# 纳米银神经毒性效应及其分子作用机制研究

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由于抗菌谱广、活性强等特点，纳米银作为抗菌剂在医学等领域中得到了广泛的应用[1]。在纳米银推广应用的同时，其潜在的毒性效应与健康风险引起了人们极大的关注[2]。我们通过对新生大鼠进行为期三个月的纳米银经鼻给药实验，探讨了纳米银潜在的神经毒理学效应。研究发现，纳米银可导致实验动物神经行为学发生明显改变，表现为在转轴上平衡能力的下降与在旷场中自主探索行为的减弱。脑组织银含量分析显示，虽然与银离子相比，纳米银的生物富集效应相对较低，但它可以靶向性地在脑组织中长期累积，并且这种累积并不因停药而削弱。组织病理学分析显示纳米银可引起大鼠小脑颗粒层细胞凋亡，小脑颗粒细胞钙通道蛋白表达也呈暴露剂量相关式下调。离体细胞实验表明纳米银可通过诱导神经细胞氧化胁迫，活化caspase-3，从而引起细胞凋亡，维生素E的引入可改善由纳米银引起的神经细胞毒性效应。这些研究发现为客观评价纳米银生物安全性风险提供了重要的科学依据。

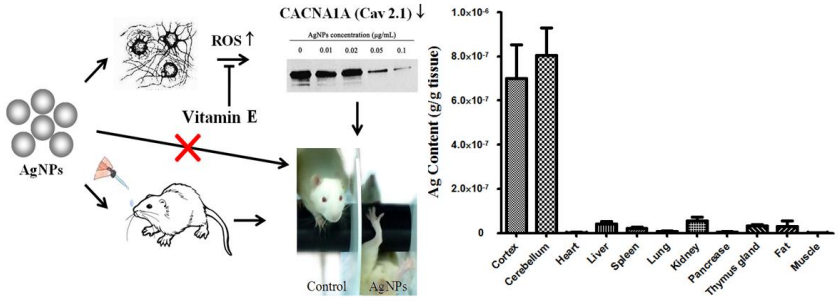


**Fig. 1** Intranasal instillation of nanosilver caused brain-targeted silver accumulation and neurotoxicological effects

**关键词：**纳米银；神经毒性；分子机制；脑靶向性；钙通道蛋白

## 参考文献

[1] Wilson Center, Project on Emerging Nanotechnologies. Washington, DC: **2015**.

[2] Seltenrich, N. *Environ. health pers.* **2013**, **121**: A220.

# Neurotoxicological Effects of Nanosilver and Its Molecular Mechanisms

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Due to the excellent antimicrobial activities of nanosilver, it has been widely used in diverse aspects including daily supplies and medical care etc. The risks and benefits of nanosilver are being hotly discussed and weighted. We performed intranasal instillation of nanosilver in neonatal rats for three months. The results showed that nanosilver exposure caused brain-targeted silver accumulation and subsequent neurotoxicological toxicities. Decreased balance ability and reduced activities were observed in nanosilver exposed rats based on rotarod tests and open filed experiments. Nanosilver exposure induced histopathological alterations in rat cerebellum and decreased the expression of CACNA1A. Oxidative stress in nanosilver-stimulated granular cells was responsible for the cell apoptosis and subsequent neurotoxicities, which could be attenuated by the administration of Vitamin E. These findings provided the substantial scientific evidences for the risk assessment on the bio-safety of nanosilver.