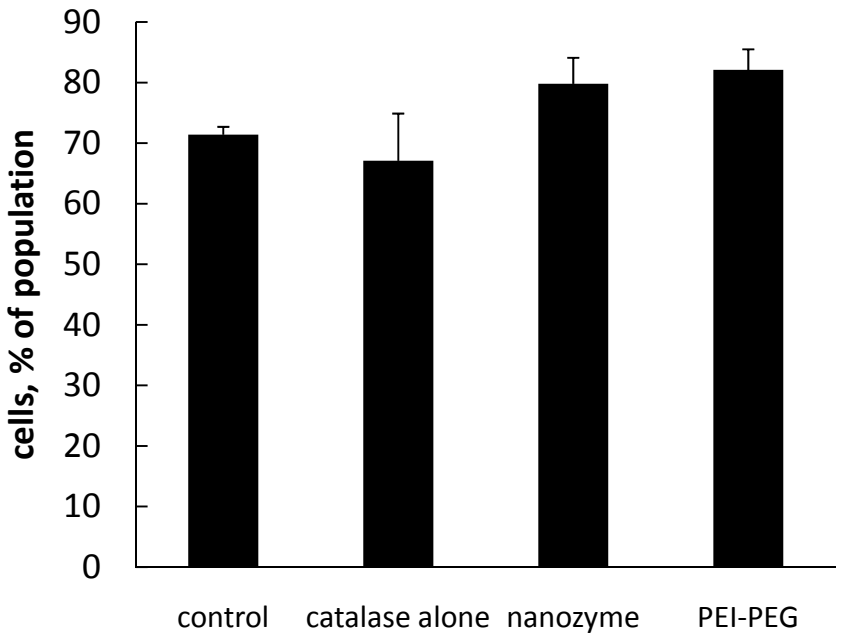

Figure 1S. Effect of nanozymes on integrin α-4β1 expression in BMM.

The cells were incubated with catalase alone, catalase nanozyme, or PEI-PEG for two hours. Following incubation BMM were stained with anti-CD49 antibodies and α4 integrin expression was evaluated by Fluorescence Activated Cell Sorting (FACS) analysis. Results indicated that catalase, block copolymer (PEI-PEG) alone, or nanozyme did not alter expression of α4 integrin, a protein that allows BMM to pass into the CNS. Values are means ± SEM for six samples per group, and $p>0.1$.

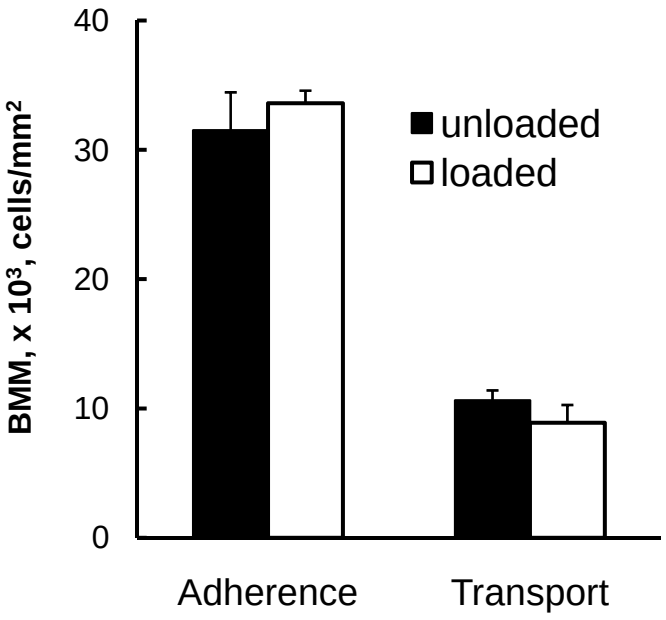

Figure 2S. Effect of nanozyme loading on BMM migration across BBMEC

BMM adherence and transport was studied in an in vitro model of BBB, confluent bovine brain microvessel endothelial cell (BBMEC) monolayers. BMM labeled with Alexa Fluor 680 were loaded with catalase nanozyme for one hour (Z=1), washed, and then added to BMVEC monolayers ($6x10^5$ cells/well) for adherence studies. BMM without nanozyme were used as a control. Migratory activity of BMM over six hours across BBMEC monolayers grown on membranes was evaluated in chambers with the chemoattractant, macrophage chemotactic factor-1 (MCP-1) (150 ng/ml) placed into the receiver chamber. No effect of nanozyme loading on the basic functions of BMM was demonstrated. The values are means ± SEM for six replicates (adherence studies) and triplicates (migratory activity studies), and $p>0.1$.

