

# **FOODSEG - WG 10**

## **Advanced food technology and preservation**

Daniela BORDA, Peter RASPOR

Bucuresti, 16<sup>th</sup> of June 2013



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- Current status of the working group discussions



# 4th draft

## **HIGH PRESSURE PROCESSING IN PRODUCTION OF MEAT AND MEAT LIKE PRODUCTS**

**1 Introduction**

**2 Principles for processing proteinaceous matrices and their preservation -GOING ON**

**3 Impact of HPP on meat constitutions -GOING ON**

**4 HPP treated food -GOING ON**

**5 Functionalization of HPP processed meat products -GOING ON**

**6 Future prospect for HPP generated technologies in meat and meat like products -GOING ON**

**7 References**

# HPP

## Consumers' expectations



compromise



Improved food quality  
Increased food safety  
Minimally affected by processing  
Attractive compositional and sensorial properties

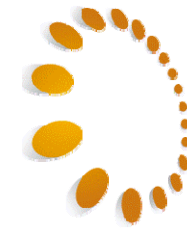


- **COMMENTS**

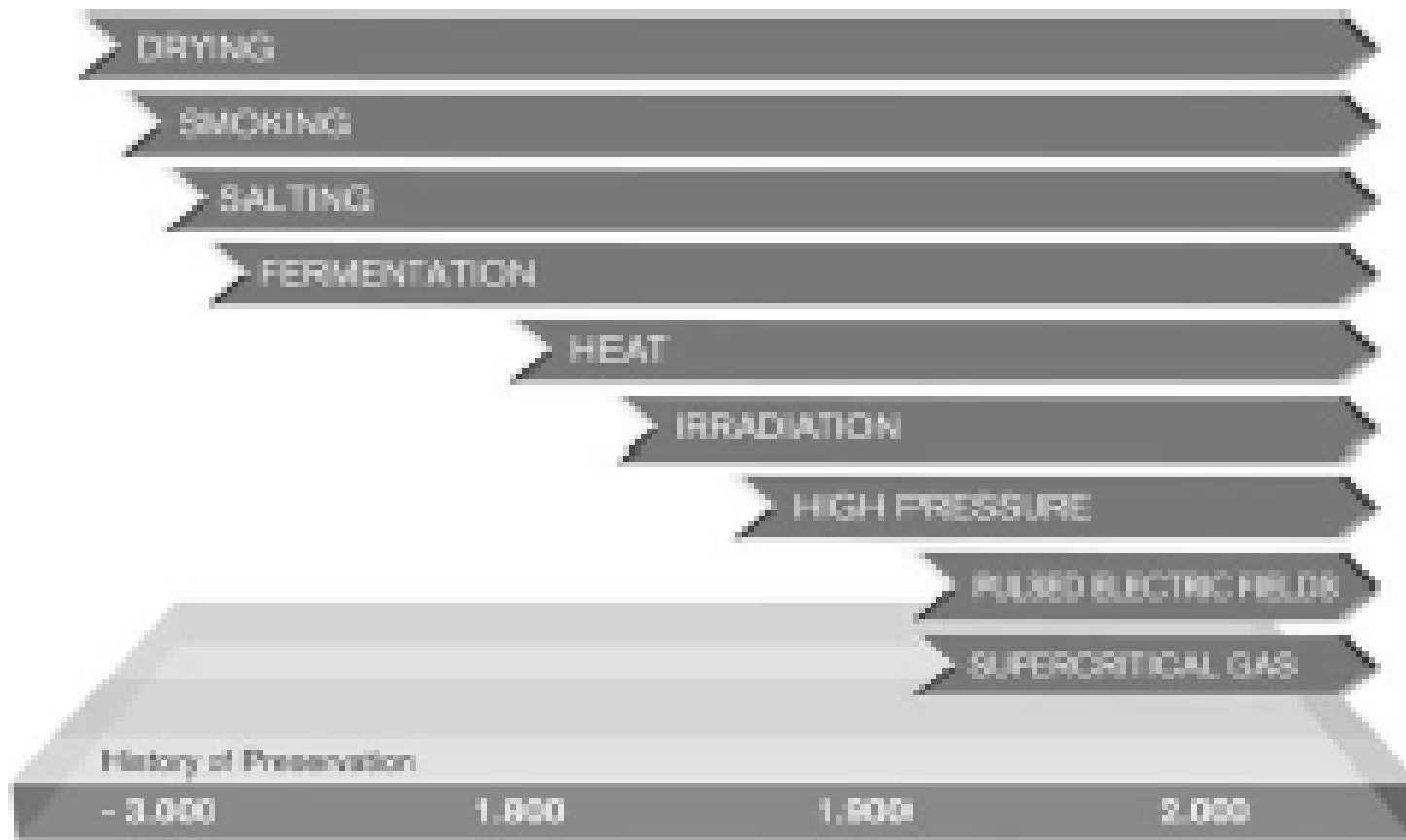
- As a consequence of development of HPP in EU, first with Flair (1989-99) and later in **COST** programs and finally in framework programs **FP5** 1998-2002, followed by **FP6** (2002-2006) and **FP7**, supported strongly research on this area.



