Supporting Information

Bone remodeling-inspired dual delivery electrospun nanofibers for promoting bone regeneration

Yi Wang,^a Wenguo Cui,^b Xin Zhao,^c Shizhu Wen,^a Yulong Sun,^a Jianmin Han,^{*d} and

Hongyu Zhang^{*a}

^a State Key Laboratory of Tribology, Department of Mechanical Engineering, Tsinghua

University, Beijing 100084, China

^b Shanghai Institute of Traumatology and Orthopaedics, Shanghai Key Laboratory for

Prevention and Treatment of Bone and Joint Diseases, Ruijin Hospital, Shanghai Jiao

Tong University School of Medicine, Shanghai 200025, China

^c Department of Biomedical Engineering, The Hong Kong Polytechnic University,

Hung Hom, Hong Kong, China

^d Department of Dental Materials, National Engineering Laboratory for Digital and Material Technology of Stomatology, Peking University School and Hospital of Stomatology, Beijing 100081, China

*Corresponding Authors

Prof. Jianmin Han

Tel: + 86 010 82195769; E-mail: siyanghan@163.com

Prof. Hongyu Zhang

Tel: + 86 010 62796053; E-mail: zhanghyu@tsinghua.edu.cn



Figure S1. The relationship between the theoretical added ALN weight and the actual loaded ALN weight into MSNs in the drug loading process. MSNs were all 100 mg in each experiment.



Figure S2. Representative SEM images of the MSNs with (a) low magnification and

(b) high magnification.



Figure S3. Nitrogen adsorption-desorption and pore volume analyses of the MSNs. (a) absorption-desorption curves and (b) pore diameter distribution. The BET adsorption isotherm in (a) shows a typical IV nitrogen adsorption-desorption pattern, indicating the mesoporous structure of MSNs.



Figure S4. The surgical process of the *in vivo* critical-sized cranial defect model and implantation of the nanofibrous membranes. Every rat had bisymmetric critical-sized bone defects, which were covered employing the nanofibrous membranes with good conformability to the tissues.



Figure S5. Images of the harvested skull tissues of all the nanofiber membranes on 4 weeks and 12 weeks. a: PG-ALN@MSNs; b: PG-ALN; c: PG-MSNs; d: PG. Scale bar: 5 mm. The blank wires in the image represent surgical sutures, which are used to suture the skin when necessary during the surgical operation.



Figure S6. Representative H&E staining images of the different specimens on 4 weeks. The red arrows point to the newly formed blood vessels. The scale bar is 50 μ m.



Figure S7. The hydrolysis process of MSNs to release silicate. The bonding of "-Si-OH" is hydrated and hydrolized into Si(OH)₄. Subsequently, the metallic ions in body fluid promote ionization into silicate via ion exchange.