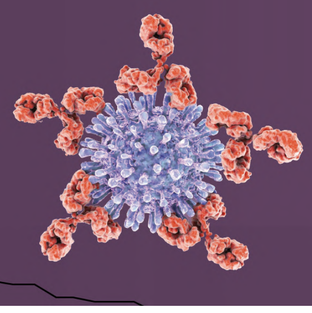

IMMUNOTHERAPY FOR INFECTIOUS DISEASES CONFERENCE

NOVEL WAYS TO FIGHT PATHOGENS

JUNE 20-23RD, 2022 - AULA MAGNA, UNIVERSITY OF PAVIA, ITALY - WWW.IDIMMUNOTHERAPY.COM

MUCOSOMES | a novel multi drug delivery platform bioinspired from mucin immunomodulatory and antimicrobial activity

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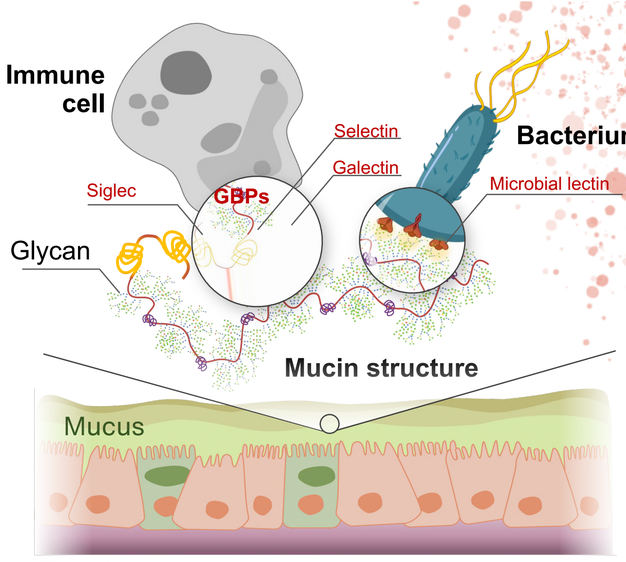


Figure 1

Mucin glycoproteins are the backbone of mucus which cover all the wet tissues of the human body. Carbohydrate groups on mucins such as N-acetylglucosamine, fucose, galactose and sialic acid, can be ligands for **glycan-binding proteins (lectins)** on both pathogens and immune cells (**Fig. 1**) [1]

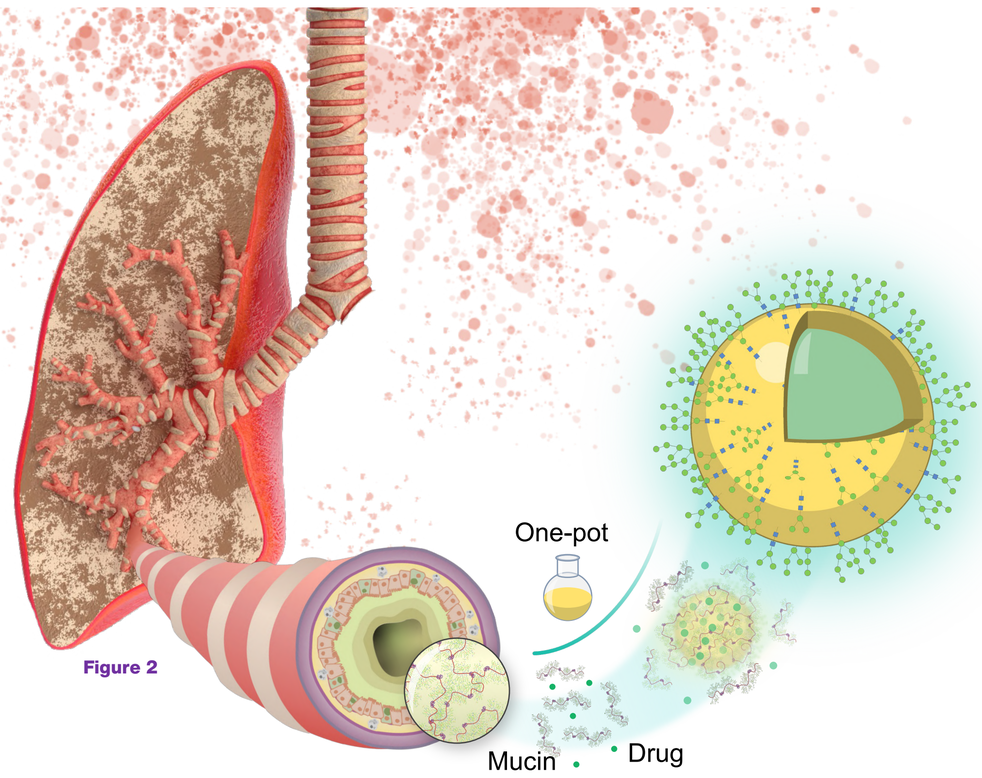
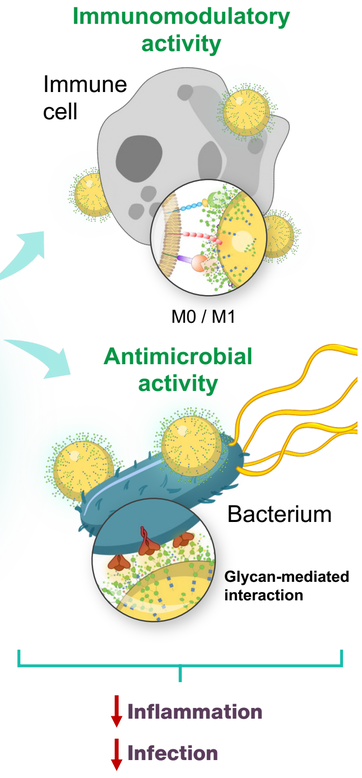