# Preservation



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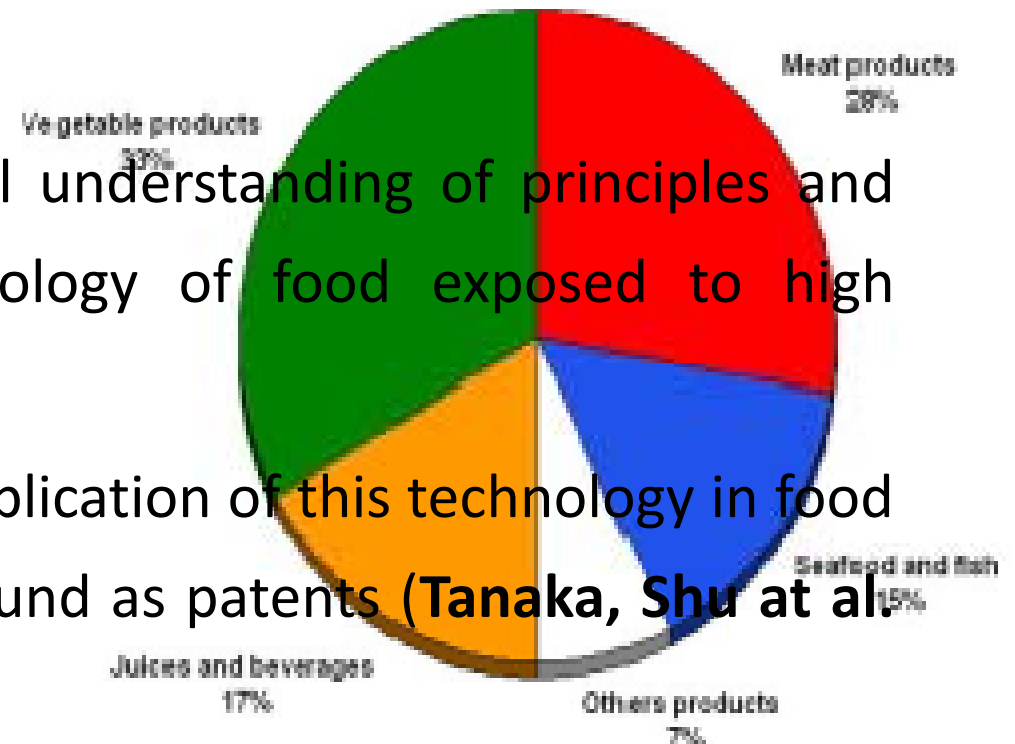
CSL graphics

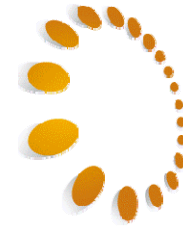
Heinz, V., Buckow, R. 2010. *Food preservation by high pressure*,  
Journal of Consumer Protection and Food Safety



- COMMENTS

- advancement in theoretical understanding of principles and chemistry, physics and biology of food exposed to high pressure.
- new practical solution in application of this technology in food processing which can be found as patents (**Tanaka, Shu et al. 2002**).





## COMMENTS

- general (Cheftel, J.Claude and Culioli, Joseph, 1997, Hogan, Eamonn et al. 2005, Hendrickx et al., 2005, 2011, Knorr)
- safety (Rendueles et al. 2011)
- specific technical/technological aspects (i.e.: tenderization of meat Bolumar, Tomas, et al. 2013).







