

O.I.Syrma¹
V.M.Skobeeva²
V.O.Ulianov¹

¹Odessa National
Medical University

²Odessa I.I. Mechni-
kov national university

Key words: silver
nanoparticles, skin,
histogenesis.

Received: 07.02.2014
Accepted: 29.02.2014

UDC 535.343:612.017.4

MORPHOLOGICAL CHANGES IN THE SKIN AFTER ADMINISTRATION OF SILVER NA- NOPARTICLES

The study was performed as a part of research work “Modeling responses of biological systems (cells, organs, body) to the effect of damaging factors” (state registration number 0109U008714).

ABSTRACT. Background. Silver nanoparticles are of interest to be used as antimicrobial agents in wound dressings and coatings in medical devices, but potential adverse effects have been reported in the literature. The most pronounced effect of silver nanoparticles and the role of particle size in determining these effects, especially in comparison to silver ions, are largely unknown. **Objective.** To investigate the morphological and functional changes in the skin tissues during intradermal injection of silver nanoparticles. **Methods.** Spherical silver nanoparticles of 30 nm were used. The experiment was performed on 140 Wistar rats. The effect after subcutaneous injection of 0.01 ml of silver nanoparticles solution was examined on the 1st, 3rd, 7th, 14th, 21st, 30th, 45th day. Standard histological techniques were used. **Results.** It was shown that after the injection of silver nanoparticles there is a complex of reactive changes in the skin, which is realized in several phases. Immediately after injection the phase of inflammation begins. Later it is replaced with the phase of regenerative histogenesis with the formation of granulation tissue and further is finished in the phase of adaptive remodeling. **Conclusion.** Morphological and functional changes after the intradermal injection of silver nanoparticles are based on the pattern of normal histogenesis that occurs at the site of injection and do not affect the intact zone.

© O.I.Syrma, V.M.Skobeeva, V.O.Ulianov, 2014
✉ enasyrma@mail.ru

Citation:

Syrma OI, Skobeeva VM, Ulianov VO. [Morphological changes in the skin after administration of silver nanoparticles]. *Morphologia*. 2014;8(1):90-4. Russian.