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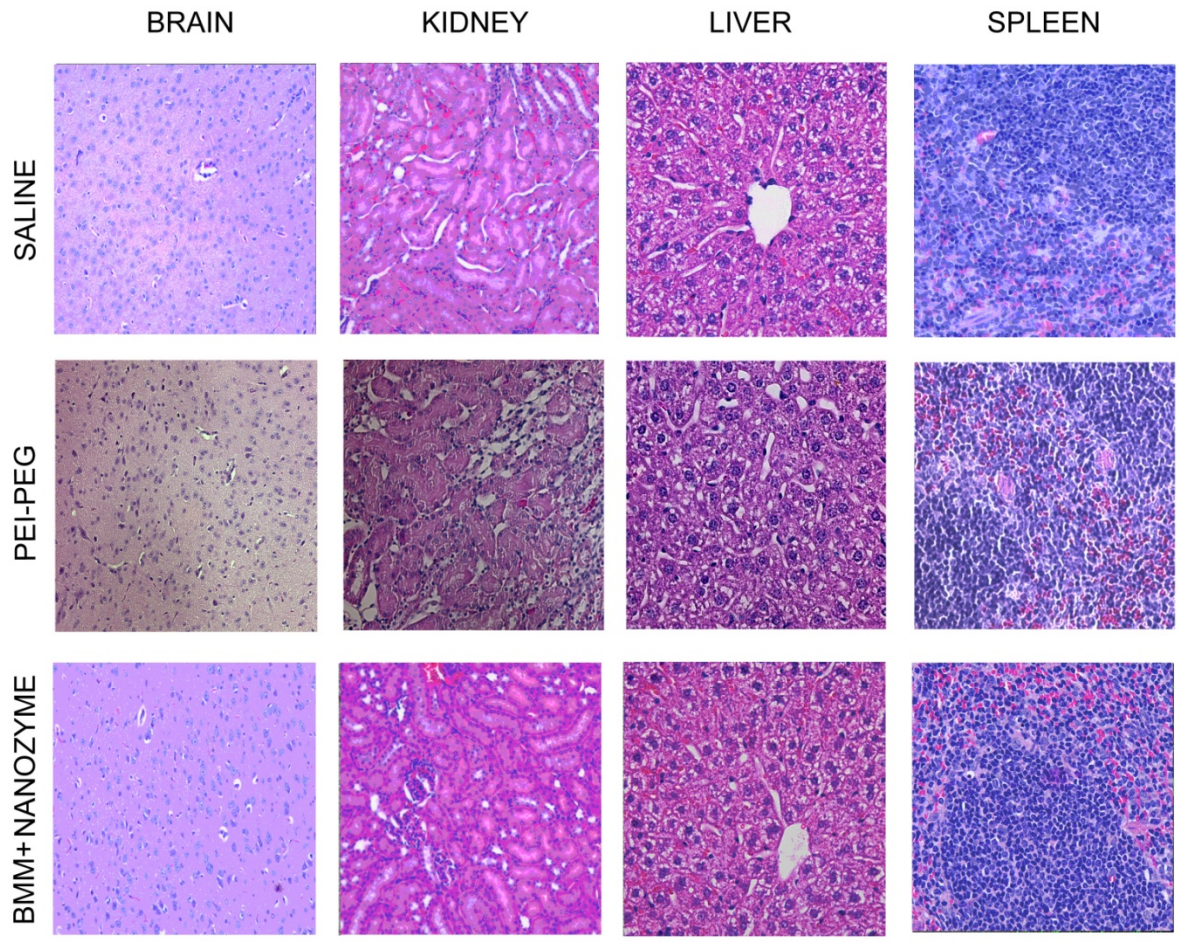

Figure 3S. Tissue nanotoxicology profiling by H&E staining.

Healthy C57Bl/6 mice were injected *i.v.* with nanozyme-loaded BMM (Z=1) ($5x10^6$ cells/mouse/100µl) or PBS as a control. Forty-eight hours later the animals were sacrificed and the internal organs were collected at necropsy. H&E stained paraffin sections of brain, kidney, liver, and spleen showed no evidence of toxicity in animals treated with nanozyme-cell formulation.

