

**Multimodal and multispectral imaging approaches to study the  
diffusion of pepsin during in vitro digestion of meat**

**Thierry Astruc<sup>1\*</sup>, Annie Vénien<sup>1</sup>, Olivier Loison<sup>1</sup>, Laetitia Théron<sup>1</sup>, Christophe  
Chambon<sup>1</sup>, Hua Ding<sup>1</sup>, Lara Barotti<sup>1</sup>, Michiyo Motoyama<sup>1,2</sup>, Delphine Pavon<sup>3</sup>,  
Feng Ming Chian<sup>4</sup>, Mike Boland<sup>4</sup>, Lovedeep Kaur<sup>4</sup>**

<sup>1</sup>INRA de Theix, UR370 QuaPA, F-63122 St-Genès-Champanelle, France

<sup>2</sup>Institute of Livestock and Grassland Science, NARO, Tsukuba, 305-0901, Japan

<sup>3</sup>Sciences et Surfaces, F-69130 Ecully, France

<sup>4</sup>Massey University, Riddet Institute, Palmerston North, New Zealand

**E-mail: [Thierry.Astruc@inra.fr](mailto:Thierry.Astruc@inra.fr)**

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**Abstract:**

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Meat and fish are high-protein foods with high nutritional value, since all the essential amino acids are represented. The most nutritious proteins are the myofibrillar proteins that are contained in the cytoplasm of muscle cells. In meat, the muscle cells are wrapped by a sheath of connective tissue (the endomysium) and grouped in bundles also wrapped with connective tissue (the perimysium). This degree of muscle organization is likely to inhibit the penetration of pepsin into myofibrillar proteins during gastric digestion and consequently affect their degradation.

To characterize the effect of muscle structure on the diffusion of pepsin and to better understand the mechanisms of digestion of meat and meat products, we have implemented a series of experiments involving imaging and complementary approaches.

Samples of meat were incubated for 2 hours in a pepsin solution at pH 2 and slowly stirred to simulate gastric digestion. Serial histological sections of 6 to 10  $\mu\text{m}$  thick (depending on the type of targeted imaging) were prepared from the entire surface of the block. The diffusion of pepsin was assessed indirectly, through its proteolytic action on the sample (histology, infrared microscopy, MALDI-TOF imaging), and directly, using immunohistochemistry and Secondary Ion Mass Spectroscopy (SIMS ).

The results show the diffusion of pepsin with a relatively constant migration front. To a lesser extent, some of the pepsin also appears to migrate along the perimysium sheaths.

For the first time, we have been able to demonstrate the diffusion of pepsin in meat digested in vitro. Implementation of complementary imaging techniques seems to be the most useful approach to acquiring new information on the mechanisms of diffusion of digestive enzymes in food.

Note: Please send abstract to the referred email address ([nercsf@163.com](mailto:nercsf@163.com)) before April 23, 2017.