



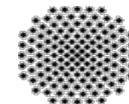
Ensuring the Integrity of the European food chain

Consumer and Brand Protection in Complex Foods from Protein Signatures Using Mass Spectrometry

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The Consortium: WP13

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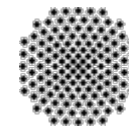


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The Consortium: WP13 Industry Participants

The Kraft Heinz Company
(Nijmegen, The Netherlands)



The Kummer Company
(Rumia, Gdansk, Poland)

What is a Complex Food?

Processed food – changed irreversibly either physically or chemically on a short length scale

Minced meat is not processed, meat paste is processed, orange juice is processed

A complex food:

- * contains more than one component
- * at least one of those components is processed

Pizza, chilled ready meals, canned infant food

Strategy

View complex foods in terms of chemistry rather than ingredients or commodities

Food is (mainly) proteins, lipids & carbohydrates

We will target proteins – and not just meat proteins

Pizza: proteins are found in wheat flour, mozzarella cheese, tomato, ham, pineapple, yeast, parsley, basil and pepper

Plenty of ‘protein species signatures’ to search for

Method

Select a protein target either by proteomics or by 'pure thought'

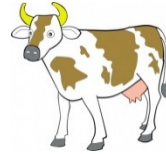
Extract the target protein (along with unwanted proteins)

Break up the target protein into pieces called peptides by using an enzyme

Measure the peptides by mass spectrometry

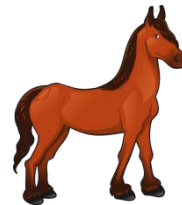
Peptides are species markers

Proteins: the Myoglobin Example



MGLSDGEWQ**L**VLN**A**WGKVEAD**V**AGHGQEV LIRLFTGHPETLEKFD
KFKHLKTEAEMKASEDLKKHG**N**TVLTALGGILKKKGHHEAE**V****K****H****L****A****E**
SHAN**K**HKIP**V**KYLEFISDAIHVLH**A**KHP**S**DFGADAQ**A**AM**S**KALELFR
ND**M**AA**Q**YK**V**LGF**H**G

MGLSDGEWQ**Q**VLN**V**WGKVEADIAGHGQEV LIRLFTGHPETLEKFDK
FKHLKTEAEMKASEDLKKHG**T**VVLTALGGILKKKGHHEAE**L****K****P****L****A****Q****S**
HAT**K**HKIP**I**KYLEFISDAIHVLH**S**KHP**G**DFGADAQ**G**AM**T**KALELFRND
IAA**K**Y**K****E**LGF**Q**G

