Development and validation of a solar-powered cardiac pacemaker

Background
Contemporary pacemakers are powered by primary batteries. Though, they have only a limited energy storing capacity. Thus, pacemakers have to be replaced after a few years. This re-intervention bears the risk of complications and is costly. To overcome these limitations, a long-term energy harvesting system inside the human body is desirable. Ambient light features good skin penetration, thus, a subcutaneously implanted pacemaker can be powered by a solar module (fig. 1). Since the implantation site and depth under the skin are crucial for efficient energy harvesting, the power output of the solar module needs to be characterized under different conditions and the pacemaker should be flexible and miniaturized.

Aim
The aim of this project is to develop a second generation solar pacemaker and to perform a real-life validation study.

Materials and Methods
The Master candidate will familiarize himself first with the concept of cardiac pacing and subcutaneous energy harvesting by a solar module. In a second step, the candidate will develop a miniaturized solar pacemaker featuring a flexible solar cell (based on an existing pacemaker circuit (fig. 1)). The overall efficiency of the flexible pacemaker will be measured experimentally on the bench. Our group also provides the opportunity for in vivo testing. In parallel, the method of subcutaneous energy harvesting by solar cells will be investigated experimentally using a dedicated solar monitor (fig. 2).

Nature of the Thesis
Hardware development 45%
Experimental 45%
Documentation 10%

Requirements
Knowledge/interest in electrical engineering

What we offer
The candidate will work in a young and dynamic team of engineers and physicians, where creative and innovative work is highly appreciated. The position provides the opportunity to be involved in the development of cutting-edge cardiovascular technology and the development of active medical implants.

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References

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