Complex skeletons for improved tracking and motion of 3D printed biorobots

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Nano and microrobots has raised great interest for its potential applications in both environmental and biomedical applications, being traditionally divided in three main categories: synthetic, biological and hybrid microrobots.[1] Among them, biohybrid robots are being explored to exploit and implement some of their unique inherent capabilities, such as adaptability, self-assembly, self-healing, or response to an external stimuli.[2] The development of 3D bioprinting techniques revolutionized the field of advanced biorobots based on living tissues, being especially remarkable the versatility of such approach when cells are directly bioprinted in a rational shape to obtain a defined functionality.

In our specific case, our biological actuator based on skeletal muscle cells is combined with an advanced 3D printed compliant skeleton useful force tracking purposes (Figure 1). Skeletal muscle cells provide a controlled contractile behavior dependent on the applied electrical stimuli, being also of interest for their self-repair capabilities, which could lead to longer operative time in the resulting biobot.[3] On the other hand, a skeleton with a controlled stiffness and a spring-like structure useful for force tracking[4] has been integrated to obtain efficient motion and provide the required stiffness for the optimal cell maturation. The resulting biohybrid robot's capabilities also depend on the performed training protocols, which are already been stablished in the group by applying electric pulse stimulation.[5] Currently, we are not only exploring the effect of such global stimulation, but also how actuation can be modulated by integrating flexible electrodes in the system able to apply local electric field.

References

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