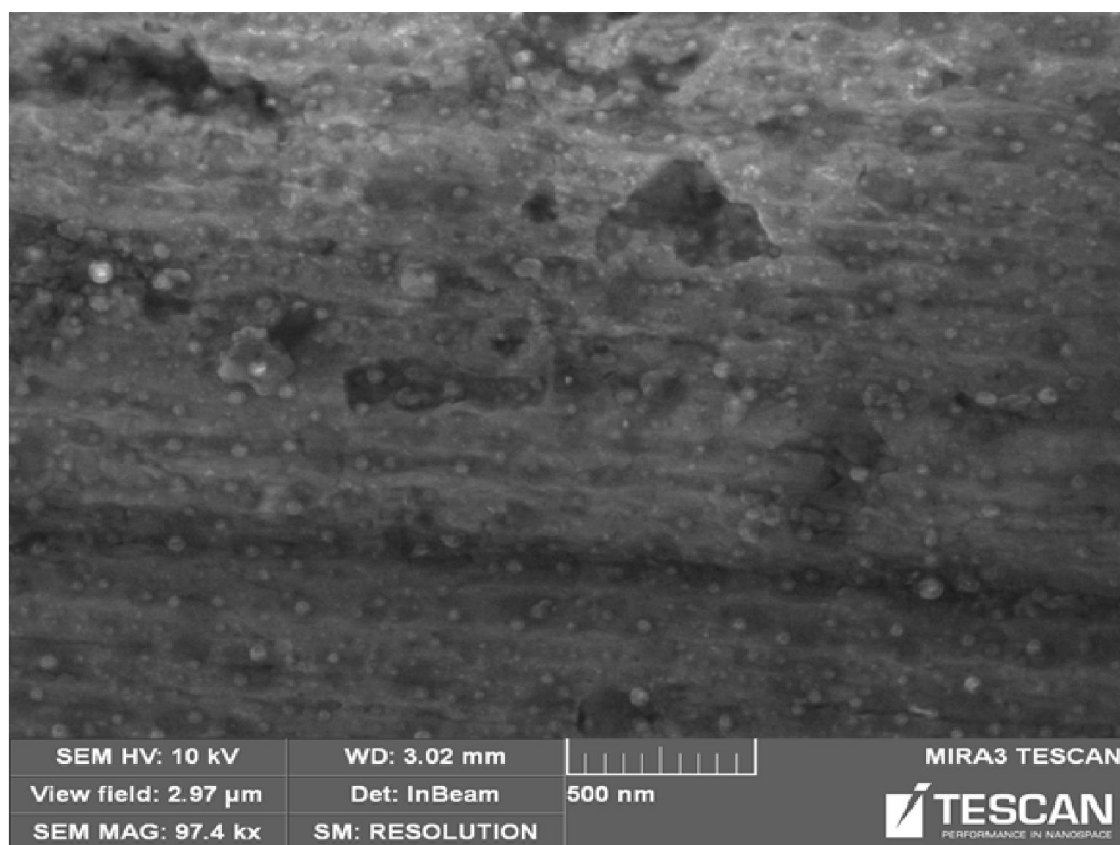


Fig. 1. Image of silver nanoparticles, made with scanning electron microscope.

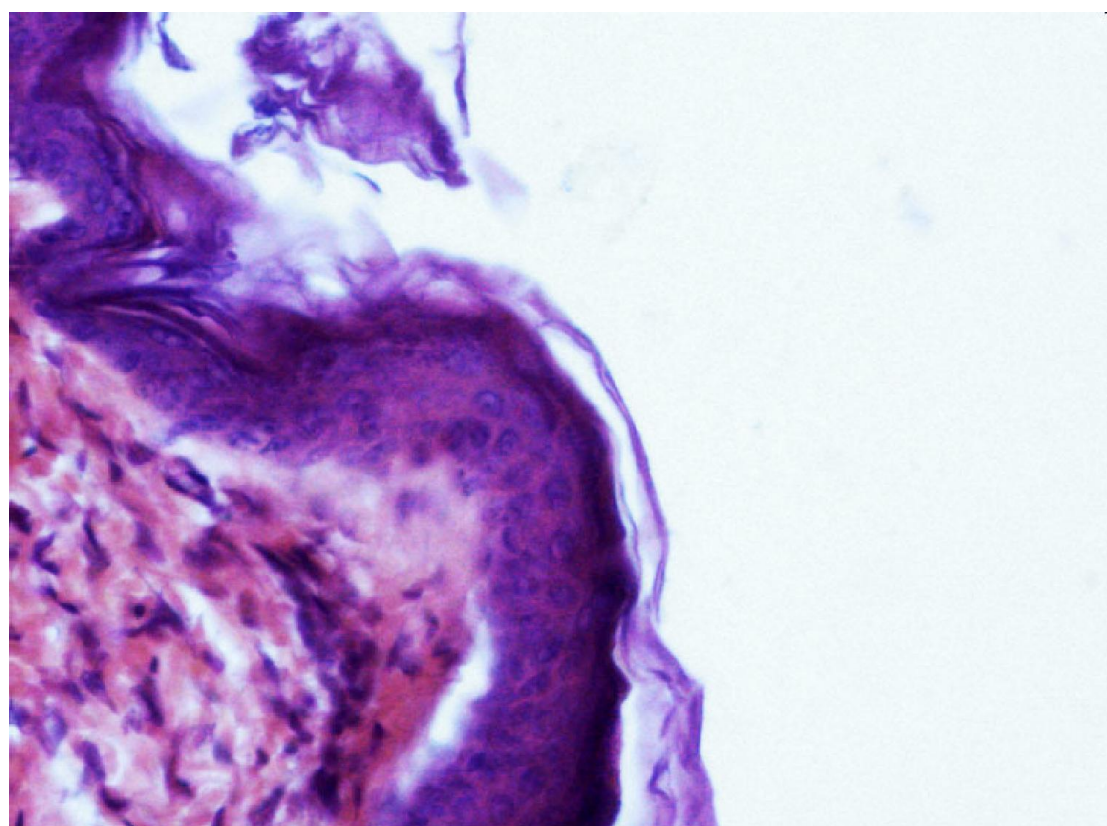


Fig. 2. Skin epidermis of rat on the 7th day after injection. Hematoxylin&Eosin staining. $\times 300$.

