

**Supporting Information for**

**Dopamine-melanin nanoparticles scavenge  
reactive oxygen and nitrogen species and activate  
autophagy for osteoarthritis therapy**

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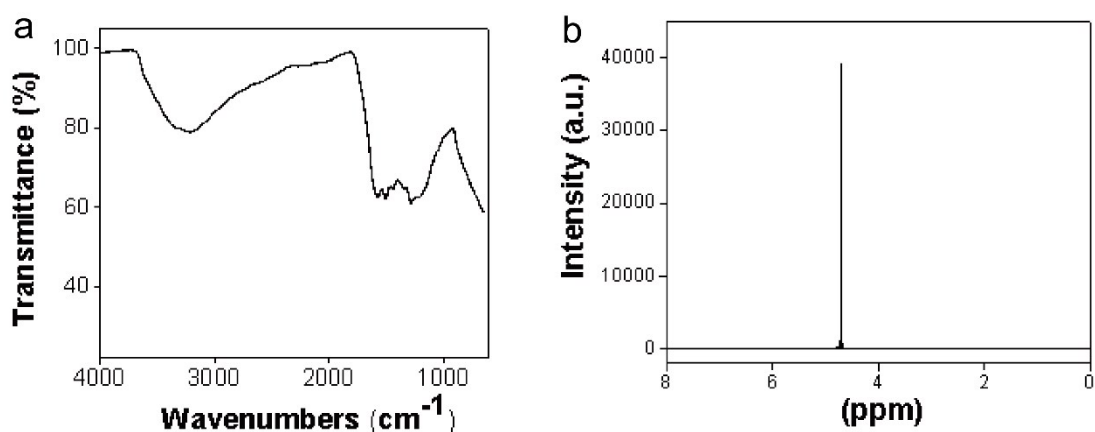
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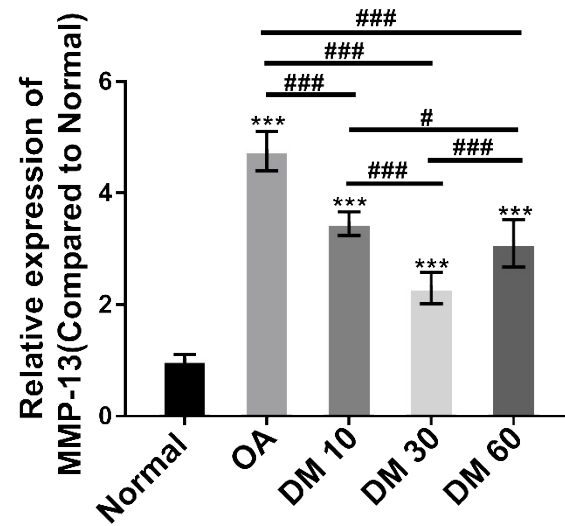
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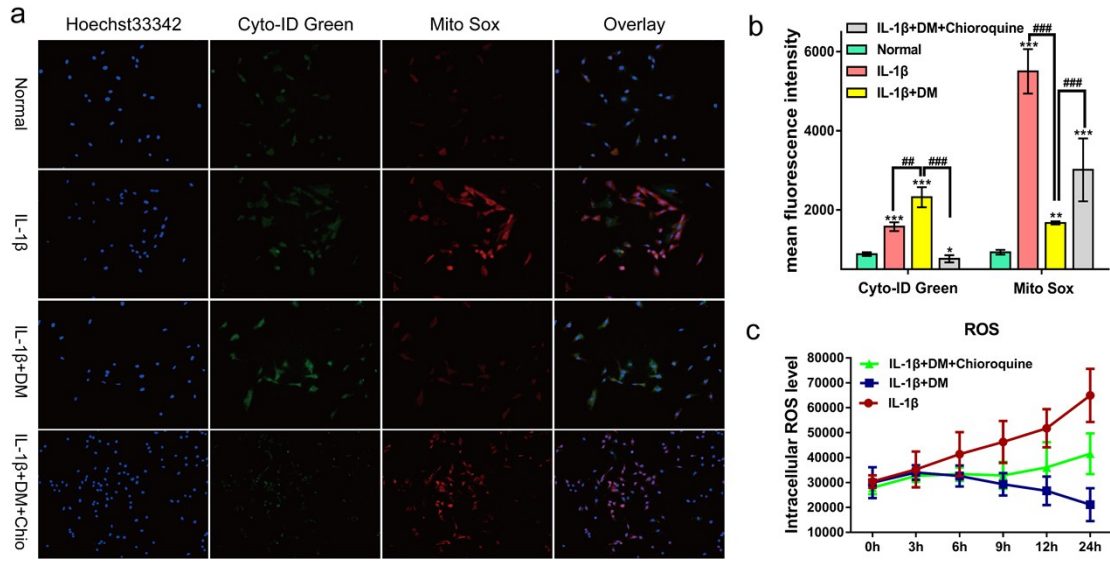
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**Figure S1.** (a) FT-IR spectrum of DM nanoparticles. The peak at  $\sim 3200\text{ cm}^{-1}$  corresponds to the stretching vibrations of -OH and N-H. The peaks at  $1574\text{ cm}^{-1}$  and  $1281\text{ cm}^{-1}$  were attributed to the C=O and C-O bonds, respectively. The peak at  $1442\text{ cm}^{-1}$  corresponds to C=C. (b)  $^1\text{H}$  NMR spectrum of DM nanoparticles. The peak at  $\sim 4.7\text{ ppm}$  in the  $^1\text{H}$  NMR spectrum is attributed to the  $\text{D}_2\text{O}$  solution.