## COMMENTS

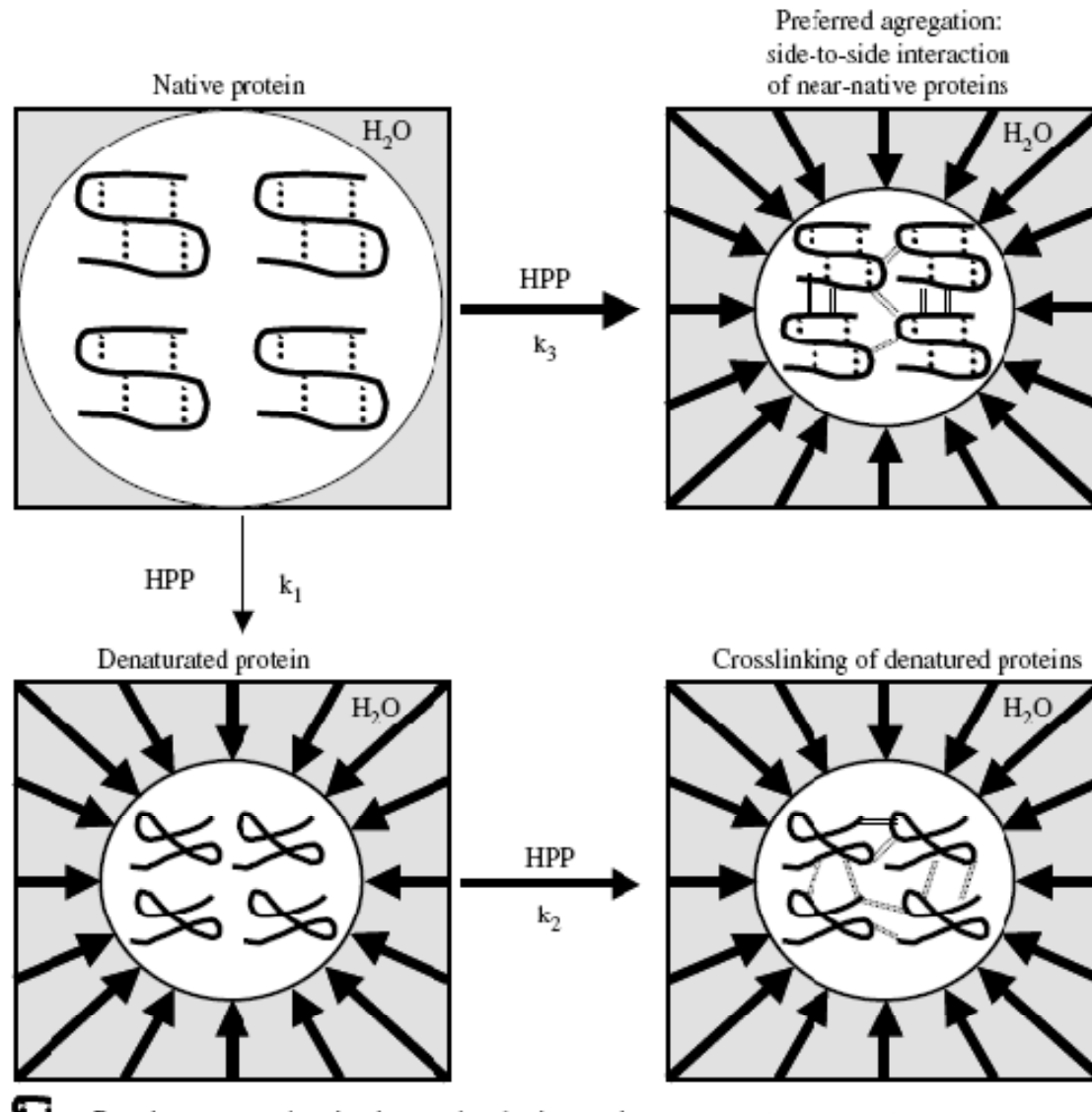
- sensorial issues (Simonin et al 2012),
- physicochemical properties of meat (Buckow, R. et al. 2013)
- energy and water saving (Pereira, R.N. / Vicente, 2010)
- methods of detection (Yuste, Josep et al 2001),
- Preservation of fresh meat (Zhou, G.H. 2010).



