Microscopic insight to food texture
a cnidarian and cephalopod case study

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Background

Texture of food is a crucial parameter for accepting new food and for our general appreciation of food [1]. However, the fundamental explanation of the molecular origin of texture remains unclear.

In relation to texture, sea animal such as ***cnidarians*** (jellyfish) and ***cephalopods*** (squid, octopus) are of special interest. When prepared according to traditional methods, they undergo very dramatic textural changes.

Jellyfish are eaten mainly in Asia, and preparation involves salting methods during which the jellyfish turns crunchy.
Cephalopods are eaten in e.g. many Asian countries and in Southern Europe. Many different preparations are known, and the textures varies dramatically (e.g. tender, soft, rubbery etc.) depending on method used.

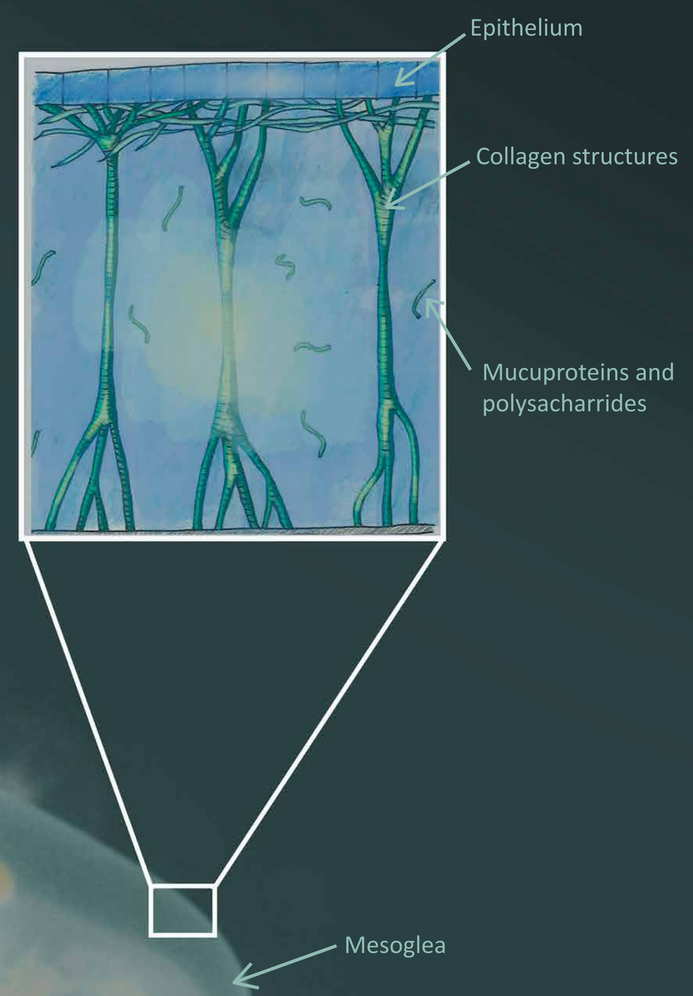
Despite the fact that both ***cnidarians*** and ***cephalopods*** are abundant in Danish waters, there is no tradition for eating neither of the two. Unfamiliar texture might be one reason.

Cnidarians and ***cephalopods*** have in common that they are rich in collagen and the strength and properties of collagen is the main factor for determining their texture.

For jellyfish, a gel-like substance called the mesoglea is likely to influence the texture of jellyfish. A theoretical framework descripting the jellyfish mesoglea by means of polymer physics was recently developed [2,3]. This work further suggest that the traditional Chinese preparation method is similar to tanning, and led to the development of an alternative preparation method using ethanol.

For both ***cnidarians*** and ***cephalopods***, there is a lack of direct evidence of the molecular rearrangements during preparation. This is partly due to the lack of technical solutions for probing the structures at the right spatial scale without inducing changes in the biological material of the food.