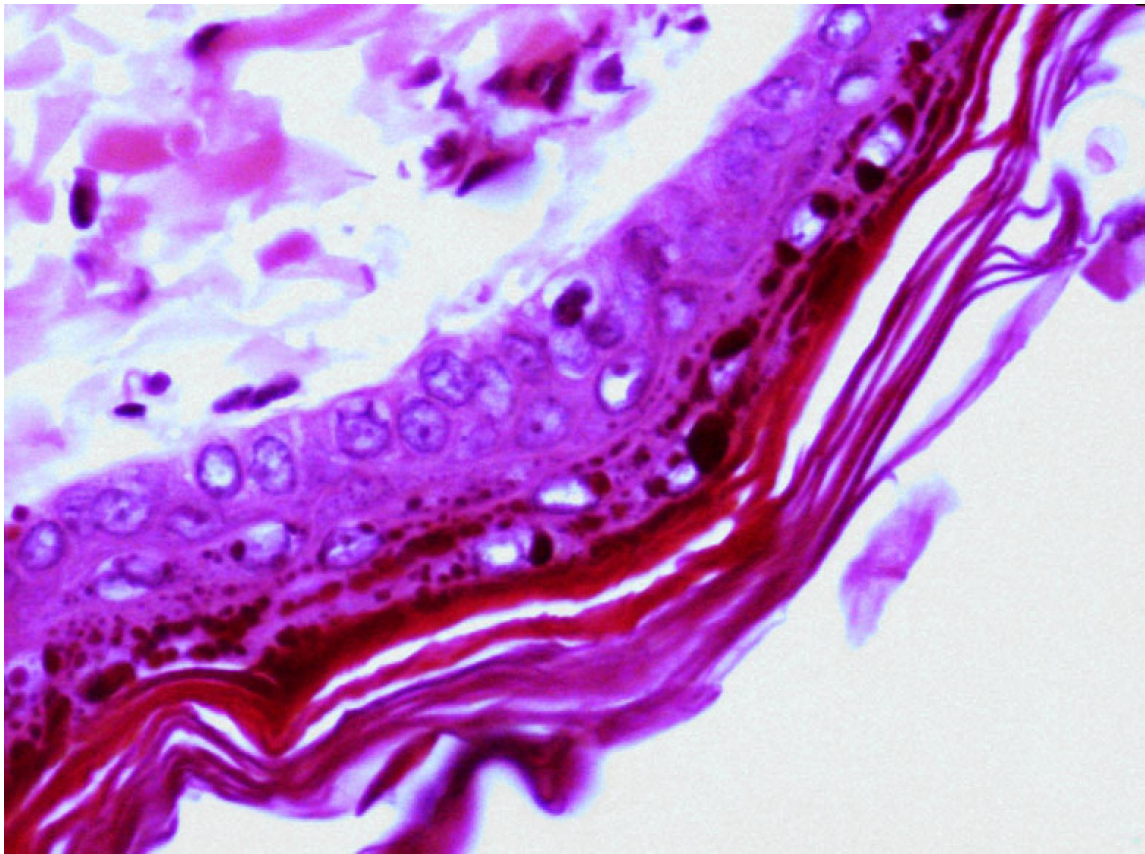


Fig. 3. Skin epidermis of rat on the 21st day after injection. Hematoxylin&Eosin staining. $\times 600$.