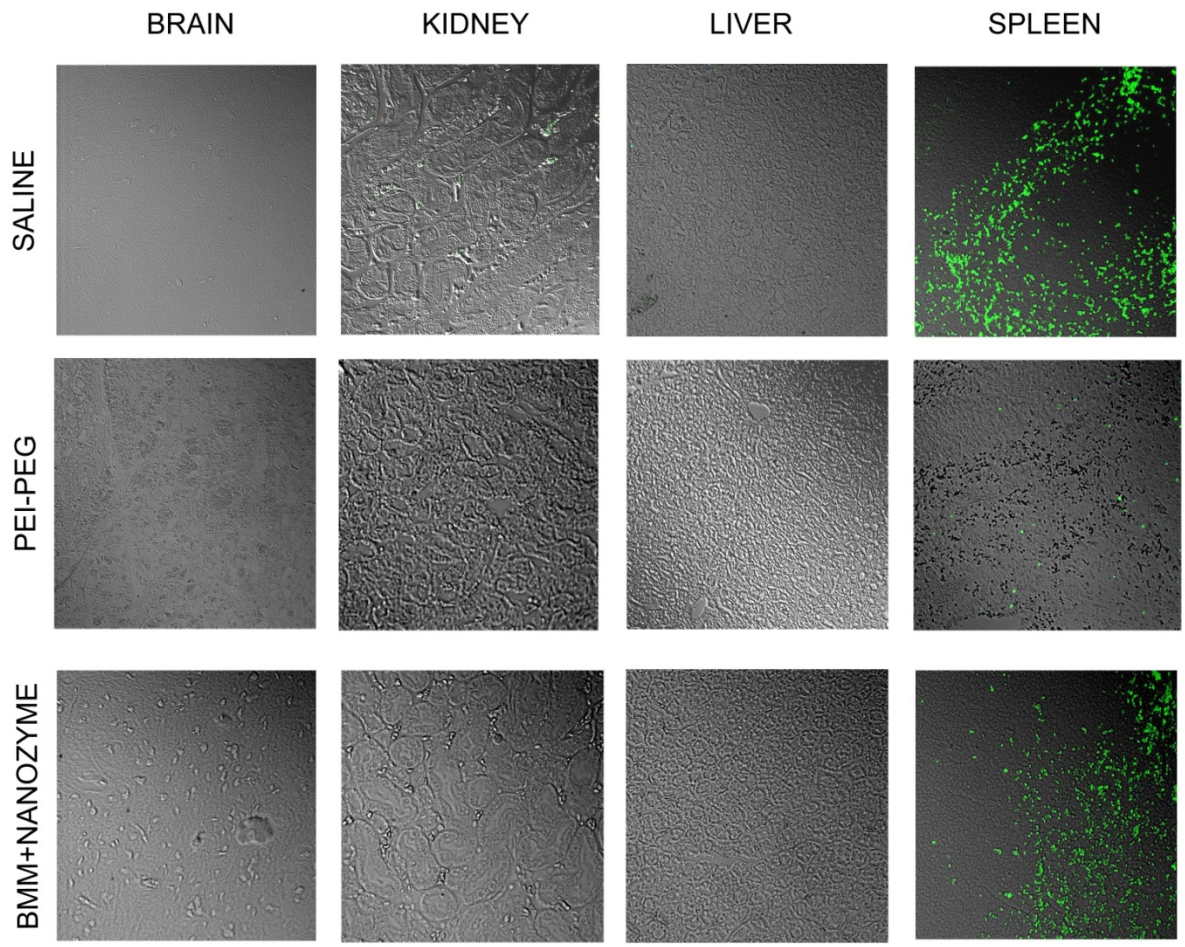

Figure 4S. Tissue nanotoxicology profiling by TUNEL staining.

MPTP-intoxicated C57Bl/6 mice (15 mg/kg) were injected with **A**: rhodamine-labeled BMM ($5x10^6$ cells/mouse) loaded with non-labeled nanozyme, or **B**: non-labeled BMM loaded with rhodamine-labeled nanozyme, or **C**: PBS. Two hours later mice were sacrificed and perfused with PBS and 4% PFA. Spleen, liver and brain were frozen; tissue specimens were sectioned with a cryostate (10 µm thick) and examined by confocal microscopy (20 x magnification). The bar represents 100 µm. Representative images from N=4 animals demonstrate detectable amounts of BMM in the brain, although, at substantially lower levels than in the liver and spleen.