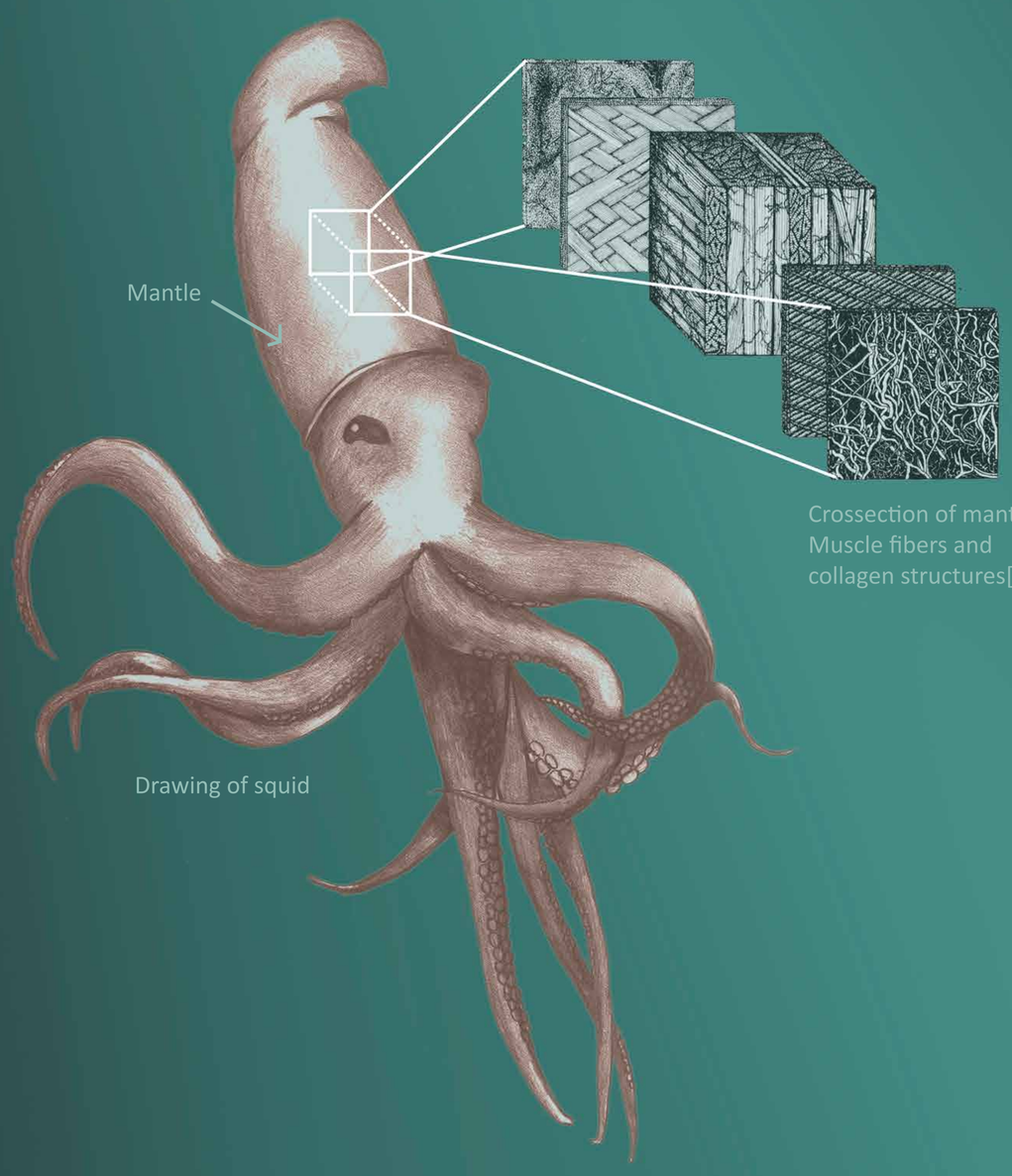
Recently, a number of optical microscopy techniques have been developed for biomedical applications [4]. These techniques offer a solution to also probe structural changes also in food. In particular, for collagen several optical techniques are available to probe the molecular structure.



Jellyfish, *Aurelis aurita*

The aim of the study

This project aims to use advanced optical imaging techniques to visualise molecular structures such as collagen within ***cnidarians*** and ***cephalopods***. This is done in order to gain insight to the relation between microscopic structural changes and macroscopic textural changes during different food preparations (e.g. salting, drying, freezing, heating…). In turn, this insight will be applied to suggest new food preparation methods.



Drawing of squid

Crossection of mantle: Muscle fibers and collagen structures[5].

Methodology/methods

Different types of advanced light microscopy will be used as a new tool to directly visualise molecular structures within the complex material of food. Techniques will include two-photon microscopy, second harmonic generation microscopy, coherent anti-stokes Raman scattering microscopy (CARS), and super-resolution microscopy. These include both label free and fluorescence based techniques. Quantitative image analysis is performed with existing imaging analysis software tools (Ilastic, Fiji etc.).

Conventional texture analysis will be used as a macroscopic measure of texture.

Physicochemical methods will be performed in order to gain understanding of the molecular behavior of the biological material and develop new food preparations.

References

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