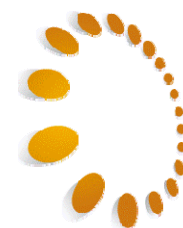
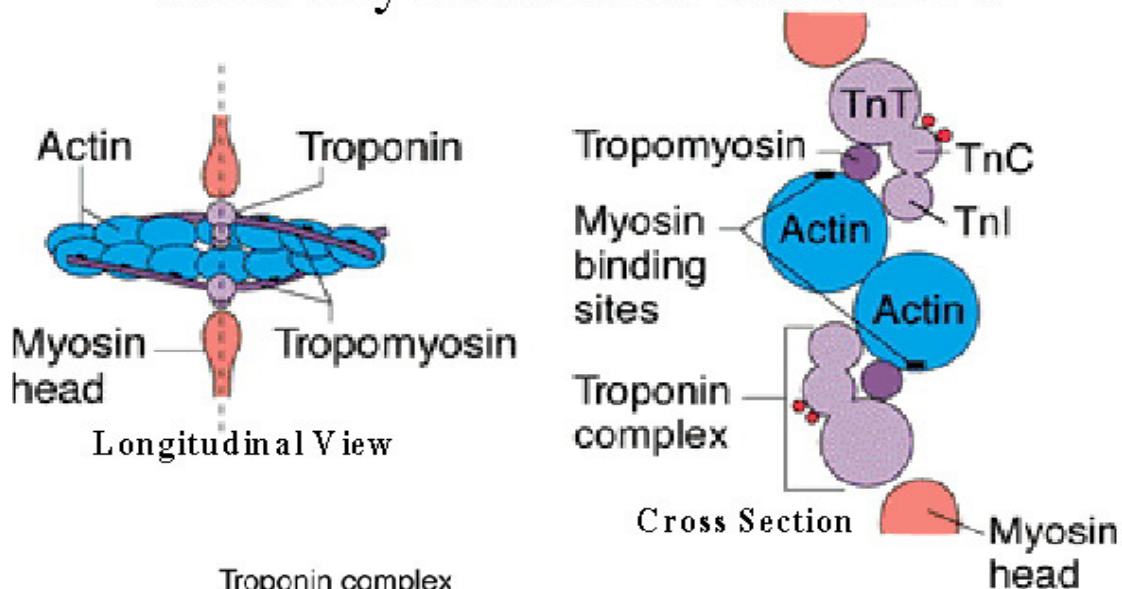
# PROTEIN STRUCTURE



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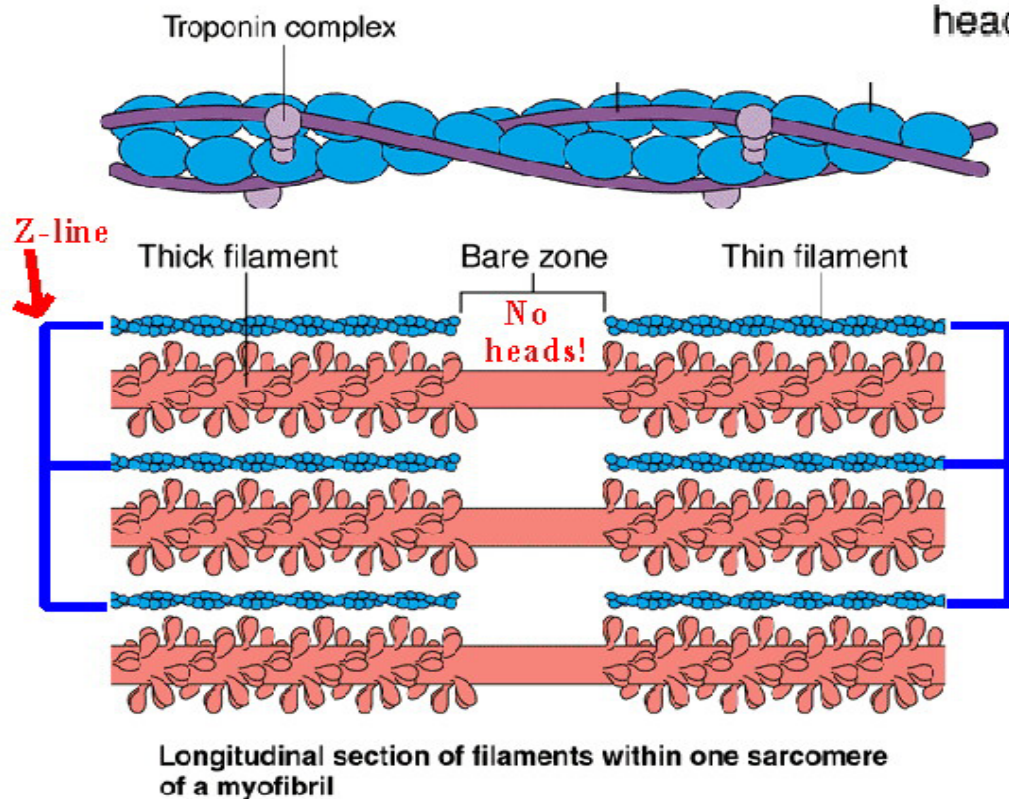
# Thin Myofilament Structure