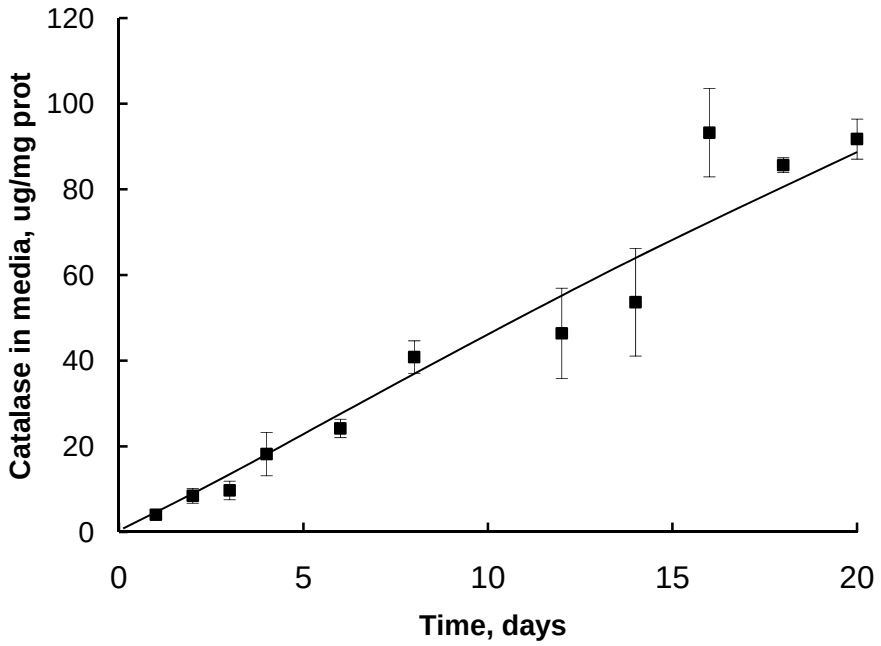

Figure 5S. Release profile of catalase nanozyme from BMM.

Cells were loaded with catalase/PEI-PEG complex (Z = 1) for 2 hours, washed with PBS, and incubated with catalase-free media for various time intervals. The loaded BMM released catalase in the external media for at least 20 days. The values are means ± SEM for six replicates.

