Transient electronics for edible neuroprosthetics

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Transient electronics is a recent challenging research field aiming at the realization of functional electronic devices able to disappear in a controlled and predefined manner [1] . Amongst different applications, biomedical devices based on transient technology have raised a lot of interest [2,3] . Their ability to dissolve within the biological environment, thus avoiding infections due to a prolonged stay and risks related to surgical retrieval, is their main appealing characteristic. In many cases the device relies on silicon-based electronics, but the incorporation of polymers in the design, mostly as flexible substrate or for drug-release purposes, is becoming more and more exploited [4] . Due to the intrinsic versatility of polymeric materials, which potentially allow for a great variety of customized application and fabrication techniques, fully polymer-based transient electronic devices represent the natural step forward in this research area. We therefore intend to contribute to the progress in the field of transient electronics by fabricating probes for neural signal recording based on biocompatible and biodegradable polymers, both as substrate and active material, thus introducing the edible neuroprosthetics concept. In the specific case, we relied on Polycaprolactone (PCL) [5] or Poly Lactic-co-Glycolic Acid (PLGA) [6] as substrate and Poly(3,4-ethylenedioxythiophene)-poly(styrenesulfonate) (Pedot:PSS) as conductive conjugated polymer. With these materials as building blocks, a series of passive neural probes were fabricated and implanted in mice brains (visual cortex area) to assess their *in-vivo* durability. Several time-points (1, 3, 6 and 9 months) have been established for the implants analysis in order to have a better comprehension of the degradation process within the biological environment and the response of the biological environment itself to the insertion of an external object. Preliminary results show that after one month of implantation the astrocytes are visibly activated as expected, whereas there is no evidence of activated microglia. In the near future, implantation of active neural probes will give insight also on the recording capacity of the devices.

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