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**Bajovic B., Bolumat T., Heinz V.** 2012. *Quality consideration with high pressure processing of fresh and value added meat products*, Meat Science

**Simonin H., Duranton F., Lambeliere.** 2012. *New insights into high-pressure processing of meat and meat products*, Comprehensive Riviws in food Sci. and Food Safet

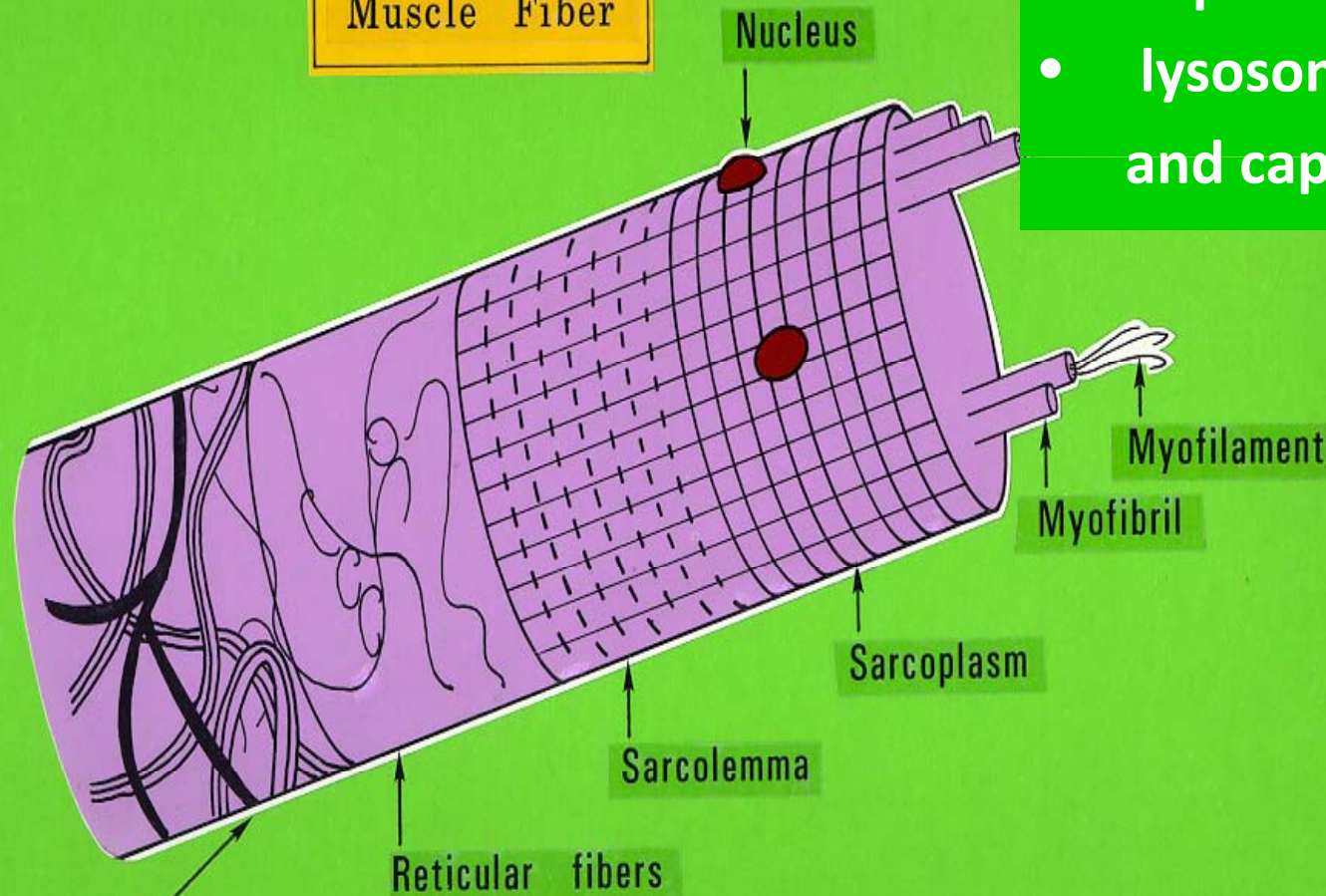


# Meat enzymes



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Diagram of  
Muscle Fiber

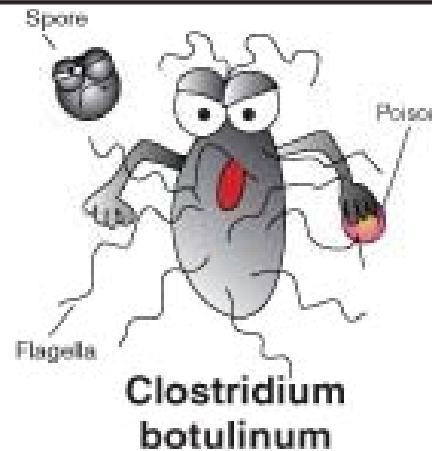
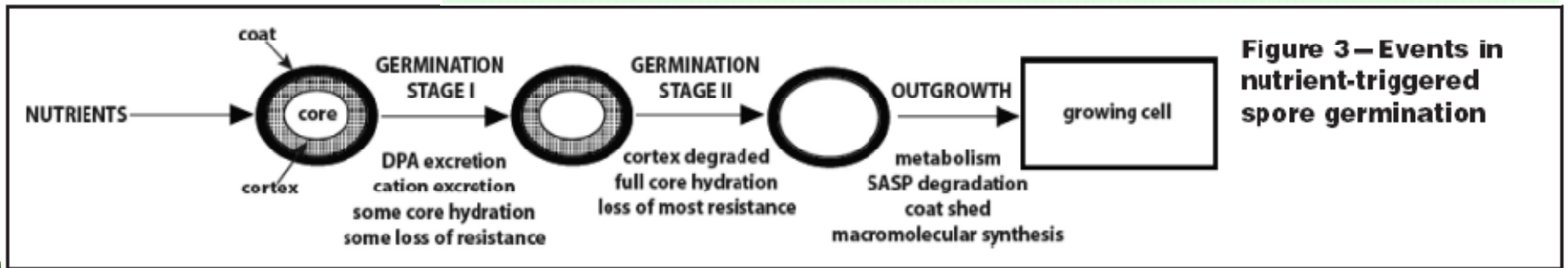
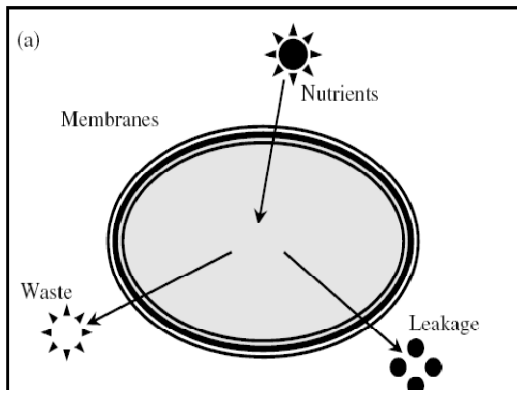


- Protease:
- Calpains,
- lysosomal cathepsins  
and caspase system

# Effect on microorganisms



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- COMMENTS

- The most studied is *Listeria monocytogenes*; (**Hereu et al 2012**)