Figure 2



Inspired by the unique properties of mucins and mucus (our first line of defense), we developed a **cutting-edge nanoplatform that exploits mucus's natural mucoadhesive and binding capacity.**

We used mucin glycoproteins to synthesize a novel class of nanoparticles that have been named **mucosomes** [2, 3].

Mucosomes production, functionalization with glycans, and drug loading occur via an easily scalable **one-pot synthesis**. The presence of surface glycans could mediate the engagement of lectins expressed by pathogens but also mammalian cells (**Fig. 2**).

EXPERIMENTAL

Size and shape

Mucosomes are nanoparticles of **spherical shape** and diameter of **≈200 nm**.

The size and shape were assessed by TEM, FESEM, DLS and NTA analysis (**Fig. 3**).

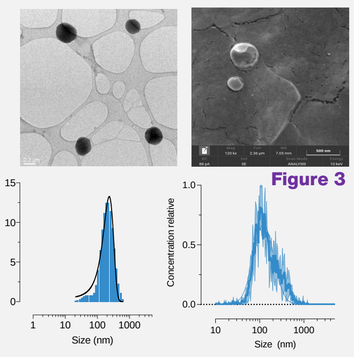
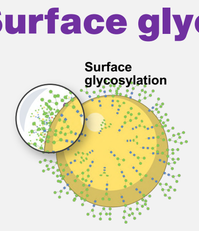


Figure 3

Surface glycosylation



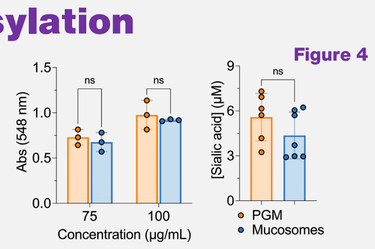


Figure 4

Mucosomes are **glycosylated nanoparticles**. The presence of carbohydrates on the surface of mucosomes is demonstrated by a Periodic acid-Schiff (PAS) staining and by derivatization and fluorometric detection of sialic acid (**Fig. 4**).

Mucoadhesive properties

Mucosomes are **mucoadhesive nanoparticles**. Mucoadhesive properties were studied by QCM analysis. Nanoparticles at first adsorb over the BSM-PEI layer and remain adsorbed even after two washing cycles with PBS (**Fig. 5**). Mucoadhesivity was also investigated by a flow-through assay by measuring the retention time of FITC-loaded mucosomes on a cystic fibrosis mucus model (**Fig. 6**)