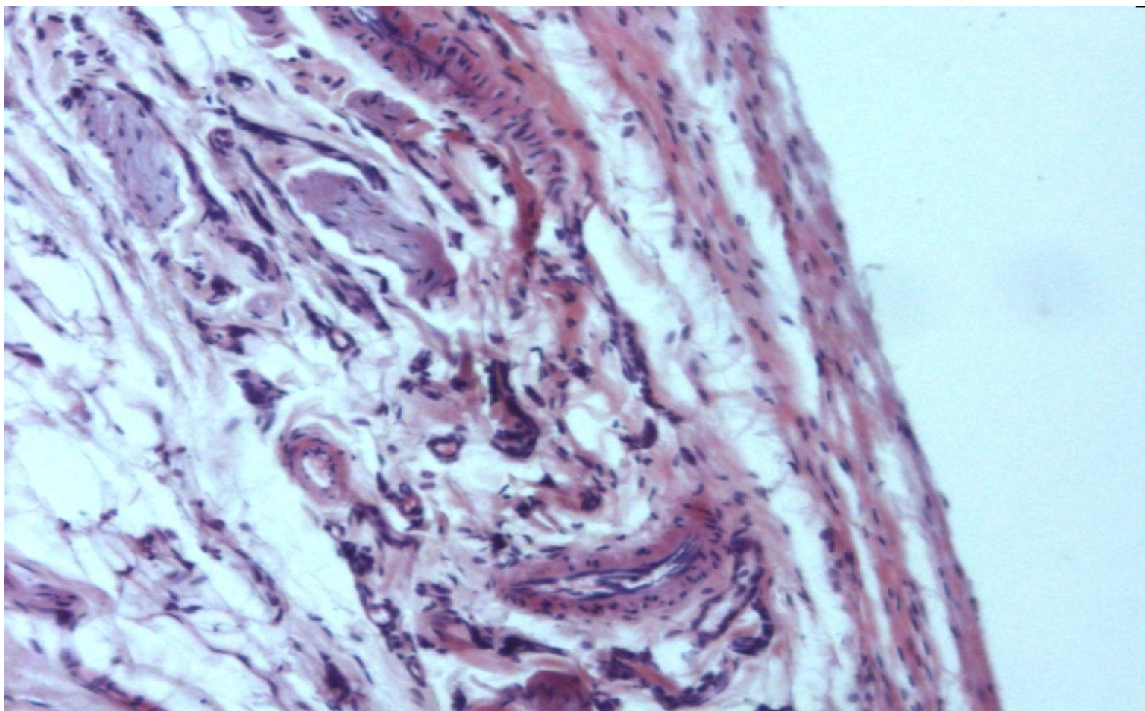


Fig. 4. Skin derma on the 14th day in the place of injection. Hematoxylin&Eosin staining. $\times 300$.