*Staphylococcus* (**Ananou, Sami et al. 2010**), *Clostridium sporogenes* (**Zhu S, et al. 2008**), *Clostridium botulinum* (**Reddy et al 2003**) *Campylobacter jejuni* (**Solomon, Hoover 2004**),

*Escherichia coli* O157:H7 (**Omer et al 2010, Holck, Askild L et al 2011**)

*Enterococcus faecium* (**Hugas et al 2003**)





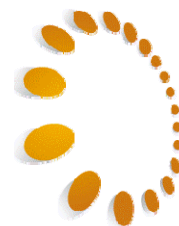
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## COMMENTS

- *Salmonella* spp.; (Porto-Fett, Anna C.S. et al. 2010)  
*Streptococcus faecalis* (Moerman et al. 2001) *Serratia liquefaciens* (Belletti et al. 2013),  
*Anisakis* larvae (Sánchez-Monsalvez et al. 2005) *Trichinella spiralis*; (Porto-Fett, Anna C.S. et al. 2010)  
*Vibrio parahaemolyticus* (Ma, 2012)  
*Bacillus subtilis* , *Bacillus stearothermophilus* (Moerman et al. 2001) *Bacillus cereus* (Suklim, Kannapha , Apr 2006),  
*Geobacillus stearothermophilus* spores (Gao, Yu-long et al. 2006)



