CLAIMS

1. A method of preparing a biomimetic membrane, wherein a vesicle is not used in preparing the biomimetic membrane, the method comprising
   a) depositing a first mixture comprising a first polyelectrolyte having a charge and a transmembrane protein on a surface of a support;
   b) depositing a second mixture comprising a second polyelectrolyte and a cross-linking agent on the first mixture which is deposited on the surface of the support, the second polyelectrolyte having a charge opposite to the charge on the first polyelectrolyte; and
   c) cross-linking the second polyelectrolyte with the cross-linking agent to obtain the biomimetic membrane.

2. The method according to claim 1, wherein the transmembrane protein comprises an aquaporin.

3. The method according to claim 2, wherein the aquaporin is AqpZ.

4. The method according to any one of claims 1 to 3, wherein the transmembrane protein is protected with a surfactant.

5. The method according to claim 4, wherein the surfactant is selected from the group consisting of n-octyl-β-D-glucoside, n-octanoylsucrose, n-nonanoylsucrose, n-decanoylsucrose, n-undecanoylsucrose, n-dodecanoylsucrose, n-heptyl-β-D-glucoside, n-heptyl-β-D-maltoside, n-heptyl-β-D-maltopyranoside, n-heptyl-β-D-glucopyranoside, n-heptyl-β-D-thioglucoside, n-heptyl-β-D-thiomaltoside, n-heptyl-β-D-thiomaltopyranoside, n-heptyl-β-D-thioglucopyranoside, n-octyl-β-D-maltoside, n-octyl-β-D-maltopyranoside, n-octyl-β-D-glucopyranoside, n-octyl-β-D-thioglucoside, n-octyl-β-D-thiomaltoside, n-octyl-β-D-thiomaltopyranoside, n-octyl-β-D-thioglucopyranoside, n-nonyl-β-D-glucoside, n-nonyl-β-d-maltoside, n-nonyl-β-D-maltopyranoside, n-nonyl-β-D-glucopyranoside, n-nonyl-β-D-thioglucoside, n-nonyl-β- D-thiomaltoside, n-nonyl-β-D-thiomaltopyranoside, n-nonyl-β-D-

thioglucopyranoside, n-decyl-β-D-glucoside, n-decyl-β-D-maltoside, n-decyl-β-D-maltopyranoside, n-decyl-β-D-glucopyranoside, n-decyl-β-thioglucoside, n-decyl-β-D-thiomaltoside, n-decyl-β-d-thiomaltopyranoside, n-decyl-β-D-thioglucopyranoside, n-undecyl-β-D-glucoside, n-undecyl-β-D-maltoside, n-undecyl-β-D-maltopyranoside, n-undecyl-β-D-glucopyranoside, n-undecyl-β-D-thioglucoside, n-undecyl-β-D-thiomaltoside, n-undecyl-β-D-thiomaltopyranoside, n-undecyl-β-D-thioglucopyranoside, n-dodecyl-β-D-glucoside, n-dodecyl-β-D-maltoside, n-dodecyl-β-D-maltopyranoside, n-dodecyl-β-D-glucopyranoside, n-dodecyl-β-D-thioglucoside, n-dodecyl-β-D-thiomaltoside, n-dodecyl-β-D-thiomaltopyranoside, n-dodecyl-β-D-thioglucopyranoside, and any combination thereof.

6. The method according to claim 4 or 5, wherein the surfactant is n-octyl-β-D-glucoside.

7. The method according to any one of claims 1 to 6, wherein the support comprises a polymer selected from the group consisting of polyacrylonitrile (PAN), polysulfone (PSF), polyvinylidene fluoride (PVDF), polypropylene, copolymers thereof, and combinations thereof.

8. The method according to any one of claims 1 to 7, wherein the support comprises polyacrylonitrile.

9. The method according to any one of claims 1 to 8, wherein the surface of the support possesses a charge prior to having the first mixture deposited thereon.

10. The method according to claim 9, wherein the charge is a negative charge.

11. The method according to any one of claims 1 to 10, wherein the support is a membrane.

12. The method according to any one of claims 1 to 11, wherein the first polyelectrolyte and the second polyelectrolyte are independently

