

Claims

1. Implantable medical device for stimulating a human or animal heart, comprising a processor, a memory unit, a His electrode (2) having a first electrode pole (20) configured to detect an electrical signal at a His bundle (4) of a human or animal heart (5), at least one further electrode (3, 9) having at least one further electrode pole (30, 91, 92, 93, 94) configured to detect an electrical signal at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4),
- characterized**
- in that the memory unit comprises a computer-readable program that causes the processor to perform the following steps when executed on the processor:
- measuring electric signals at a His bundle (4) of a human or animal heart (5) with the first electrode pole (20),
- measuring electric signals at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4) with the at least one further electrode pole (30, 91, 92, 93, 94), and
- evaluating intracardiac electrogram signals and/or impedance signals measured between the first electrode pole (20) and the at least one further electrode pole (30, 91, 92, 93, 94), with the provision that this evaluating does not only comprise a determination of an atrial-His bundle transition time.
2. Implantable medical device according to claim 1, **characterized** in that the cardiac region different from the His bundle (4) is a right atrium, a right ventricle (6) or a left ventricle (10).
3. Implantable medical device according to claim 1 or 2, **characterized** in that the computer-readable program causes the processor to determine a relation between a

signal detected by the first electrode (2) and a signal detected by the at least one further electrode (3, 9).

4. Implantable medical device according to claim 3, **characterized** in that the relation is
5 or comprises a time relation between two signals.
5. Implantable medical device according to claim 3 or 4, **characterized** in that the relation is or comprises an amplitude relation between two signals.
- 10 6. Implantable medical device according to any of the preceding claims, **characterized** in that the computer-readable program causes the processor to determine a condition of the human or animal heart (5) on the basis of the evaluated intracardiac electrogram signals and/or impedance signals.
- 15 7. Implantable medical device according to any of the preceding claims, **characterized** in that the computer-readable program causes the processor to determine, based on the performed evaluation, at least one parameter representative for a hemodynamics and/or a contractility of the heart (5).
- 20 8. Implantable medical device according to any of the preceding claims, **characterized** in that the computer-readable program causes the processor to adjust, based on the performed evaluation, an algorithm for controlling the implantable medical device (1).
9. Implantable medical device according to claim 8, **characterized** in that the algorithm
25 is chosen from the group consisting of a capture classification algorithm, an automatic threshold test, a beat-to-beat capture control algorithm, and a closed loop stimulation algorithm.
10. Implantable medical device according to any of the preceding claims, **characterized**
30 in that the at least one further electrode (3, 9) is a quadrupolar electrode (9) having four electric poles (91, 92, 93, 94).

11. Implantable medical device according to claim 10, **characterized** in that the computer-readable program causes the processor to determine a change of an impedance between each of the four electric poles (91, 92, 93, 94) and the first electric pole (20) during a cardiac cycle over a first period of time.

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12. Method for determining a condition of a human or animal heart with an implantable medical device for stimulating a human or animal heart, the implantable medical device (1) comprising a processor, a memory unit, a His electrode (2) having a first electrode pole (20) configured to detect an electrical signal at a His bundle (4) of a human or animal heart (5), at least one further electrode (3, 9) having at least one further electrode pole (30, 91, 92, 93, 94) configured to detect an electrical signal at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4),

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characterized

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in that the method comprises the following steps:

measuring electric signals at a His bundle (4) of a human or animal heart (5) with the first electrode pole (20),

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measuring electric signals at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4) with the at least one further electrode pole (30, 91, 92, 93, 94),

evaluating intracardiac electrogram signals and/or impedance signals measured between the first electrode pole (20) and the at least one further electrode pole (30, 91, 92, 93, 94), with the provision that this evaluating does not only comprise a determination of an atrial-His bundle transition time, and

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determining a condition of the heart (5) on the basis of the preceding evaluating step.

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13. Computer program product comprising computer-readable code that causes a processor to perform the following steps when executed on the processor:

measuring electric signals at a His bundle (4) of a human or animal heart (5) with a His electrode (2) having a first electrode pole (20),

5 measuring electric signals at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4) with at least one further electrode (3, 9) having at least one further electrode pole (30, 91, 92, 93, 94), and

10 evaluating intracardiac electrogram signals and/or impedance signals measured between the first electrode pole (20) and the at least one further electrode pole (30, 91, 92, 93, 94), with the provision that this evaluating does not only comprise a determination of an atrial-His bundle transition time.

14. Method of treatment of a human or animal patient in need of such treatment by means of an implantable medical device for stimulating a human or animal heart, wherein the implantable medical device (1) comprises a processor, a memory unit, a His electrode (2) having a first electrode pole (20) configured to detect an electrical signal at a His bundle (4) of a human or animal heart (5), at least one further electrode (3, 9) having at least one further electrode pole (30, 91, 92, 93, 94) configured to detect an electrical signal at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4), the method comprising the following steps:

25 measuring electric signals at a His bundle (4) of a human or animal heart (5) with the first electrode pole (20),

30 measuring electric signals at a cardiac region (6, 10) of the same heart (5) different from the His bundle (4) with the at least one further electrode pole (30, 91, 92, 93, 94),

35 evaluating intracardiac electrogram signals and/or impedance signals measured between the first electrode pole (20) and the at least one further electrode pole (30, 91, 92, 93, 94), with the provision that this evaluating does not only comprise a determination of an atrial-His bundle transition time,

adjusting an algorithm for controlling the implantable medical device (1) based on the preceding evaluating step, and

- 5 stimulating a cardiac region (4, 6, 10) of the human or animal heart (5) with at least one of the His electrode (2), the at least one further electrode (3, 9) or a simulation unit configured to stimulate a cardiac region, wherein the stimulating is performed by applying the adjusted algorithm.