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In vivo exposure to Ag nanoparticles leads to internalization of Ag ions and cellular structure alterations

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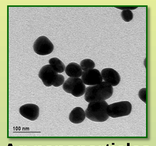
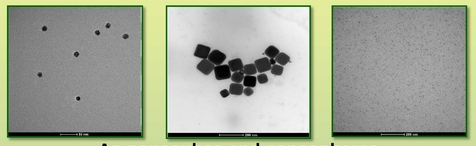
Hypothesis

Silver nanoparticles (Ag-NPs) will provoke effects on different levels of biological complexity. If Ag^+ and not Ag-NPs enter the cells then Ag^+ will be found in metal storing granules of exposed tissue and will co-localize with copper, a marker of the locations of metal storing granules. If Ag^+ enters cells they will be removed from the cytoplasm and no severe toxicity will occurred.



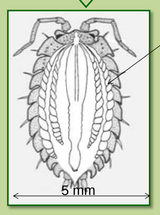
Ag nanoparticles
Sigma-Aldrich



Ag nanocubes and nanospheres
Institute of Nanoscience of Aragon (INA)

Ingestion of Ag-NPs

Exposure concentration 0.03 to 5000 µg of Ag/g dry food.



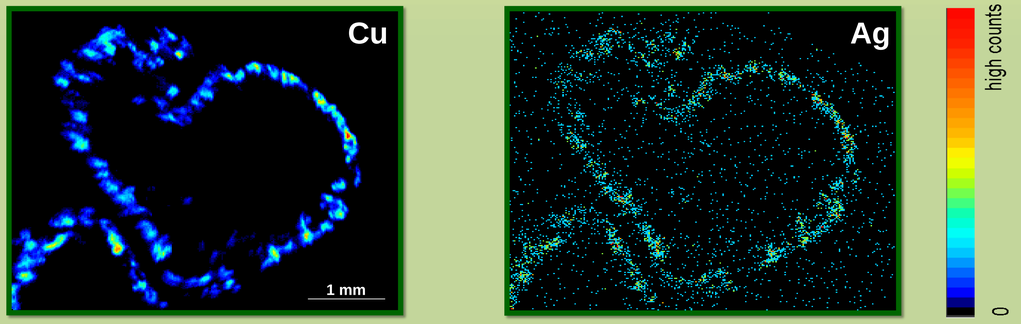
Porcellio scaber
(Ispoda, Crustacea)

Digestive gland- MODEL TISSUE

➢**No effect** on mortality, weight change or feeding rate of animals after 14 days of feeding with Ag-NPs spiked food.

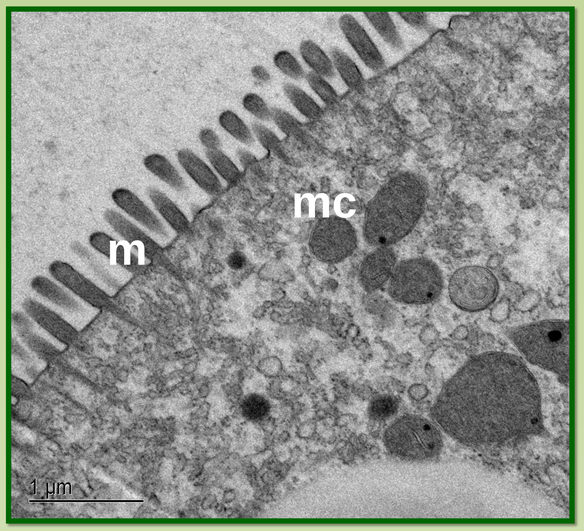
Do Ag-NPs or Ag^+ enter the digestive gland cells?

