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Bacteria on surfaces –engineering surface microstructures to control bacterial adhesion and biofilm growth

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Bacteria are highly effective at populating living or inanimate surfaces, which causes significant problems in the healthcare industry, such as nosocomial infections, and the infection of medical devices. There is much to learn on the roles of surface topology at nano and micro scales, wettability and local adhesion forces on bacterial attachment and growth. This talk will present recent results on materials engineered to prevent bacterial attachment, and surface microtopologies to control and direct biofilm growth. Herein we demonstrate the role for superhydrophobic non-wetting surfaces to control (short-term) cell attachment, and we have modelled bacterial cell attachment as particles acting under a balance of local surface tension forces [1]. Further, we have designed a novel class of ultra low-adhesion surfaces (known as SLIPS) that incorporate a micron-scale thick lubricant layer immobilized at a surface [2,3]. These surfaces are highly effective to prevent the wetting of a wide range of contacting liquids, hydrophobic and charged particles, and bacterial cell adhesion. Importantly, many such designs that work by such physical mechanisms can be effective for a broad range of cell types, and are not biologically-specific and susceptible to resistance.

[1] Hatton BD & Aizenberg J Nano Letters (2012)12(9):4551-4557; [2] Wong TS, et al. Nature (2011) 477(7365):443-447; [3] Vogel N, Belisle R, Hatton BD, Wong TS, & Aizenberg J Nature Communications (2013) 4(2167).

Author: HATTON, Benjamin (U Toronto)

Presenter: HATTON, Benjamin (U Toronto)

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