A miniaturized model of the infantile digestive tract

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We present the development of a new, continuous-flow model of the infantile digestive system. *In vitro* digestions are a key component in the analysis of new pharmaceuticals and nutrients, and are normally carried out in a batch-wise reaction [1]. The infantile digestive system strongly resembles the adult digestive tract, but there are crucial differences. First of all, the stomach is less acidic (at pH 5–6, instead of 1–3). Second, the stomach has a lower concentration of enzymes. Finally, the enzymatic processes taking place in the infantile intestine are also different than in the adult digestive tract. We have developed a microfluidic digestive tract to mimic infantile digestion, consisting of two modules: a gastric compartment, and an intestinal compartment. Since thorough mixing in microfluidic systems is challenging, we employ so-called 'chaotic' micromixers to represent the stomach and intestine, consisting of herringbone-shaped grooves in the microfluidic channels to enhance mixing by chaotic advection. A loop of tubing connecting the micromixers is used to incubate the mixtures to allow the enzymes to work [2]. We demonstrate the functionality of our system by digesting a milk protein, lactoferrin, which plays an important role in the nutrition and health of infants. We analyzed the progress of digestion at various points in our system and compared it to a standard *in vitro* digestion in a test tube, by measuring the lactoferrin content at these locations by HPLC. With this system, we plan to monitor the possible digestion of medicinal drugs and nutrients before transferring them to a microfluidic barrier model of the intestinal wall to assess absorption.

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References

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