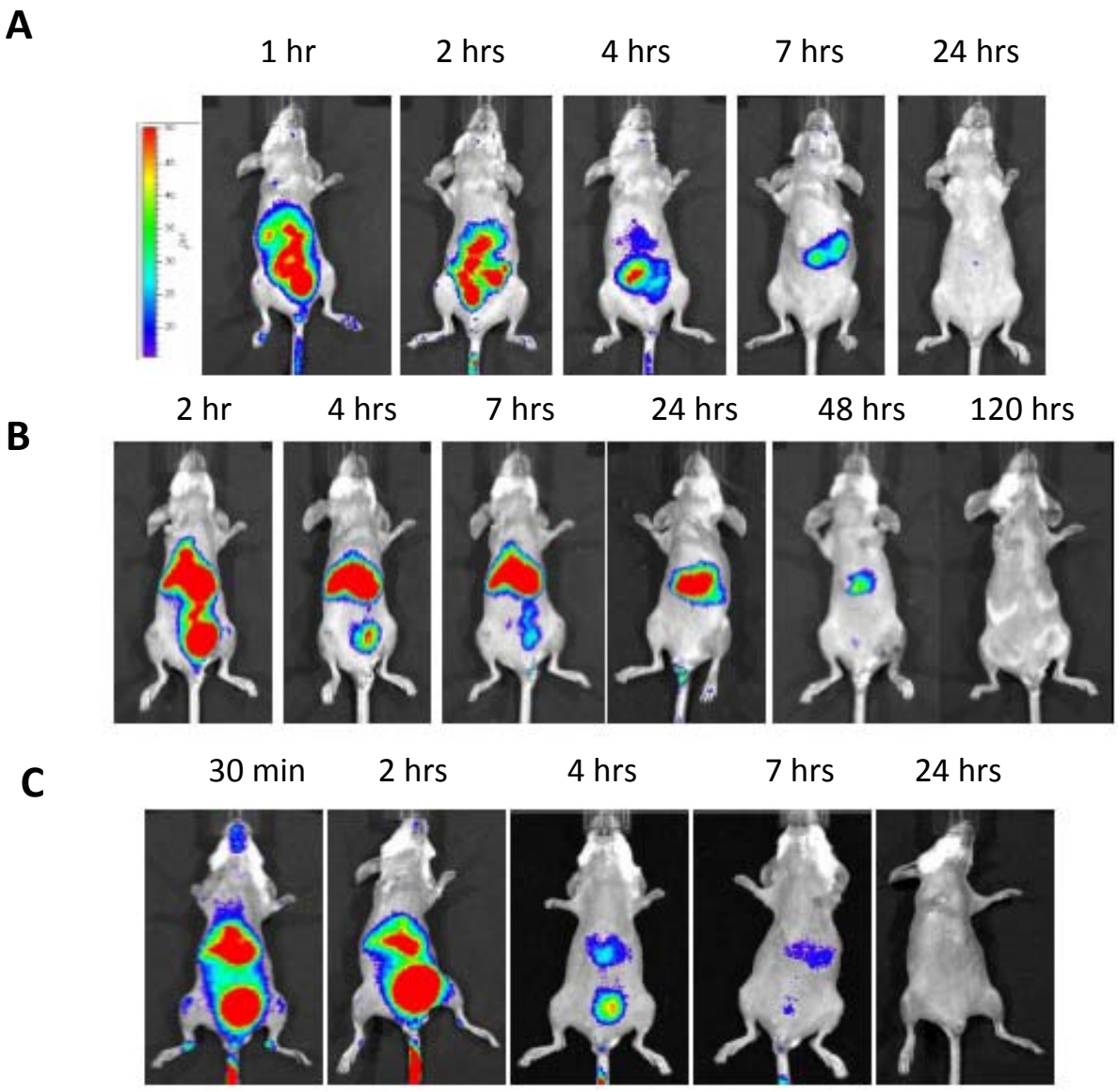

Figure 6S. Biodistribution of BMM-carried nanozymes in MPTP-intoxicated mice by IVIS

MPTP-intoxicated Balb/c mice (15 mg/kg) were *i.v.* injected with **A**: Alexa Fluor 680-labeled nanozyme loaded to BMM ($5x10^6$ cells /mouse); **B**: Alexa Fluor 680-labeled BMM loaded with non-labeled nanozyme, and **C**: Alexa Fluor 680-labeled nanozyme administered alone. Representative images from N=4 mice per group (ventral planes) taken at various time points show large accumulation of nanozyme and cell carriers in the peritoneal area, most likely corresponding to liver

and spleen uptake. Nanozyme administered alone (without cell carriers) was cleared faster than nanozyme loaded into the cells.

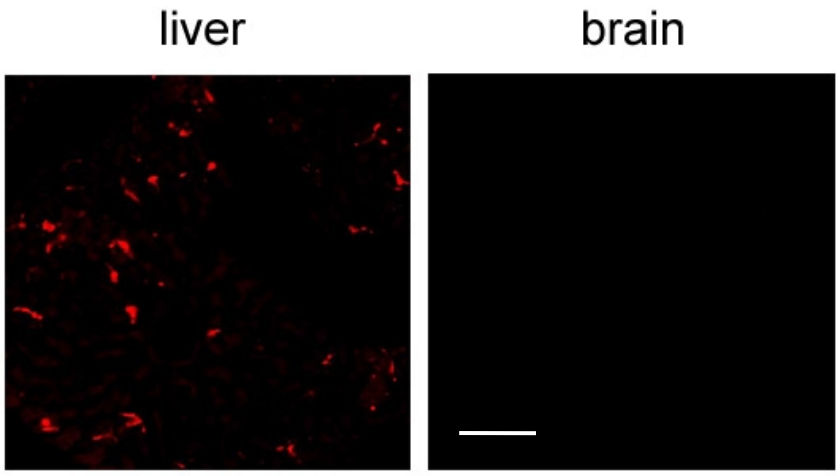

Figure 7S. **Tracking of rhodamine-labeled BMM loaded with catalase nanozyme in non-MPTP-treated mice.**

Naive C57Bl/6 mice were injected with rhodamine-labeled BMM ($5x10^6$ cells/mouse) loaded with non-labeled nanozyme. Two hours later mice were sacrificed and perfused with PBS and 4% PFA. Liver and brain were frozen; tissue specimens were sectioned with a cryostat (10 μm thick) and examined by confocal microscopy (40 x magnification). The bar represents 100 μm. Representative images from N=4 animals demonstrate detectable amounts of BMM in the liver and very few, if any, in the brain.

