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From Piazzale Tecchio to Wall Street: the short story of a long polymer hydrogel

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An innovative class of superabsorbent (SAP) materials was developed to target the raising challenge of creating a completely biodegradable product for industrial applications.

Moving forward towards the biomedical applications, the technology platform was changed to create the first superabsorbent material entirely based on food grade products. In particular, our aim was to develop orally administered SAPs, capable of increasing the volume and the elasticity of the ingested foods throughout the entire gastrointestinal (GI) system, without additional caloric value, in a similar manner to raw vegetables. We hypothesized that such biomimetic approach could enable new mechanobiological treatments for the GI tract, with favorable efficacy and safety profile.

To this aim, we developed a technological platform to produce novel cellulose-based hydrogels that are exclusively based on carboxymethylcellulose sodium salt (CMC) as the polymer backbone (used as a thickening agent in foods), and citric acid (CA) as the crosslinking agent (found in citrus fruits). By utilizing an in vitro GI model, we show that the SAP can be tuned to function in the wide range of conditions found in the GI tract. In particular, the hydrogel show elasticity levels, when in the stomach and small intestine, remarkably similar to some raw vegetables, while starkly contrasting to functional fibers. Once in the colon, the hydrogels are partially degraded through enzymatic activity thereby releasing the carried water, while the cellulosic material is excreted with the feces. Clinical studies performed on this platform [1, 2] and resulting regulatory clearances, in the US and Europe, show that it represent a useful aid in weight management for the treatment of individuals with overweight and obesity. Moreover, encouraging data from ex vivo and in vivo animal models suggest that the elasticity, in addition to the composition, play a key role in the maintenance of gut tissue health. These findings pave the way to additional indications of the elated to metabolic diseases and gut health.

To bring the technology from the research through the clinic, and eventually to the market, a Start up company was incorporated, which completed many rounds of funding till the listing at the NYSE in Wall Street in Jan '22. The first product, to target obesity, is already on the market in US.

1. Greenway, F. L. et al. A randomized, double-blind, placebo-controlled study of Gelesis100: a novel non-systemic oral hydrogel for weight loss. *Obesity* 27, 205-216 (2019).
2. Urban, L. E. et al. Effect of a non-systemic, orally-administered hydrogel, GS100, on metformin pharmacokinetics. *Can. J. Physiol. Pharmacol.* 96, 1127-1131 (2018).

Presenter: SANNINO, Alessandro (University of Salento)