Research (What is	New mechanism of cell death
it about?)	
UNN authors	Pleskova S.N., Gorshkova E.N., Novikov V.V.
We find (The	We demonstrated a new mechanism of cell death induced by upconversion
result)	nanoparticle (UCNPs) called 'mummification'.
Abstract Nanoparticles are increasingly being used for treatment and diagnostic purpo	
	but their effects on cells is not fully understood. Here, the interaction of fluorescent
	upconversion nanoparticles (UCNPs) with neutrophils was investigated by imaging
	and measurement of membrane-cytosceletal elasticity by atomic force microscopy.
	Two types of UCNPs were used: 1) bare F ₃ :Er/Yb UCNPs of 50-100 nm diameter,
	2) protein-coated UCNPs of 300-500 nm diameter at the same concentration.
	It was found that bare UCNPs induce the death of neutrophils mainly by necrosis,
	and to a smaller extent by a novel process called 'mummification'. Necrosis occurs
	by gradual loss of intracellular contents and nuclei, 45-110 min after exposure to
	UCNPs. Mummification is apparent as an increase in the rigidity of the neutrophils'
	membrane and acquisition of a characteristic bumpy shape with numerous
	protrusions; this structure does not change during atomic force microscopy
	scanning.
	Coating UCNPs with protein by incubation with serum leads to (1) formation of
	nanoparticle aggregates in the nm and μ m size range, (2) a reduction in toxicity, (3)
	reduced mummification of neutrophils, and (4) no significant reduction of the
	elasticity of the membrane-cytoskeletal complex of neutrophils 30 min after
	exposure to coated UCNPs. The study shows that serum proteins greatly curb the
	toxicity of nanoparticles and reveals mummification as a novel mechanism of
	UCNPs-induced cell death.

Representative	1. Pleskova S.N., Gorshkova E.N., Novikov V.V., Solioz M.	Q2
articles	Treatment by serum up-conversion nanoparticles in the	
2016-2017,	fluoride matrix changes the mechanism of cell death and the	
quartiles	elasticity of the membrane. Micron. 90, 23-32 (2016).	2
	Q-index (Qi) of the result	3

In collaboration Univ Bern, Dept Clin Res, Murtenstr 35, CH-3008 Bern, Switzerland
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UCNPs

- Neutrophils the most abundant (40% to 70%) type of white blood cells in most mammals.





- (a) Well spread cells showing formation of stress fibers after 20 min;
- (b)) membrane damage and appearance of atypical granules after 80 min;
- (c) poorly spread cells showing a decrease in cell volume and membrane damage after 90 min;
- (d) destruction of the cell by necrosis at 110 min;
- (e)mummification, manifested by the tuberosity on the cell surface and decreased membrane elasticity after 110 min;
- (f) mummification with the emergence of dense cytoplasmic granulation and tuberosity over the surface near the nucleus after 120 min.