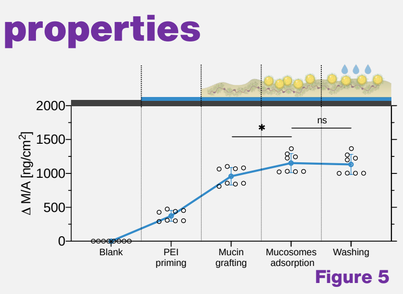


Figure 5

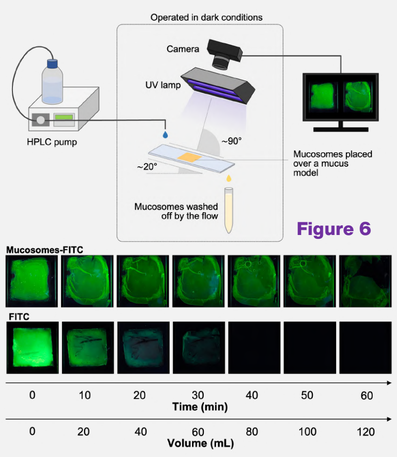


Figure 6

In vitro & *in vivo* testing

In vitro tests showed **cytocompatibility** with HeLa cells (**Fig. 7**) and **absence of immunogenic** effects (**Fig. 8**).

In vivo experiments showed that mucosomes mainly biodistributed in the **lungs** and liver without inducing localized or systemic toxicity (**Fig. 9**).