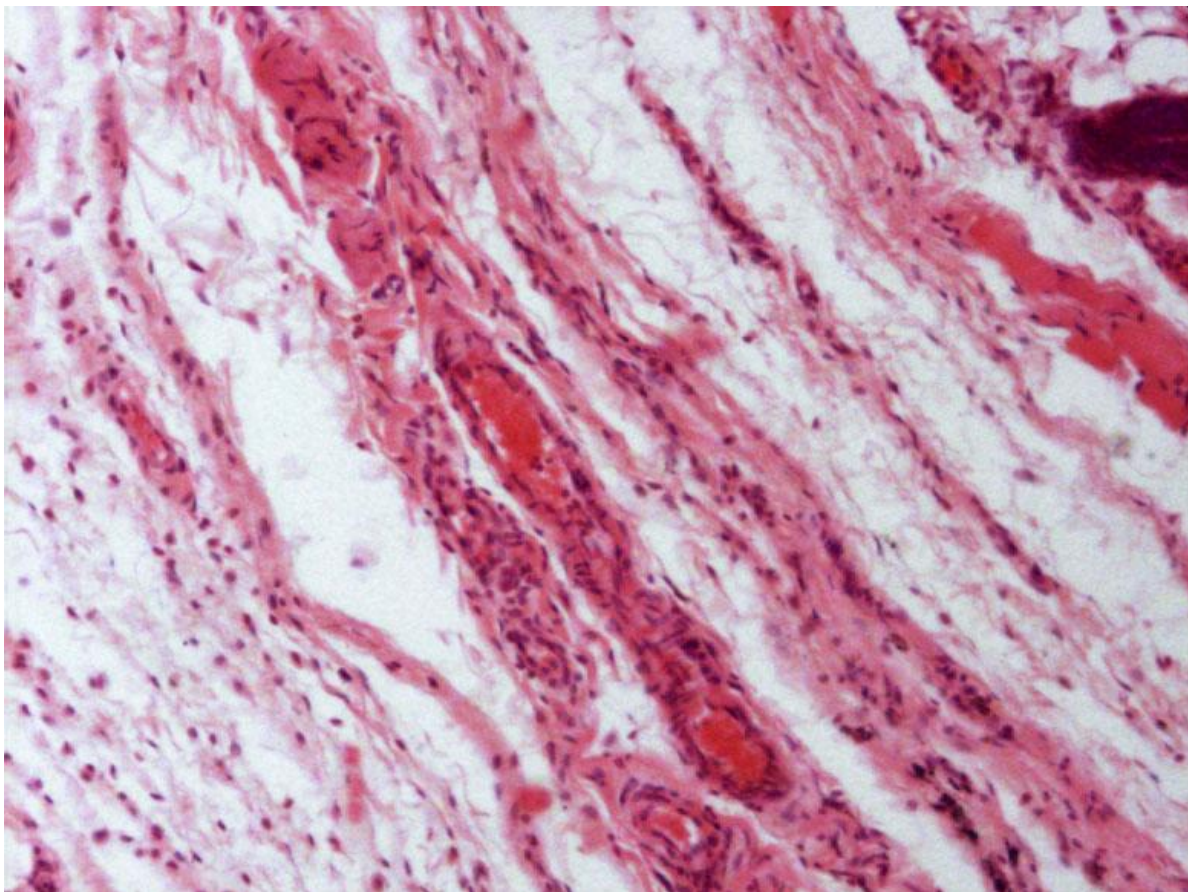


Fig. 5. Skin derma on the 30th day in the place of injection. Hematoxylin&Eosin staining. ×300.

References:

1. Chekman IS., Gorchakova NO., NagornaOO., Nagorna TI. [Nanoparticles: introduction into medical practice]. *Journal of Pharmacology and Pharmacy*. 2010;(10):2-11. Ukrainian.
2. Martínez-Gutierrez F1, Thi EP, Silverman JM, de Oliveira CC, Svensson SL, VandenHoek A, Sánchez EM, Reiner NE, Gaynor EC, Pryzdial EL, Conway EM, Orrantia E, Ruiz F, Av-Gay Y, Bach H. Antibacterial activity, inflammatory response, coagulation and cytotoxicity effects of silver nanoparticles. *Nanomedicine*. 2012 Apr;8(3):328-36. doi: 10.1016/j.nano. 2011.06.014. Cited in: PubMed; PMID: 21718674/
3. Gotsulskyy VYa, Chechko VE, Zaremba VG. [Correlometer for random pulse signals]. *Pri-bory i Tekhnika Eksperimenta*. 1997;(2):161-2. Russian
4. Sarkisov DS, Perov YuL, editors. [Microscopic technique: manual]. Moscow: Meditsina; 1996. 544 p. Russian.

5. Klishov AA. [Histogenesis and tissue regeneration]. Leningrad: Meditsina; 1984.232 p. Russian
6. Miadelets OD, Adaskevich VP. [Morphofunctional dermatology]. Moscow: Meditsinskaiialiteratura; 2006.735 p. Russian
7. Musina LA, Muslumov SA, Lebedev AI, Zykov OV. [The role of macrophages in the regeneration of connective tissue when biomaterials implanted]. Actual issues of pathology: Healthcare of Bashkortostan. 2004; (4): 146-9. Russian.
8. Kwan KH, Liu X, To MK, Yeung KW, Ho CM, Wong KK. Modulation of collagen alignment by silver nanoparticles results in better mechanical properties in wound healing. Nanomedicine. 2011 Aug;7(4):497-504. doi: 10.1016/j.nano.2011.01.003. Cited in: PubMed; 21272666.