resolution and signal-to-noise ratio, holotomography represents nowadays one of the best solutions for long term live cell imaging applications.

NANOCELLULOSE AND ITS COMPOSITES IN BIOMEDICAL DEVICES

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Nanosized cellulose (NC) is a material of natural origin obtained by an eco-friendly procedure, in the form of fibrils (NCF) or crystallites (CNC). In particular, CNC prepared by carboxylation and ultrasonic dispersion according to Saito *et al.* [1], are rod-shaped, rigid and regular nanostructures with thickness 3-5 nm and 250-500 nm length[2,3]. The high surface area together with the strong hydrogen bonding and cation coordination capacity, favour the interaction of CNCs with the surrounding species. Accordingly, CNCs are easily dispersed in water, while undergo a layer-by-layer assembly when dried and entangle in soft hydrogels by a cation-driven process. CNC-derived materials show unique features in term of structure and functional properties and are suitable for the fabrication of medical and life science devices. However, the nanotoxicity of CNC as component of biomedical devices is still an open question. In this presentation we will report about the fabrication of CNC hydrogels and their incorporation in nanocomposite materials. The material properties such as microstructure, mechanical performances, and *in vitro* toxicity are also presented.

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NANOCARRIERS FOR NEUROMUSCULAR DISEASES

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Myotonic dystrophy type 1 and 2 (DM1 and DM2) are genetic disorders caused by CTG and CCTG expanded repeats, respectively. The transcribed expanded RNAs accumulate in nuclear foci where splicing factors are sequestered, thus causing a general splicing deregulation in multiple tissues. In both DMs, pathological traits are muscle weakness, dystrophy/atrophy and myotonia, with disabling effects and possibly premature death. Currently, no therapy is available for DMs. Different therapeutic molecules have been successfully tested in experimental models to target the expanded RNAs; however, most of the delivery or toxicity problems remain unsolved. Our research aims at designing a novel therapeutic strategy using biocompatible nanoparticles (NPs) to administer drugs or oligonucleotides able to counteract RNA toxicity in DMs, with special reference to skeletal muscle. Drug-loaded NPs may improve therapeutic efficacy by protecting the encapsulated molecules from enzymatic degradation and ensuring their delivery and sustained release inside the cell. Among the different NPs we tested, poly(lactide-co-glycolide) (PLGA) NPs and hyaluronic acid (HA)-based NPs proved to be highly biocompatible for cultured murine and human myoblasts and myotubes[1,2]. We elucidated the mechanisms of their uptake, distribution and degradation by fluorescence and transmission electron microscopy. We also investigated NPs distribution in explanted mouse skeletal muscles maintained under fluid dynamic conditions[3]. Both PLGA and HA NPs proved to efficiently load pentamidine, one of the promising therapeutic agents, and preliminary results on cultured myoblasts from DM1 patients demonstrated that pentamidine delivered by PLGA NPs reduced the pathological accumulation of nuclear foci with limited cytotoxic effects.

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HYPERTHERMIC NANOPARTICLES TO TRIGGER LIPOLYSIS

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During last years, evidence has been provided on the involvement of obesity in the pathogenesis and aggravation of several life-threatening diseases. In this view, we set up an innovative protocol to induce a nanoparticle-mediated lipolysis *in vitro* by combining light and electron microscopy, and biochemical approaches. Under appropriate administration conditions, 3T3-L1 mouse adipocytes proved to efficiently and safely internalize superparamagnetic iron oxide nanoparticles (SPIONs), which are able to produce heat when subjected to alternating magnetic field[1-3]. Thus, 3T3-L1 adipocytes were submitted to SPIONs-mediated hyperthermia treatment (SMHT), with the aim of modulating their lipid content[4,5]. The treatment resulted in a significant delipidation persisting for at least 24 h, in the absence of cell death, damage or dedifferentiation. Interestingly, some factors normally linked with lipolysis event or in lipid metabolism[6] were not modulated upon SMHT, suggesting the involvement of a novel/alternative mechanism in the lipolysis observed. Notably, the same SMHT was able to induce delipidation also in primary cultures of human adipose-derived adult stem cells. The success of this new approach *in vitro* opens promising perspectives for the application of SMHT in different biomedical fields. Next steps could be the use of SPIONs in an animal model of obesity, to analyze the metabolic pathways activated by the SMHT, and the application of SMHT in an experimental model of cancer in obese mice to study the crosstalk between adipose and tumor tissues.

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