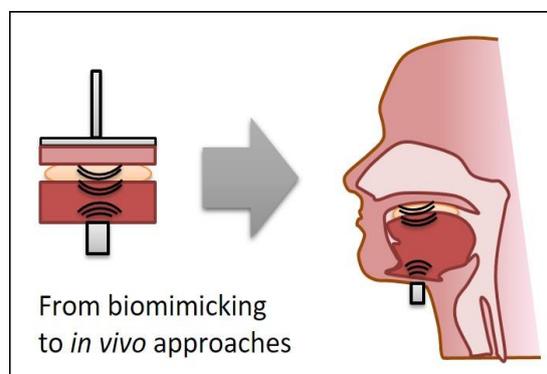


POSTDOC position at SayFood, Thiverval-Grignon, France

Quantitative ultrasound for the investigation of tongue-food interactions during oral processing.

Context: In the framework of the ANR project QUSToFood (ANR-17-CE21-0004), a postdoctoral position is open at UMR SayFood. QUSToFood proposes to use Quantitative Ultrasound (QUS) methods for the study of texture perceptions resulting from the mechanical interactions between the tongue and the palate during the oral processing of food. These interactions induce the stimulation of tongue mechanoreceptors and enable the continuous evaluation of the mechanical status of food all along oral processing (from introduction into the mouth to the triggering of swallowing in safe and comfortable conditions). QUS are non-destructive, non-invasive and provide real-time measurement which can be employed both *in vitro* and *in vivo*, directly on the individual. The method developed in QUSToFood could thus help to characterize potential losses of sensory quality induced by food and agro ecological transitions, or to meet pleasure and health criteria for specific populations such as infants with sensory processing disorders or seniors suffering from swallowing disorders.

A bio-mimicking set-up has been developed to progressively reproduce, in controlled *in vitro* conditions, the complex characteristics of the oral manipulation of food between the tongue and the palate. A QUS experimental device was designed, measuring the temporal variations of the acoustic energy backscattered after the emission of acoustic stimuli in the tongue-food-palate system. Signal processing methods made it possible to characterize the degree of intimate contact between food and tongue asperities, as well as the relative deformations undergone by the different media.



Missions: The first mission of this postdoctoral fellowship is to continue the exploratory work on the proof of concept of QUS methods on the bio-mimicking set-up. In particular, we will be interested in trying to capture vibratory events related to the micro deformations of the asperities of tongue surface, or to friction between tongue and palate in presence of food. Original modalities coupling ultrasound imaging with shear wave elastography will also be explored to relate the movements, deformations and changes in rigidity occurring in the tongue. The second mission of the project will consist in feasibility studies to investigate the adaptability of the technique in an *in vivo* configuration. The QUS system will be transformed in order to allow robust and reproducible measurements under the chin of the consumer. After approval by an ethical research committee, an

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in vivo study involving a restricted group of volunteers will be conducted in order to compare the dynamic evolutions of QUS parameters with those of sensory perceptions throughout oral processing.

Special emphasis will be placed on the dissemination of results through presentations in international conferences and publications in high-ranking peer-reviewed journals. The multidisciplinary nature of the project will make it possible to address a wide variety of scientific communities, including food science, acoustics or biomechanics.

Keywords: Quantitative ultrasound; Biomechanics; Rheology; Tribology; Food; Tongue; Oral processing; Texture

Candidate: The ideal candidate must have completed a PhD in the field of physics, mechanics, biomedical or food engineering. Experience and interest in signal and image processing, and in the in-house design of experimental systems would be an advantage. In all cases, the candidate must have a strong interest and aptitude for multidisciplinary approaches, as this project combines biomechanics, acoustics, rheology, tribology, instrumentation, signal and image processing, food science and sensory analysis.

About SayFood: Paris Saclay food and bioproduct engineering research unit (so-called UMR SayFood) is a joint research unit between AgroParisTech (Paris Institute of Technology for Life, Food and Environmental Sciences) and INRAE (French National Research Institute for Agriculture, Food and Environment, formerly INRA). The lab results from the recent merge between UMRs Genial and GMPA, becoming the main research cluster in Paris area focusing on food and bioproduct processing. Among the many and varied research topics addressed at SayFood, a multidisciplinary group of researchers is particularly interested in the mechanisms of food breakdown during oral processing and digestion. Their aim is to understand how the structure of food impacts the kinetics of release of sensory stimuli, or the availability of nutrients.

Contract and location: This contract is for 24 months and the start date is flexible, but shall not be later than January 1, 2021. The gross salary will be from 2500€, depending on the number of years after PhD. The project will be carried out in the labs of UMR SayFood located in the AgroParisTech center of Thiverval-Grignon (a short bus ride from the "Plaisir Grignon" train station, which serves the center of Paris in 25 min). The relocation of the laboratories to a new site in Palaiseau is planned for the second half of the year 2022. The work schedule will be adapted accordingly.

Application: The selection process will start immediately and go on until the position is filled. To apply or inquire further, please contact Vincent Mathieu at vincent.mathieu@inrae.fr. Please include a C.V. and a letter of motivation, along with relevant publications and the name of references.

Some references:

Mantelet M., Restagno F., Souchon I. and Mathieu V., "Using ultrasound to characterize the tongue food interface: an *in vitro* study examining the impact of surface roughness and lubrication", *Ultrasonics*, 103 (2020) 106095.

Mantelet M., Srivastava R., Restagno F., Souchon I. and Mathieu V., "Real time ultrasound assessment of contact progress between food gels and tongue mimicking surfaces during a compression", *Food Hydrocolloids*, in press.



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