**Figure S2.** Quantitative analysis immunohistochemical staining of MMP-13 in rat cartilage tissue by Image J. Values are presented as means  $\pm$  SD,  $n=6$ . \* indicates  $P < 0.05$ ; \*\*,  $P < 0.01$ ; \*\*\*,  $P < 0.001$ , relative to the normal group. #, indicate,  $P < 0.05$ ; ##,  $P < 0.01$ ; ###,  $P < 0.001$ , relative to the OA group.



**Figure S3.** Effect of autophagy on free radical scavenging of DM nanoparticles. (a) Chondrocyte samples concurrently stained with Cyto-ID Green dye and MitoSox Red dye were analyzed by confocal microscopy. (b) The fluorescence intensity of chondrocytes was analyzed by Image J. (c) After treated 30  $\mu$ g/mL DM Nanoparticles and/or Chloroquine for 0, 3, 6, 9, 12 and 24 h, the chondrocytes were stained with DCFH for 30 minutes, and the intracellular ROS levels were analyzed on a fluorescence microplate reader. IL-1 $\beta$  (with 10ng/mL IL-1 $\beta$ ); IL-1 $\beta$  +DM (with 10ng/mL IL-1 $\beta$  and 30  $\mu$ g/ml DM nanoparticles); IL-1 $\beta$ +DM+Chloroquine (with 10 ng/mL IL-1 $\beta$ , 30  $\mu$ g/ml DM nanoparticles and 1 $\mu$ mol/L Chloroquine). Values are presented as means  $\pm$  SD. \* indicates  $P < 0.05$ ; \*\*,  $P < 0.01$ ; \*\*\*,  $P < 0.001$ , relative to the normal group. #,  $P < 0.05$ , ##,  $P < 0.01$ , ###,  $P < 0.001$ , relative to the IL-1 $\beta$ +DM group.

**Table 1.** Primer sequences used in qRT-PCR experiments

Gene name	Forward primer	Reverse primer
GAPDH	5'-AGGGCCCTGACAACTCTTTT-3'	5'-AGGGGTCTACATGGCAACTG-3'
IL-1 $\beta$	5'-TGAGCTCGCCAGTGAAATGA-3'	5'-CATGGCCACAACAACCTGACG-3'
MMP-13	5'-GCCATTACCAGTCTCCGAGG-3'	5'-TACGGTTGGGAAGTTCTGGC-3'
TNF- $\alpha$	5'-TCAGAGGGCCTGTACCTCAT-3'	5'-GGAGGTTGACCTTGGTCTGG-3'
IL-6	5'-TCTGCGCAGCTTTAAGGAGT-3'	5'-CCCAGTGGACAGGTTTCTGA-3'
COX-2	5'-ACACTCTATCACTGGCATCC-3'	5'-GAAGGGACACCCTTTCACAT-3'
iNOS	5'-GTGTTCCACCAGGAGATGTTG-3'	5'-CTCCTGCCCCACTGAGTTCCGTTC-3'
LC3	5'-GACGTCACCGGGCGAGTTA-3'	5'-GCTGTACCTCCTTACAGCGG-3'
Beclin-1	5'-TCCGGGCTCCCGAGG-3'	5'-GGGGGATGAATCTGCGAGAG-3'
ATG7	5'-TGGTTACAAGCTTGGCTGCT-3'	5'-TCAAGAACCTGGTGAGGCAC-3'