Claims

1. A nerve stimulation system for treating pain in a patient, the system comprising an implantable device having:

a housing;

a power source;

a processor configured to control the impedance in the device and to optimize ground loop impedance; and

at least one stimulation electrode arranged on the housing and in electrical communication with the power source and the processor, the stimulation electrode adapted to transmit an electrical signal for stimulating at least one nerve cell of the patient,

wherein the power in the power source is wirelessly generated.

2. The nerve stimulation system of claim 1, wherein the device further comprises at least one reference electrode arranged on the housing.

3. The nerve stimulation system of claim 2, wherein the housing has a first end and a second end, and wherein the stimulation electrode is arranged at the first end and the reference electrode is arranged at the second end.

4. The nerve stimulation system according to any one of the preceding claims, the system further comprising at least one transceiver, wherein the device is configured to be in data communication with the transceiver, and the transceiver configured to provide instructions to the device to generate and transmit the electrical signal for stimulating at least one nerve cell in the patient.

5. The nerve stimulation system of claim 4, wherein the transceiver is configured to induce electrical power in the device.

6. The nerve stimulation system of claim 4 or 5, wherein the processor is configured to wirelessly communicate with the transceiver.

7. The nerve stimulation system of claim 6, wherein the processor is configured to wirelessly communicate with the transceiver via radio frequency (RF).

8. The nerve stimulation system of any one of claim 6 or 7, wherein the processor is configured to generate the electrical signal.

9. The nerve stimulation system of any one of the preceding claims, wherein the device includes a temperature transducer configured to monitor the temperature of the device, or optionally the temperature of the environment surrounding the device.

10. The nerve stimulation system of any one of the preceding claims, wherein the device includes an antenna.

11. The nerve stimulation system of any one of the preceding claims, the device having more than one stimulation electrode.

12. The nerve stimulation system of claim 11, wherein each of the stimulation and reference electrodes has a diameter ranging from 1 µm to 200 µm in one dimension.

13. The nerve stimulation system of claim 11 or 12, wherein the device is configured to select the stimulation electrodes for transmission of the electrical signal.

14. The nerve stimulation system of any one of claims 11 to 13, wherein the distance between each stimulation electrode ranges between 1 µm to 500 µm.

15. The nerve stimulation system of any one of claims 13 or 14, wherein the transceiver is configured to provide instructions to the device for the selection of the stimulation electrodes for transmission of the electrical signal.

16. The nerve stimulation system of any one of claims 4 to 15, wherein the transceiver is configured to receive data from the device.

17. A nerve stimulation implantable device comprising:

a housing;

a power source;

a processor configured to control the impedance in the device and to optimize ground loop impedance; and

at least one stimulation electrode arranged on the housing and in electrical communication with the power source and the processor, the stimulation electrode adapted to transmit an electrical signal for stimulating at least one nerve cell of the patient,

wherein the power in the power source is wirelessly generated.

18. The nerve stimulation implantable device of claim 17, wherein the device further comprises at least one reference electrode arranged on the housing.

19. The nerve stimulation implantable device of claim 18, wherein the housing has a first end and a second end, and wherein the stimulation electrode is arranged at the first end and the reference electrode is arranged at the second end.

20. The nerve stimulation implantable device according to any one of claims 17 to 19, wherein the processor is configured to generate the electrical signal.

21. The nerve stimulation implantable device according to any one of claims 17 to 20, wherein the device includes a temperature transducer configured to monitor the temperature of the device, or optionally the temperature of the environment surrounding the device.

22. The nerve stimulation implantable device of any one claims 17 to 21, the device having more than one stimulation electrode.

23. The nerve stimulation implantable device of claim 22, wherein each of the stimulation and reference electrodes has a diameter ranging from 1 µm to 200 µm in one dimension.

24. The nerve stimulation implantable device of any one of claims 22 or 23, wherein the device is configured to select the stimulation electrodes for transmission of the electrical signal

25. The nerve stimulation implantable device of any one of claims 22 to 24, wherein the distance between each stimulation electrode ranges between 1 µm to 500 µm.