Particle induced X-ray emission analyses of cross section of digestive gland of animal exposed to Ag-NPs

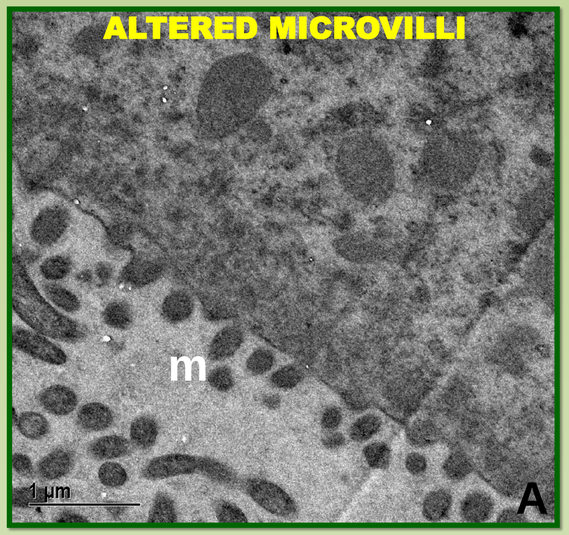


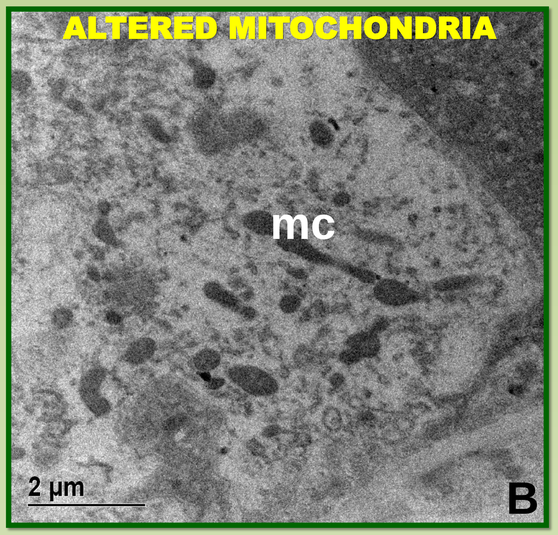
Ag co-localised with Cu in metal storing granules ⟶ Ag^+ rather than Ag-NPs particles entered the cells.

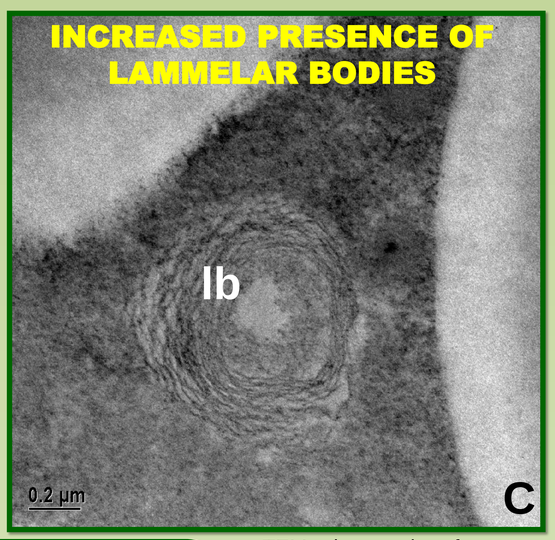
Transmission electron microscopy (TEM) of digestive glands exposed to Ag-NPs



TEM micrograph of cross section of digestive gland cell of control animal.
(mc) mitochondria,
(m) microvili.







TEM micrographs of cross section of digestive gland cell of an animal exposed to 5000 µg Ag-NPs/g dry food.
(A) altered microvilli (m),
(B) altered mitochondria (mc),
(C) example of lamellar body (lb) found in the cell of exposed animal.

Conclusions

➢Ag^+ and not Ag-NPs enter the digestive gland cells after ingestion of different Ag nanoparticles.

➢Clasical toxicological parameters did not show any toxicity of different Ag-NPs.

➢Increased presence of lammelar bodies indicates either a removal of internalized Ag^+ or a disturbance in lipid metabolism.

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