We claim:

1. A biocompatible conductive biomaterial comprising a conductive polymer and a biocompatible component, the conductive polymer comprising an aminomethoxybenzoic acid (AMBA) polymer, wherein the conductive polymer is conjugated to the biocompatible component.

2. The biocompatible conductive biomaterial of claim 1, wherein the AMBA is selected from 3-amino-4-methoxybenzoic acid (3-4-AMBA), 4-amino-2-methoxybenzoic acid (4-2-AMBA), 4-amino-3-methoxybenzoic acid (4-3-AMBA), 2-amino-5-methoxybenzoic acid (2-5-AMBA), and 2-amino-4-methoxybenzoic acid (2-4-AMBA), and mixtures thereof.

3. The biocompatible conductive biomaterial of claim 1 or 2, wherein the biocompatible component is selected from gelatin, chitosan, collagen, fibronectin, elastin, alginate, and derivatives and mixtures thereof or wherein the biocompatible component comprises a synthetic product, optionally a biodegradable synthetic polymer.

4. The biocompatible conductive biomaterial of claim 3, wherein the biocompatible component is or comprises gelatin.

5. The biocompatible conductive biomaterial of any one of claims 1 to 5, wherein the conductive polymer is covalently conjugated, to the biocompatible component.

6. The biocompatible conductive biomaterial of any one of claims 1 to 6, wherein the biomaterial is a liquid solution, a hydrogel, a membrane, a 3D-patch or sponge, a sheet, or a mesh for grafting.

7. The biocompatible conductive biomaterial of any one of claims 1 to 6, wherein the biomaterial is a hydrogel, optionally wherein the hydrogel is crosslinked.

8. The biocompatible conductive biomaterial of any one of claims 1 to 7, wherein the biocompatible conductive biomaterial has a conductivity of least or greater than about 10^{-6} or at least or greater than about 10^{-5} S/cm, or of at least or greater than about 10^{-4} S/cm or least or greater than about 10^{-3} S/cm or least or greater than about 10^{-2} S/cm.

9. The biocompatible conductive biomaterial of any one of claims 1 to 8, wherein the biocompatible conductive biomaterial has a conductivity of at least 2-fold, at least 3-fold, at least 4-fold, at least 5-fold, at least 6-fold, at least 7-fold, at least 8-fold, at least 9-fold, or at least 10-fold greater than a control biomaterial that does not comprise the conductive polymer.

10. The biocompatible conductive biomaterial of any one of claims 1 to 10, wherein the molar ratio of the conductive polymer and the biocompatible component is about 30:1 to about 60:1.

11. The biocompatible conductive biomaterial of any one of claims 1 to 10 further comprising one or more of culture media and cardiomyocytes.

12. A conductive hydrogel comprising an aminomethoxybenzoic acid (AMBA) polymer and gelatin, optionally further comprising one or more of culture media and cardiomyocytes.

13. The conductive hydrogel of claim 12, wherein the AMBA polymer is conjugated to one or more amino groups of the gelatin.

14. The conductive hydrogel of claim 12 or 13, wherein the hydrogel has a conductivity of least or greater than about 10^{-6} S/cm, at least or greater than 10^{-5} S/cm, at least or greater than about 10^{-4} S/cm or least or greater than about 10^{-3} S/cm or at least or greater than 10^{-2} S/cm.

15. The conductive hydrogel of claim 12 or 13, wherein the hydrogel has a conductivity of at least 2-fold, at least 3-fold, at least 4-fold, at least 5-fold, at least 6-fold, at least 7-fold, at least 8-fold, at least 9-fold, or at least 10-fold greater than a gelatin hydrogel that does not comprise the AMBA polymer.

16. The conductive hydrogel of any one of claims 12 to 15, wherein the water content of the hydrogel is about 80 wt. % to about 90 wt. % of the hydrogel.

17. A device utilizing the biocompatible conductive biomaterial of any one of claims 1 to 10 or the conductive hydrogel of any one of claims 11 to 16.

18. The device of claim 17, wherein the device is an implantable device comprising an electrode.

19. The device of claim 18, wherein the device comprises at least one electrode coated at least partially by the biocompatible conductive biomaterial or the conductive hydrogel.

20. The device of any one of claims 17 to 19, wherein the device is a cardiac pacemaker, optionally a single chamber pacemaker, a dual chamber pacemaker or a biventricular pacemaker.

21. The device of any one of claims 17 to 19, wherein the device is an implantable cardioverter defibrillator.

22. A kit comprising an implantable device comprising an electrode, optionally a pacemaker or an ICD, and a biocompatible conductive biomaterial comprising a conductive polymer and a biocompatible component, the conductive polymer comprising an aminomethoxybenzoic acid (AMBA) polymer, and instructions for installing the device such that the biocompatible conductive biomaterial surrounds the electrode when installed.

23. A method of making the biocompatible conductive biomaterial of any one of claims 1 to 10, or the hydrogel of any one of claims 11 to 16, the method comprising conjugating a conductive polymer and a biocompatible component, the conductive polymer comprising an aminomethoxybenzoic acid (AMBA) polymer.

24. The method of claim 23, for making the hydrogel comprising gelatin, the method comprising combining AMBA and gelatin, polymerizing the AMBA and gelatin to produce conjugated AMBA-gelatin, and cross-linking the AMBA-gelatin or cooling the AMBA-gelatin.

25. The method of claim 23 or 24 wherein the AMBA and gelatin are polymerized using APS.

26. The method of any one of claims 23 to 25, wherein the AMBA-gelatin is cross-linked using EDC.

27. The method of any one of claims 23 to 26 further comprising adding culture media and/or cardiomyocytes and growing the cardiomyocytes.

28. Use of the biocompatible conductive biomaterial of any one of claims 1 to 11, the hydrogel of any of claims 12-16, the device of any one of claims 17 to 21 or the kit of claim 22 in the manufacture of a medicament for ameliorating or treating a heart condition, optionally a heart condition described herein.

29. Use of the conductive hydrogel of any one of claims 12 to 16, a device comprising said conductive hydrogel or a kit for making said hydrogel in the manufacture of a medicament for ameliorating or treating a heart condition, optionally a heart condition described herein.

30. The use of claim 28 or 29, wherein the heart condition is myocardial infarction, ischemic myocardium, myocardial fibrosis, heart failure, atrioventricular block, arrhythmia, bradycardia or a conduction abnormality, optionally resulting from cardiac surgery.

31. The use of claim 30, wherein the heart condition is atrioventricular block and the biocompatible conductive biomaterial is for restoring atrioventricular conduction or the heart condition results from cardiac surgery after replacing a cardiac valve.

32. The use of claim 30, wherein the heart condition is myocardial fibrosis and the biocompatible conductive biomaterial is introduced into or onto fibrotic scar tissue.

33. The use of any one of claims 28 to 32, wherein the medicament comprises the biocompatible conductive biomaterial and the medicament is for reducing the pacing threshold of a cardiac pacemaker and/or for increasing myocardium reactivity to heart pacing in the subject.