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Biocompatibility of implantable biomedical devices

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Biomedical devices have been broadly used to treat human disease, especially chronic diseases where pharmaceuticals are less effective. Heart valve and artificial joint are examples. Biomedical devices perform by delivering therapies such as electric stimulations, mechanical supports and biological actions. While the uses of biomedical devices are highly successful they can trigger adverse biological reactions as well. The property that medical devices perform with intended functions but not causing unacceptable adverse effects was called biocompatibility in the early time. As our understanding of biomaterial-biological interactions getting broader, biocompatibility has more meanings. In this talk, I will present some adverse biological reactions observed with implantable biomedical devices. Among them are surface fouling of implantable sensors, calcification with vascular devices, restenosis with stents, foreign particle migration and mechanical fractures of devices due to inflammation reactions. While these effects are repeatable, there are very few quantitative data and theories to define them. The purpose of this presentation is to introduce this biocompatibility concept to biophysicists to stimulate research interests at different angles. An open question is how to quantitatively understand the biocompatibility that, like many other biological processes, has not been quantified experimentally.