed-up during several days. The internalization of codes by phagocytosis, their effectiveness for individual cell tracking, and their possible effects on the survival rate were evaluated.

An inverted optical microscope with a 60X objective was employed to localize, identify and photograph the codes inside the cells (Figure 1). Cell survival rate was evaluated in individual cells with (n=38) and without (n=70) a barcode during 10 days and every 24 hours, obtaining comparable results in cells carrying or not a barcode. Cell displacement was also recorded, and results indicated that polysilicon devices didn't induce any citotoxicity or damaging effects.

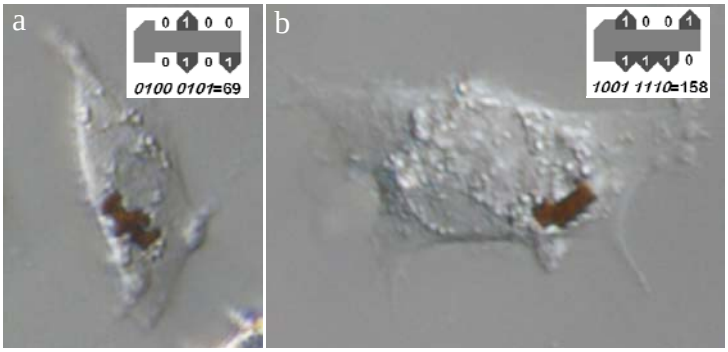

Figure 1.
Two cells with an internalized barcode that corresponds to (a) 69 and (b) 158 decimal numbers. A schematic view of both barcodes is shown in the insert.

[1] A. Bulbarello, S. Sattayasamitsathit, A.G. Crevillen, J. Burdick, S. Mannino, P. Kanatharana, P. Thavarungkul, A. Escarpa, and J. Wang, "Striped Alloy Nanowire Optical Reflectance Barcodes Prepared from a Single Plating Solution" *Small*, **4(5)**, 597-600 (2008).

[2] M. Han X. Gao, J.Z. Su, and S.Nie, "Quantum-dot-tagged microbeads for multiplexed optical coding of biomolecules" *Nat. Biotechnol.*, **19(7)**, 631-635 (2001).

[3] B.K. Oh, J.M. Nam, S.W. Lee, and C.A. Mirkin, "A fluorophore-based bio-barcode amplification assay for proteins" *Small*, **2(1)**, 103-108 (2006).