Integration Strategy for Heterogeneously Integrated Wearable and Implantable Electronics

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We live in a world where electronics play critical enabling role. Specifically, matured and advanced CMOS technology with its arts and science of miniaturization has propelled variety of CMOS devices to a level where their lofty performance over cost benefit has ushered into a wide range of application spectrum ranging from computers to display to today's home automation. Going forward we may want to ask ourselves a few important questions:

1. Can CMOS technology be expanded further to add new functionalities to CMOS devices while retaining their existing attributes in tact?
2. Whether this exercise will have a better functionalities over cost metric?
3. If the first two questions are addressed well, whether the existing applications will be strengthened and/or diversified? Whether new applications may emerge?

To address these questions, nature can be a great source of understanding and knowledge. Since, most of the natural species and biology have soft tissues and asymmetric terrain of skin surfaces, by transforming traditional rigid electronics into physically compliant one, we can intimately interface with nature to have better understanding how it works and we can use that learning to engineer a better world for us.

In this talk, I will discuss our progress in this direction to design optimal integration strategies to heterogeneously integrated wearable and implantable electronics. I will discuss how biocompatibility and thermal budget limitation influence our design criteria for wearable and implantable electronics. From material choice to process chemistry, device design to integrated circuit formation and finally encapsulation - all depend on these two specific criteria and we find heterogeneous integration is the key to achieve manufacturable integration strategies for them.