Buccal delivery of peptide drugs with an octopus inspired suction patch

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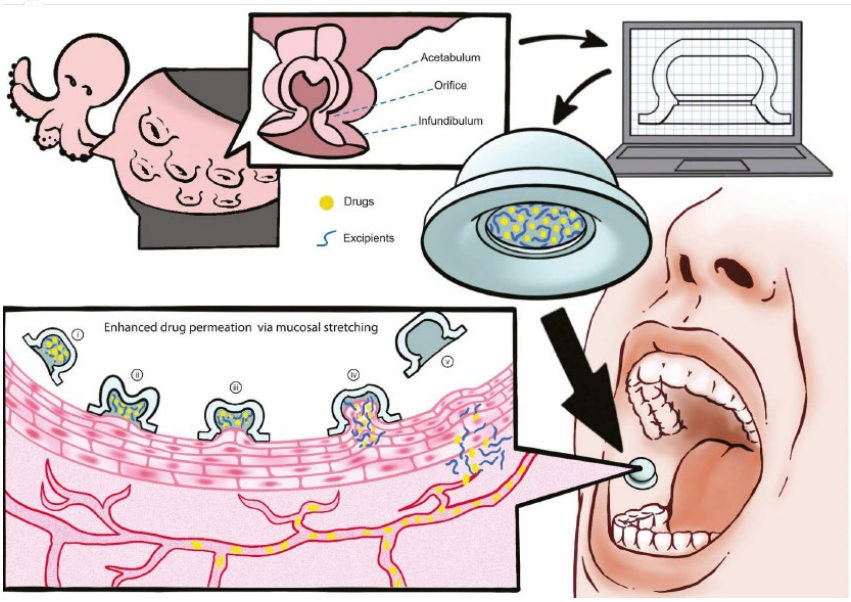
Peptide drugs have revolutionised the treatment of many diseases, from chronic metabolic disorders to prostate cancer. However, with few exceptions, they mostly require parenteral administration due to their instability in the gastrointestinal tract and poor permeability. The work presented here covers the development of the octopus-inspired suction patch platform for the delivery of peptide drugs via the buccal mucosa, from initial concept to in vivo proof of concept.[1,2] Inspired by an octopus sucker, a self-applicable suction patch loaded with a drug formulation was designed. The platform was characterised in vitro and ex vivo on fresh porcine buccal mucosa, and further validated in beagle dogs. In summary, the adhesion strength of the suction patch significantly outperformed state-of-the-art mucoadhesive patches. Additionally, a new permeation-enhancing mechanism of drug delivery was identified, based on the synergy between mechanical stretching and chemical permeation enhancers. Pharmacokinetic studies in beagle dogs showed that the bioavailability of model peptide drugs in the range from 1.1 to 4.1 kDa could reach bioavailabilities of > 10% and increase the absorption compared to commercial oral formulations of semaglutide (4.1 kDa) and desmopressin (1.1 kDa) by at least an order of magnitude. Finally, a first-in-human comfort study with 40 healthy volunteers confirmed the patch's ease of use and good acceptance.



Concept of the octopus-inspired suction patch for delivering peptide drugs through the buccal mucosa.[1]

[1] Luo, Z., Klein Cerrejon, D., Römer, S., Zoratto, N., & Leroux, J. C. Boosting systemic absorption of peptides with a bioinspired buccal-stretching patch. *Science Translational Medicine*, **2023**, *15*(715), eabq1887.

[2] Klein Cerrejon, D., Krupke, H., Gao, D., Paunović, N., Sachs, D., & Leroux, J. C. Optimized suction patch design for enhanced transbuccal macromolecular drug delivery. *Journal of Controlled Release*, **2025**, *380*, 875-891.