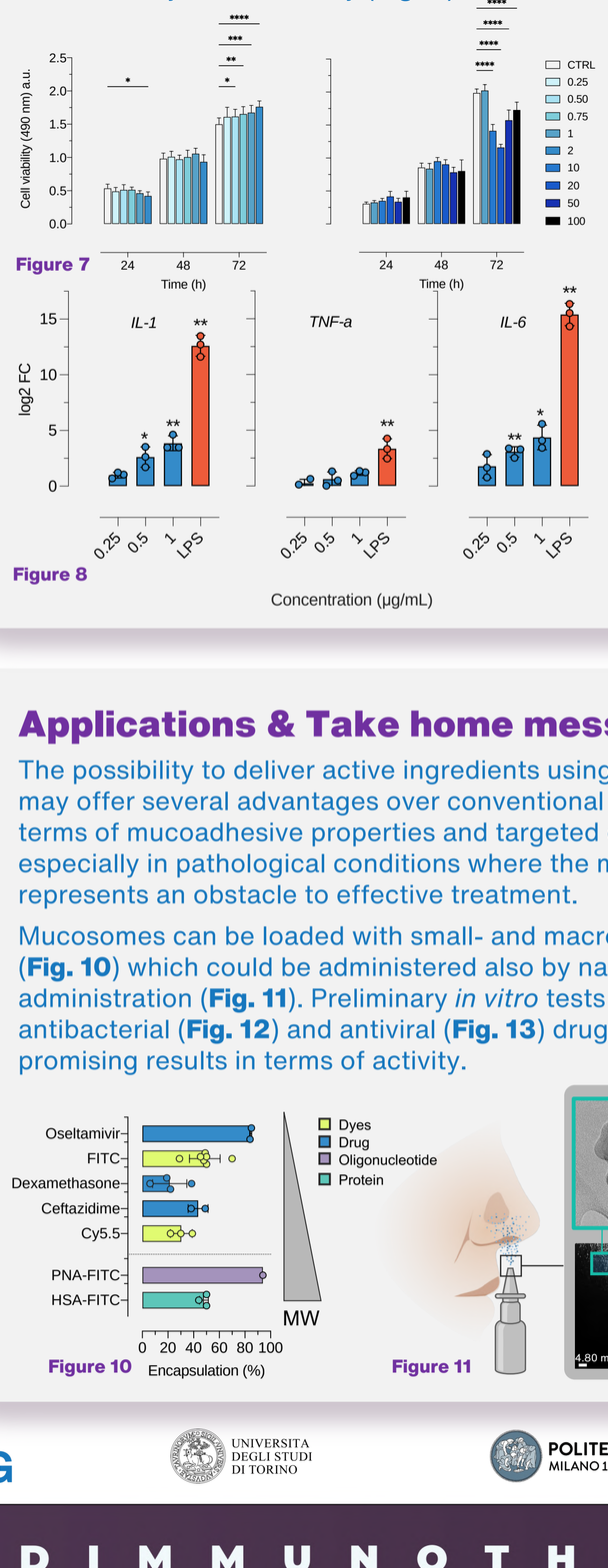


Figure 7

Figure 8

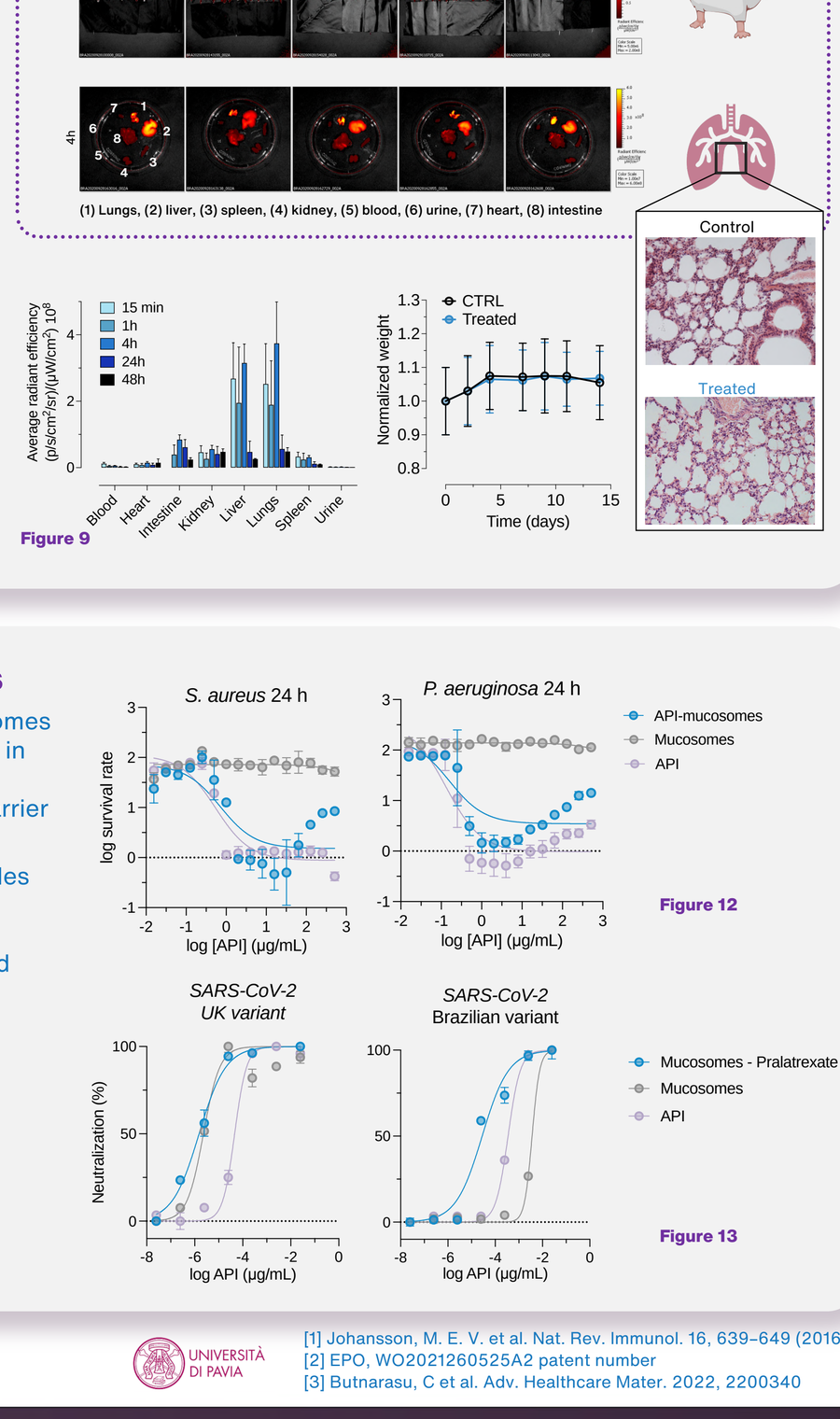


Figure 9

Applications & Take home messages

The possibility to deliver active ingredients using mucosomes may offer several advantages over conventional systems in terms of mucoadhesive properties and targeted delivery, especially in pathological conditions where the mucus barrier represents an obstacle to effective treatment.

Mucosomes can be loaded with small- and macromolecules (**Fig. 10**) which could be administered also by nasal administration (**Fig. 11**). Preliminary *in vitro* tests with antibacterial (**Fig. 12**) and antiviral (**Fig. 13**) drugs showed promising results in terms of activity.

Figure 10

Figure 11

Figure 12

Figure 13

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[1] Johansson, M. E. V. et al. Nat. Rev. Immunol. 16, 639–649 (2016)
[2] EPO, WO2021260525A2 patent number
[3] Butnarasu, C et al. Adv. Healthcare Mater. 2022, 2200340