# Chemical safety



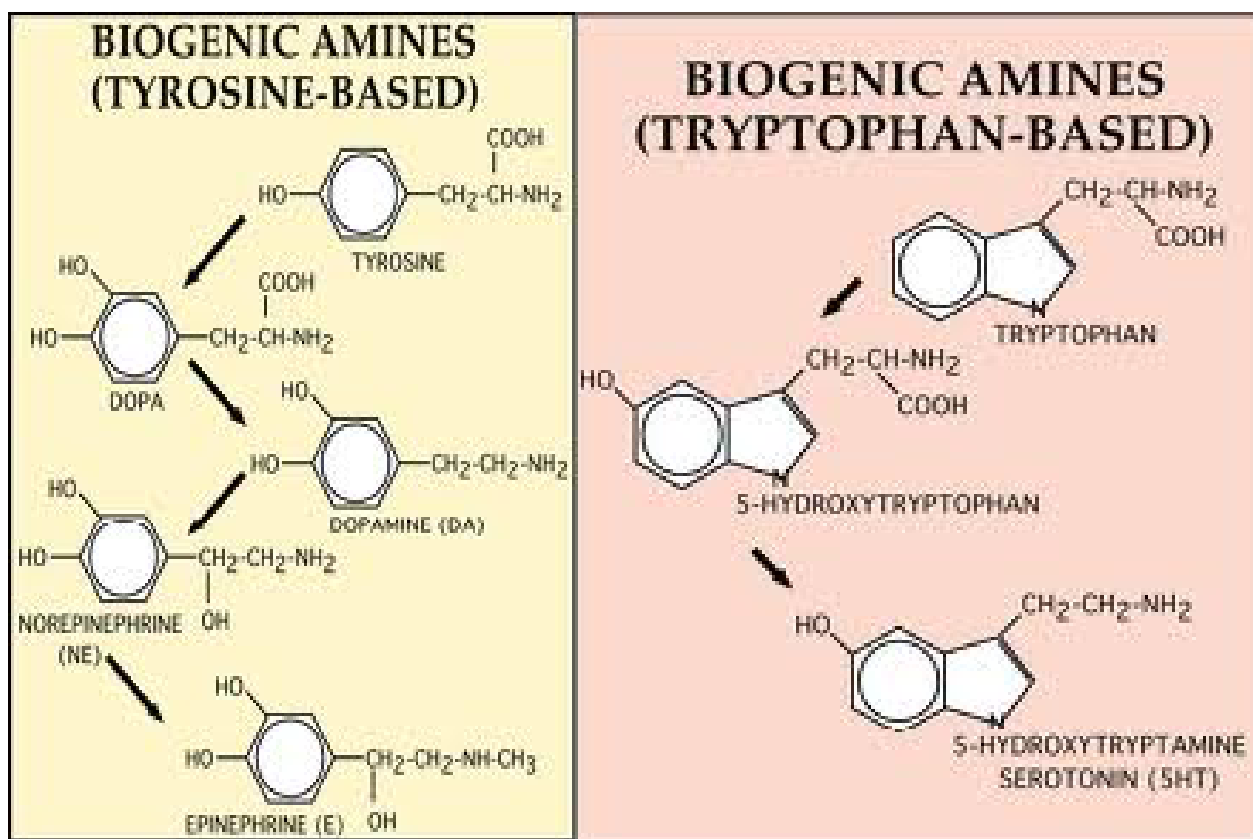
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## CONTROL

73–32  $\mu\text{g/g}$ ,  
103–46  $\mu\text{g/g}$ ,  
and 118–35  $\mu\text{g/g}$

## HPP

84–13  $\mu\text{g/g}$ ,  
112–36  $\mu\text{g/g}$ ,  
116–45  $\mu\text{g/g}$

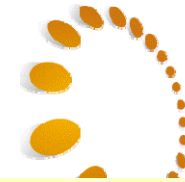


Simon-Sarkadi, L., Pásztor-Huszár, K., Dalmadi I., Gabriella Kiskó . 2012  
Effect of high hydrostatic pressure processing on biogenic amine content of  
sausageduring storage, Food Research Int.





