

Postdoctoral Position

“Biomimetic Soft Robotics to study the Biomechanics of Swallowing”

UMR SayFood (formerly GMPA) AgroParisTech / INRAE

Biomimetic soft robotics is gaining increasing popularity in prosthetics but also as a biomechanical research tool. A biomimetic *in vitro* experiment replicating some essential features of the oral phase of human swallowing was recently developed and used to study the impact of rheology on the swallowing dynamics of liquid food [1, 2, 3, 4] and pharmaceutical solid oral forms in presence of different carriers [5, 6]. Recently, a new soft robotics prototype, able to simulate a deficient coordination of the tongue peristalsis, which can lead to swallowing disorders, has also been developed [7].

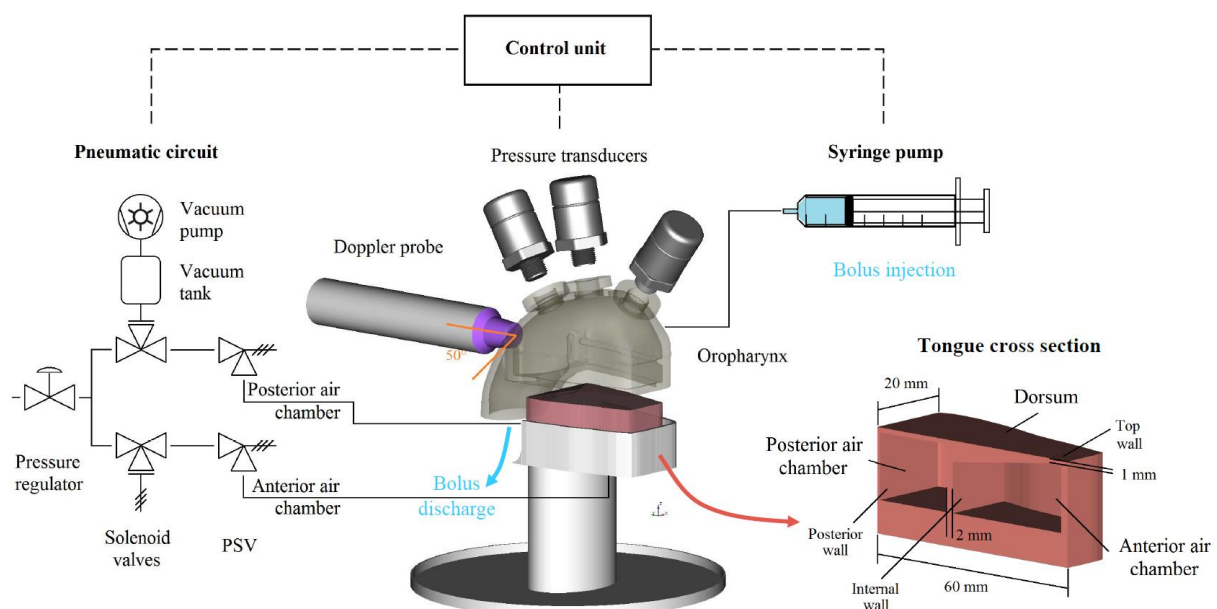


Fig.1 Soft Robotic Tongue developed to study the Biomechanics of Swallowing [7].

This Postdoctoral project, sponsored by an industrial group with strong R&D, aims at: i) validating and improving the *in vitro* biomechanical model by comparing the *in vitro* flow with *in vivo* data from the literature, ii) extending the capabilities of the biomimetic soft robotic models to study the biomechanics of swallowing and in scenarios relevant to specific consumer groups.

Profile

The ideal candidate has recently received a PhD in mechanical, electronical, biomedical or chemical engineering and has a documented experience in robotics and/or in developing complex experimental setup and their control. Experience in soft robotics would be a strong asset, but is not required. The ideal candidate should be fluent in spoken and written English. Fluency in French would be appreciated, but it is not required.

Start date and host research group

This **one-year Postdoctoral project** should ideally start by May 1st, 2020. The salary will depend on the level of experience. An extension of the contract may be possible, depending on the results obtained.

INRAE (formerly INRA) is the French National Research Institute for Agriculture, Food and the Environment: a community of more than 10,000 people dedicated to carrying out research on these themes in France and abroad and ranked second worldwide for food science and technology [8].

AgroParisTech is a higher education and research institute ("Grande Ecole") aiming at addressing some of the main global challenges of the 21st century : feeding a growing population while sustainably managing territories, preserving natural resources, supporting innovation and integrating the bio economy. AgroParisTech is ranked 1st in France and 17th worldwide in the subject "Agricultural sciences" in the ShanghaiRanking's Global Ranking of Academic Subjects 2019.

This project will be carried out in the labs of the former UMR GENIAL, that has recently merged with UMR GMPA to form **UMR SayFood**, and shall be carried out at **Massy's AgroParisTech center**, conveniently located a short walk from the RER B station "Les Baconnets", or a short bus ride from the RER C station "Massy-Palaiseau", very well connected to the centre of Paris.

How to Apply:

Applications should be sent via email to marco.ramaioli@inrae.fr (Senior Research Scientist at UMR 782 GMPA / SayFood) and should include: the Curriculum Vitae, a letter of motivation and relevant publications.

Please apply ASAP, but ideally before March. 31st 2020. The selection will start at end March and will continue until a suitable candidate is appointed.

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- [1] Mowlavi S., Engmann J., Burbidge A., Lloyd R., Hayoun P., Le Reverend B. and Ramaioli M., In vivo observations and in vitro experiments on the oral phase of swallowing of Newtonian and shear-thinning liquids, 2016, J.Biomechanics, 49, 16, 3788-3795.
 - [2] Hayoun, P., Engmann, J., Mowlavi, S., Le Reverend, B., Burbidge, A. and Ramaioli, M., A model experiment to understand the oral phase of swallowing of Newtonian liquids, 2015, Journal of Biomechanics, 48, 14, 3922-3928.
 - [3] Marconati M. and Ramaioli M., The role of extensional rheology in the oral phase of swallowing: an in vitro study, 2019, *submitted*, <https://arxiv.org/pdf/2001.07810.pdf>
 - [4] Marconati M., Engmann J., Burbidge A., Mathieu V., Souchon I. and Ramaioli M., A review of the approaches to predict the ease of swallowing and post-swallow residues, 2019, Trends in Food Science & Technology, 86, 281-297.
 - [5] Marconati M., Lopez F., Tuleu C., Orlu M. and Ramaioli, M. , In vitro and sensory tests to design easy-to-swallow multi-particulate formulations, 2019, European Journal of Pharmaceutical Sciences, 132, 157-162.
 - [6] Marconati M., Raut S., Burbidge A., Engmann J. and Ramaioli M., An in vitro experiment to simulate how easy pills are to swallow, 2018, International Journal of Pharmaceutics, 535, 27-37.
 - [7] Marconati M., Pani S., Engmann J., Burbidge A. and Ramaioli M., A soft robotic tongue to develop solutions to manage swallowing disorders, 2019, *submitted*, <https://arxiv.org/pdf/2003.01194.pdf>
 - [8] InCites™ Clarivate Analytics data on 1st April 2018, analysis on WoS publications from 1st January 2016 to 31 December 2017. <http://institut.inra.fr/en/Objectives/Generating-knowledge>