Supporting information
Materials and methods
Materials
Polycaprolactone (PCL), dopamine, methyl acrylic anhydride, N'N'-methylene-bis-acrylamide (MBA), gelatin from porcine skin, ethanol, trifluoroethanol, pyrrole and chloroform were all ordered from Sigma-Aldrich. Igacure@2959 was ordered from BASF. All the chemicals did not have further purification.

Experiment
Preparation of dopamine cross-linker
First, Double stilled water/ethanol (v/v=4:3) solution was adjusted to a pH of 6. Then 500 mg of MBA (3 mmol) was added to make the final concentration to be 70.1 mg/ml. After solubilization, 475 mg of dopamine (2 mmol) was introduced to the solution under nitrogen protection to exclude oxygen. The reaction was carried out under darkness in an oil bath at 45 ^{0}C and stirring for 3 days. The dopamine-MBA crosslinker was obtained after lyophilization and was stored at -20 ^{0}C.

Preparation of MA-gelatin (MA-G)
MA-gelation was followed previous reference with modifications[17]. Briefly, 10% (w/v) gelatin was obtained by dissolving 1gram gelatin in 10 ml double stilled water at 50 ℃. Then 0.5 ml of methyl acrylic anhydride was introduced to the gelatin solution and allowed to react for 1 hour under vigorous stirring. The product MA-G was obtained by dialysis against double distilled water and lyophilization.

Preparation of PCL/MA-G nanosheet
200 mg of MA-G and polycaprolactone (PCL) were dissolved in 2 ml 2,2,2-Trifluoroethanol separately. After solubilization, the two solutions were mixed together under magnetic stirring to form a homogenous solution which was placed in a syringe mounted with a syringe pump (PH2000 Infusion). The positive lead from a high voltage (18KV) supply (GAMMA, High Voltage Research) was attached to the needle via an alligator clip. On the opposite side, there was a 10*10 cm aluminum foil to collect fibers. The distance from the needle to the aluminum foil was 14 cm. The aluminum foil was connected to ground. The pump rate of solution was set to be 1 mL/h.

Mechanical characterization
To evaluate the mechanical properties of the nanofiber mats, dog-bone shaped samples with width 2 cm and gauge length 8 cm were prepared and the thickness of the samples was around 0.05 mm. The tensile properties were determined utilizing a 5N load cell with a strain rate of 5 mm/min on universal tensile tester (INSTRON 5965). The load–extension parameter and Young Modulus of patches were given by instrument software.

Preparation of nanosheet
The 5 X 10 cm PCL/MA-G sheet with around 50 μm in thickness was first immersed in a 4 mL solution of 20 mg dopamine-MBA cross-linker and 1(w/v) % irgacure 2959. Then UV light (at 365 nm) was applied to the membrane. After 30 min of UV exposure, the sample was washed PBS for three times and dried at room temperature.

NMR and UV absorption
1H NMR spectra was recorded by a Bruker Avance 300 NMR spectrometer (300 MHz). Samples were dissolved in deuterium oxide. UV-visible absorption spectra were recorded with an Ultrospec 4300 pro UV/Visible spectrophotometer.

Morphology of nanofibers and diameter measurement
Nanofibers' morphology was examined by using a JEOL-5900 scanning electron microscope. For the homogeneity, we measured the total 300 fibers, based on 10 SEM images (30 fibers on each SEM image) using IMAG J.

Component's percentage
The prepared MA-G/PCL nanosheet was immersed in chloroform for 2 days in order to dissolve PCL completely. After drying the samples, the average percentage of PCL in nanosheet was 55%.

Animal model
In order to detect the therapeutic repairing effect of nanosheet, a gastrotomy model was introduced. 20 eight-week old male C57BL/6 mice (weight 20 g) were divided into four groups: control group (incision only), sutured group (incision with suture), nanosheet group 1(incision using nanosheet without dopamine-MBA crosslinker), nanosheet group 2 (Incision using nanosheet with dopamine-MBA crosslinker). Sample size is 5 for each group. They were fed with a standard diet and under standard laboratory conditions for one week and had no diet for 12 hours and no water for 4 hours before the experiments. All experiments were approved by the Southern Medical University Animal Ethics Committee in accordance with the Regulations for the Administration of Affairs Concerning Experimental Animals (China). The surgical procedures were performed by the same skillful abdominal surgeon. After anesthesia procedure, the mice were put on the mice operation table and sterilized. According to a standard procedure, an epigastrium median incision on the anterior abdominal wall was made to explore the stomach, and then an incision of 1 cm length was made in the anterior wall of the mice stomach. In the control group, the incision was left without any suture/ligation or other treatment: only the abdominal wall was closed. In sutured group, the incision was sutured and ligated in a standard procedure with 5-0 poly (propylene) suture. In the nanosheet group 1, a supporting suture without ligation was stitched along the middle of incision line to make the mucosa contact with each other. Then the nanosheet ($1.5*1.0$ cm^2 area with 50 μm in thickness) was placed on the incision site. Immediately after covering, the supporting sutures (no ligation) were pulled out leaving only one suture in the incision middle to fix the nanosheet and the abdominal wall was closed. In the Nanosheet Group 2, the nanosheet coated dopamine ($1.5*1.0$ cm^2 with 50 μm in thickness) was placed on the incision site, and all the other operating procedures were the same as Nanosheet Group 1. All mice were alive after the surgical procedure and all of them were monitored for one week. Seven days after operation, the mice were sacrificed under lethal chloral hydrate anesthesia and their stomachs were removed, fixed with 10% formaldehyde, paraffin-embedded, cut into 5μm sections and stained with hematoxylin-eosin (HE) staining for examination.
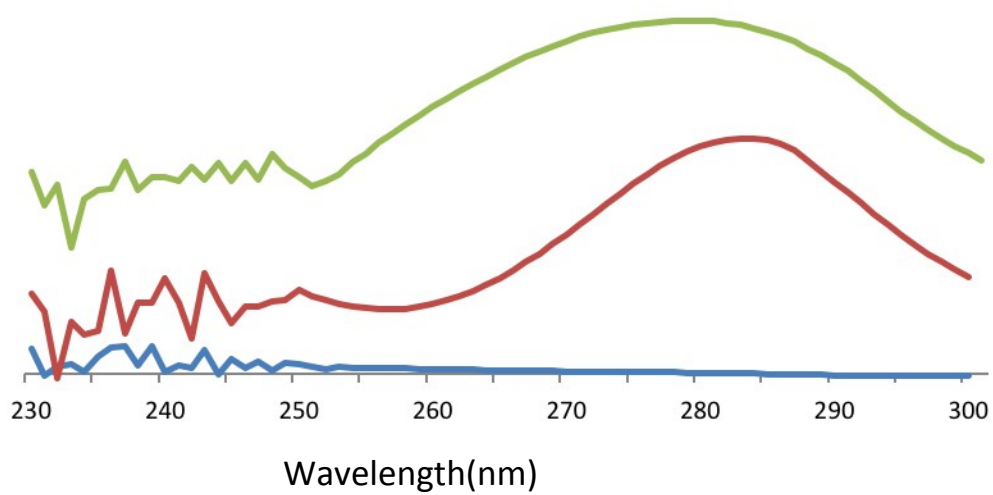
Wavelength(nm)

Figure S1. UV-absorption spectra of dopamine (red line), MA-G/PCL (blue line) and dopamine-MA-G/PCL (green line).