(i) a polyanion selected from the group consisting of poly(vinylsulfonic acid), poly(styrene sulfonic acid), poly(acrylic acid), poly(methacrylic acid), poly(maleic acid), poly(itaconic acid), sulfated poly(vinyl alcohol), poly(vinylsulfonic acid), poly(acrylic acid-co-maleic acid), poly(styrene sulfonic acid-co-maleic acid), poly(ethylene-co-acrylic acid), poly(phosphoric acid), poly(silicic acid), hectorite, bentonite, alginic acid, pectic acid, xanthan, gum arabic, dextran sulfate, carboxy methyl dextran, carboxy methyl cellulose, cellulose sulfate, cellulose xanthogenate, starch sulfate, starch phosphate, lignosulfonate, polygalacturonic acid, polyglucuronic acid, polyguluronic acid, polymannuronic acid, chondroitin sulfate, heparin, heparan sulfate, hyaluronic acid, dermatan sulfate, keratan sulfate; poly-(L)-glutamic acid, poly-(L)-aspartic acid, acidic gelatins (A-gelatins), starch, amylose, amylopectin, cellulose, guar, guar gum, pullulan, dextran, chitin or chitosan derivatives having the following functional groups: carboxymethyl, carboxyethyl, carboxypropyl, 2-carboxyvinyl, 2-hydroxy-3-carboxypropyl, 1,3-dicarboxyisopropyl, sulfomethyl, 2-sulfoethyl, 3-sulfopropyl, 4-sulfobutyl, 5-sulfopentyl, 2-hydroxy-3-sulfopropyl, 2,2-disulfoethyl, 2-carboxy-2-sulfoethyl, maleate, succinate, phthalate, glutarate, aromatic and aliphatic dicarboxylates, xanthogenate, sulfate, phosphate, 2,3-dicarboxy, N,N-di(phosphatomethyl)aminoethyl, N-alkyl-N-phosphatomethylaminoethyl, salts thereof, and combinations thereof, or

(ii) a polycation selected from the group consisting of polyallylamine, poly(aniline); poly(pyrrole); poly(alkylenimines); poly-(4-vinylpyridine); poly(vinylamine); poly(2-vinylpyridine), poly(2-methyl-5-vinylpyridine), poly(4-vinyl-N-C1-C18-alkylpyridinium salt), poly(2-vinyl-N-C1-C18-alkylpyridinium salt), aminoacetylated polyvinyl alcohol; poly-(L)-lysine, poly-(L)-arginine, poly(ornithine), basic gelatins (B-gelatins), chitin or chitosan derivatives having the following functional groups: 2-aminoethyl, 3-aminopropyl, 2-dimethylaminoethyl, 2-diethylaminoethyl, 2-diisopropylaminoethyl, 2-dibutylaminoethyl, 3-diethylamino-2-hydroxypropyl, N-ethyl-N-methylaminoethyl, 2-diethylhexylaminoethyl, 2-hydroxy-2-diethylaminoethyl, 2-hydroxy-3-trimethylammonionopropyl, 2-hydroxy-3-

triethylammonionopropyl, 3-trimethylammonionopropyl, 2-hydroxy-3-pyridiniumpropyl, S,S-dialkylthioniumalkyl, salts thereof, and combinations thereof.

13. The method according to any one of claims 1 to 12, wherein the first polyelectrolyte is a polycation.

14. The method according to any one of claims 1 to 13, wherein the first polyelectrolyte comprises poly(allylamine hydrochloride).

15. The method according to claim 14, wherein the poly(allylamine hydrochloride) has a molecular weight in the range of about 120,000 to about 200,000.

16. The method according to any one of claims 1 to 15, wherein amount of the first polyelectrolyte in the first mixture is in the range of about 4 wt% to about 8 wt%.

17. The method according to any one of claims 1 to 16, wherein amount of the transmembrane protein in the first mixture is in the range of about 0.01 mg/mL to about 0.2 mg/mL.

18. The method according to any one of claims 1 to 17, wherein the second polyelectrolyte is a polyanion.

19. The method according to any one of claims 1 to 18, wherein the second polyelectrolyte comprises poly(vinylsulfonic acid).

20. The method according to claim 19, wherein the poly(vinylsulfonic acid) is obtainable by polymerizing a vinylsulfonic acid sodium salt solution.

21. The method according to claim 20, wherein molar ratio of the cross-linking agent to the vinylsulfonic acid sodium salt in the second mixture is in the range of about 2 % to about 3 %.

22. The method according to any one of claims 1 to 21, wherein the cross-linking agent is selected from the group consisting of N, N'-methylenebis(acrylamide), divinylbenzene, N,N'-ethylenebis(acrylamide), N,N'-propylenebis(acrylamide), N,N'-butamethylenebis(acrylamide), N,N'-diallylacrylamide, N,N'-hexamethylenebisacrylamide, triallylisocyanurate, 1,4-diacryloylpiperazine-1,1,1-trimethylolpropane diallyl ether, triethylene glycol divinyl ether, diallyl maleate, bis(acryloylamido)methane, ethyleneglycoldimethacrylate, diethyleneglycoldimethacrylate, 3-(acryloyloxy)-2-hydroxypropyl methacrylate, and combinations thereof.

23. The method according to any one of claims 1 to 22, wherein the cross-linking agent is N, N'-methylenebis(acrylamide).

24. The method according to any one of claims 1 to 23, wherein cross-linking the second polyelectrolyte with the cross-linking agent comprises irradiating the second mixture with ultraviolet light.