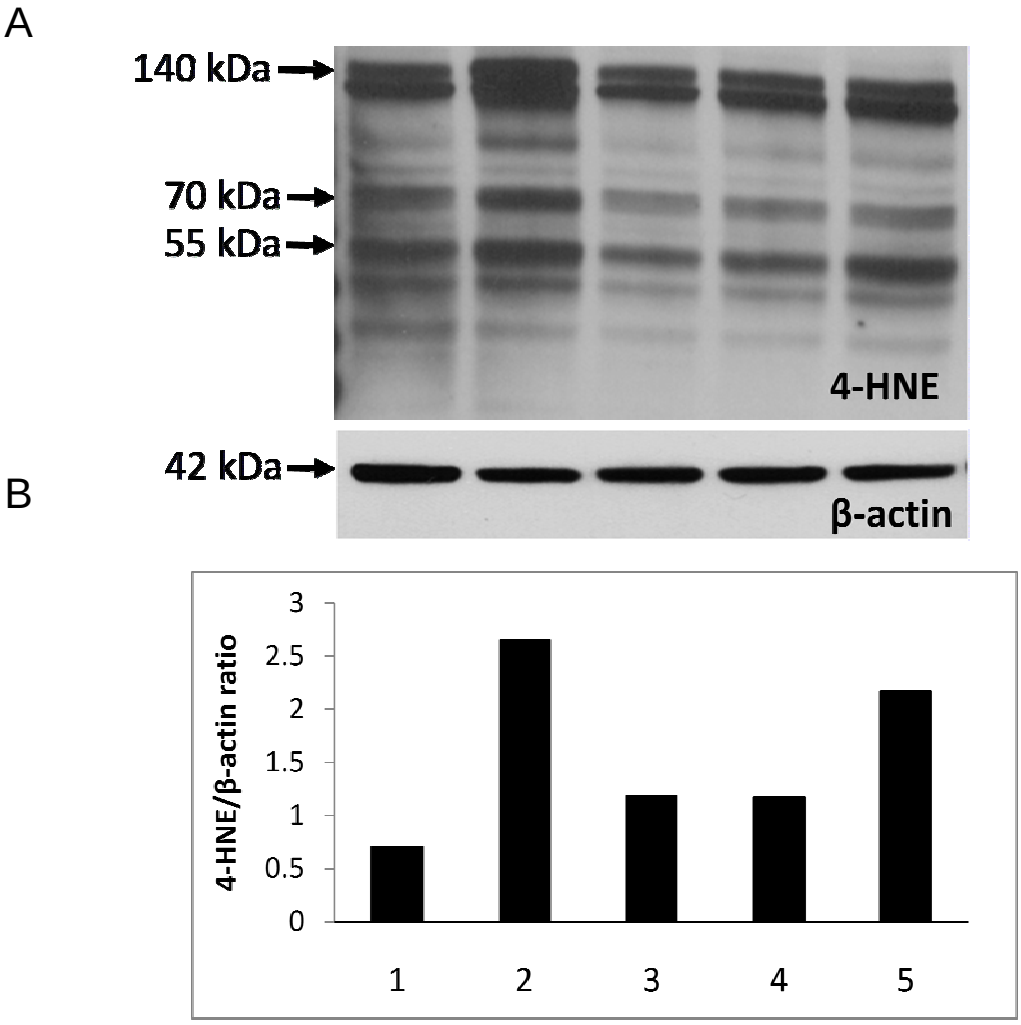

Figure 8S. **Effect of nanozyme-loaded BMM on oxidative stress in MPTP-intoxicated mice**

MPTP-intoxicated C57Bl/6 mice (18 mg/kg) were injected *i.v.* with PBS (second bar), nanozyme alone (third bar), BMM loaded with nanozyme ($5x10^6$ cells/mouse/100μl) (fourth bar), or empty BMM (fifth bar). PBS-treated mice were used as non-intoxicated controls (first bar). Forty-eight hours later animals were sacrificed, and brain tissues were subjected to western blot analysis with staining for 4-HNE adducts. Expression levels shown by **A**: representative gel; and **B**: densitometry data. Results from N=6 mice per group demonstrating decrease of oxidative stress in animals treated with catalase nanozyme loaded into the cells, as well as nanozyme alone. No effect on lipid peroxidation was detected after treatment with empty BMM.