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Interactions between electrospun fibers and the surrounding biological environment; cells and small molecules

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Electrospun fibers have a morphology that can be controlled to resemble structures found in nature such as spider silk, a ragwort leaf and the extra cellular matrix. This unique morphology makes the fibers suitable among others for biomedical applications such as tissue engineering, wound healing, and drug delivery. The choice of material also affects the performance of the fibers. Biopolymers are highly appealing due to their excellent biocompatibility and biodegradability, and interactions between biopolymeric fibers such as electrospun fish proteins (FSP) (Figure 1. A) and a biological system may provide further beneficial effects. However, the electrospun fibers may also interact with the surrounding environment, such as small molecules, which can affect the fiber properties.

The potential of using FSP fibers as a carrier matrix for therapeutic proteins has been investigated, especially focusing on the challenges related to oral delivery. The inherent structural and chemical properties of the FSP fibers displayed excellent biocompatibility, yet interacted with enzymes found in the gastrointestinal tract and intestinal epithelium, which lead to an increased insulin transport across a Caco-2 cell monolayer to around 12 % of the of the applied dose (Figure 1. B). Moreover, the insulin loaded FSP fibers (FSP-Ins) interacted with biorelevant molecules in solution. In specific, the presence of surfactants in the solution to which the FSP-Ins fibers where added affected: i) the release properties of insulin from FSP-Ins fibers (Figure 1. C), ii) the inner porosity of the fibers, and iii) the properties of the accessible fiber surface. The effects caused by the biorelevant molecules were dependent on their physico-chemical properties such as charge. Altogether these results indicate that electrospun fibers interact with the surrounding environment; e.g. cells or small molecules.

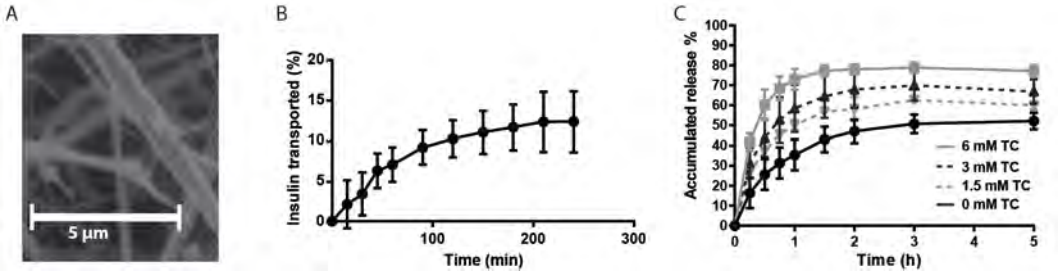

Figure 1. A) SEM image of FSP-Ins fibers, B) transport of insulin released from FSP-Ins fibers across a Caco-2 cell monolayer, C) release of insulin from FSP-Ins fibers in MES-HBSS buffer with different amounts of taurocholate (TC). Data represent mean ± SD, n > 3.

References

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