# HPP and salt



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## Microstructure

- Duranton, F. ; Simonin, H. ; Cheret, R. ; Guillou, S. ; De Lamballerie, M. 2012. **Effect of high pressure and salt on pork meat quality and microstructure.** Journal of Food Science, Vol.77(7-9), p.E188-E194

## Brine & Enzymes

- Grossi, A, Gkarane, V., Otte, J.A., Ertbjerg P.,Orlien, V., 2012. **High pressure treatment of brine enhanced pork affects endopeptidase activity, protein solubility and peptide formation.** Food Chemistry, 1556-1563.

## Colour

- Ferrini, G. ; Comaposada, J. ; Arnau, J. ; Gou, P. **Colour modification in a cured meat model dried by Quick-Dry-Slice process® and high pressure processed as a function of NaCl, KCl, K-lactate and water contents** Innovative Food Science and Emerging Technologies, 2012, Vol.13, pp.69-74

# SALT REFORMULATION



- Ma, F., Sun, G, Wang, W., 2012. Effects of high pressure and  $\text{CaCl}_2$  on properties of salt soluble meat protein gels containing locust bean gum
- Omana D, Plastow, G, Betti, M. 2011.  
 $\beta$ -glucan as a partial salt replacer in high pressure processed chicken breast meat, Food Chemistry



## SAFETY ASPECTS

Durantanton, F. ; Guillou, S; Simonin, H.; Cheret, R.; De Lamballerie, M. 2012. **Combined use of high pressure and salt or sodium nitrite to control the growth of endogenous microflora in raw pork meat.** Journal of Food Science, Vol.77(7-9), p.E188-E194



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## COMMENTS

Foodborne pathogens control by bacteriocin-like substances from *Lactobacillus* spp.

the death rate may be increased because of **sub-lethal injuries** to living cells by added bacteriocins like enterocins A and B, sakacin K, pediocin AcH or nisin (**Garriga, M. et al 2002, Chung, Hyun-Jung, 2003**)



# Tailored foods

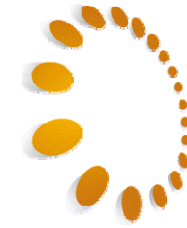


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- Tokijuji, A., et al., 2013. Texture, sensory and swallowing characteristics of high pressure heat treated pork meat gels as a dysphagia diet.  
Meat science



- COMMENTS



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Application of HPP is expanding to different meat

- Bovine (**McArdle, R. et al 2010**),
- Chicken (**Alves, A.B, et al 2012**).
- Turkey (**Chan, Jacky T.Y. et al 2011**)
- Crabs (**Suklim Kannapha 2006, Chan, Jacky et al 2011**),
- Shrimps (**Kaur, Barjinder Pal et al 2013**)
- Fish -Tilapia (**Ko, Wen-Ching, et al 2006**),
- Crocodile *Caiman crocodilus yacare* (**Canto, A.C.V.C.S. 2012**)



# COMMENTS



- **Cooked Ham (Vercammen, Anne et al 2011)**
- **Dry ham (Picouet, Pierre A. Et al 2012)**
- **Deli meat (Juck, Gregory, 2011)**
- **Sausage (Ananou, Samir 2010)**



# Packaging



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- Active packaging
- Migration of the components from packaging







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**ADVANCEMENTS IN HIGH PRESSURE PROCESSING & APPLICATIONS IN VEGETAL ORIGIN  
FOODS AND FOOD SAFETY INDICATORS**

Daniela BORDA <sup>✉</sup>, Iulia BLEOANCA, Maria TURTOI, **The Annals of the University  
Dunarea de Jos of Galati. Fascicle VI FOOD TECHNOLOGY, ISSN 1843 – 5157,**  
<http://www.ann.ugal.ro/tpa/>

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- Main defined gaps in science of your WGs



- COMMENTS
- Duplication of research and development
- Non consistency in methodological approach
- Questionable comparability of analytical methods
- Model systems for research (buffers model, real meat model mimetic)
- Microorganisms applied for testing
- Mathematical models



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The final outcome we would like to get

- What recent research (up to now) did not cover, but it should?
- What current practice did not adopt in spite of all good proves of science?
- What we should do in the next research and application step to make HPP the technology of choice in meat and meet like products processing?





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- Research
- Functionalization
  - Reducing the salt content

Tailored foods

Safety Mycotoxins

Virulence

Migration from packages

Free radicals





## Suggestion for new topics to be promoted for the work programmes of HORIZON 2020

- Standardization of the methods for approval of novelty in processing
- Free radical issue and healthy food processing