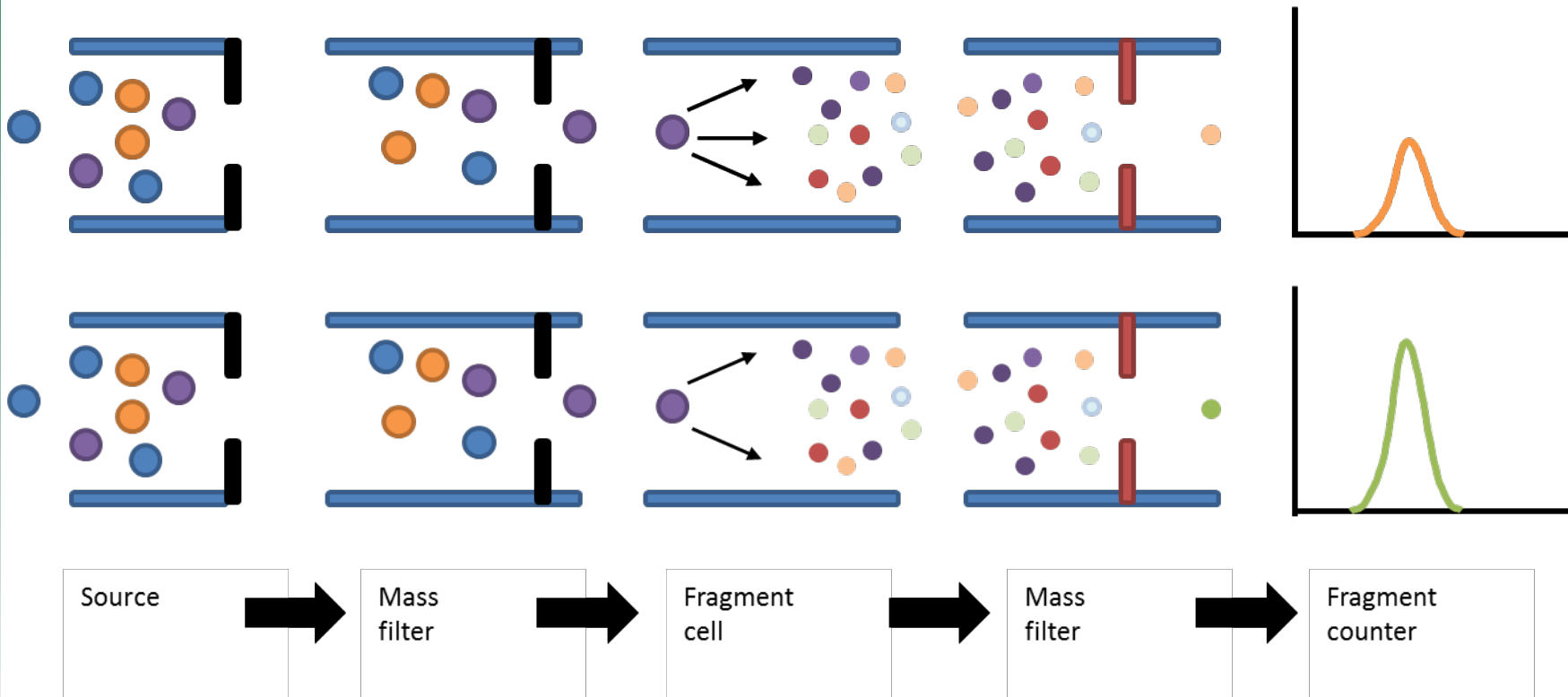


Proteins into Peptides

MGLSDGEWQQVLNVWG**K** VEADIAGHGQEV**LIR**
LFTGHPETLE**K** FDK**K** FK**K** HL**K** TEAEM**K** ASEDL**K**
K HGTVVLTALGGIL**K** **K** **K**
GHHEAEL**K**PLAQSHAT**K** HK**K** IPI**K**
YLEFISDAIIHVLHS**K** HPGDFGADAQQGAMT**K**
ALELFR**R** NDIAA**K** Y**K** ELGFQ**G**

(Horse myoglobin with trypsin)

MRM Mass Spectrometry



Peptides into Fragments

HPGDFGADAQQGAMTK

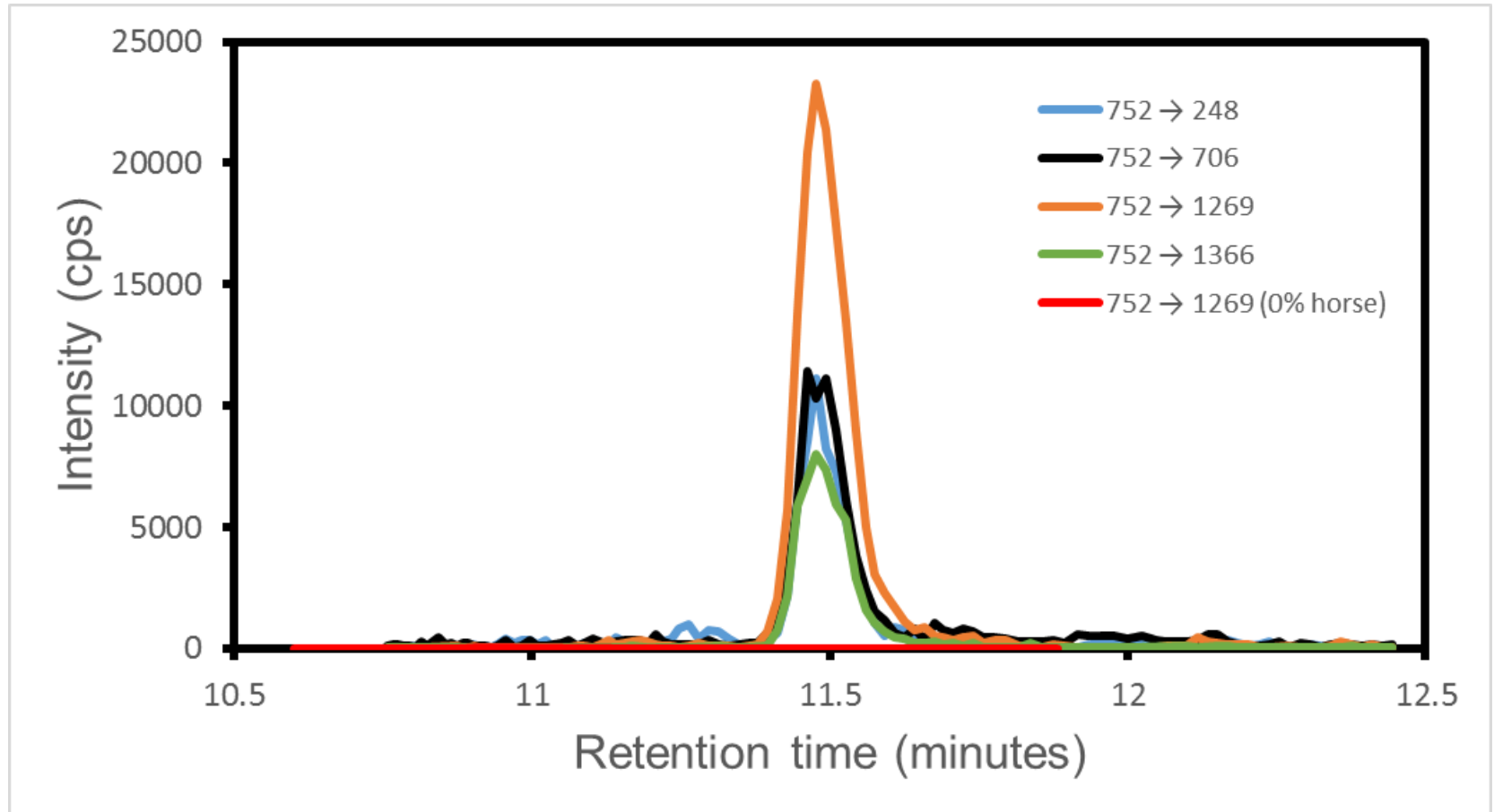


**Peptide (precursor)
+ Fragment =
'Transition'**

**Highly specific
Sensitive
Quantitative**

TK
MTK
AMTK
GAMTK
QGAMTK
AQQGAMTK
DAQGAMTK
ADAQQGAMTK
GADAQQGAMTK
FGADAQQGAMTK
DFGADAQQGAMTK
GDFGADAQQGAMTK
PGDFGADAQQGAMTK

1% w/w Horse in Beef (raw meat)

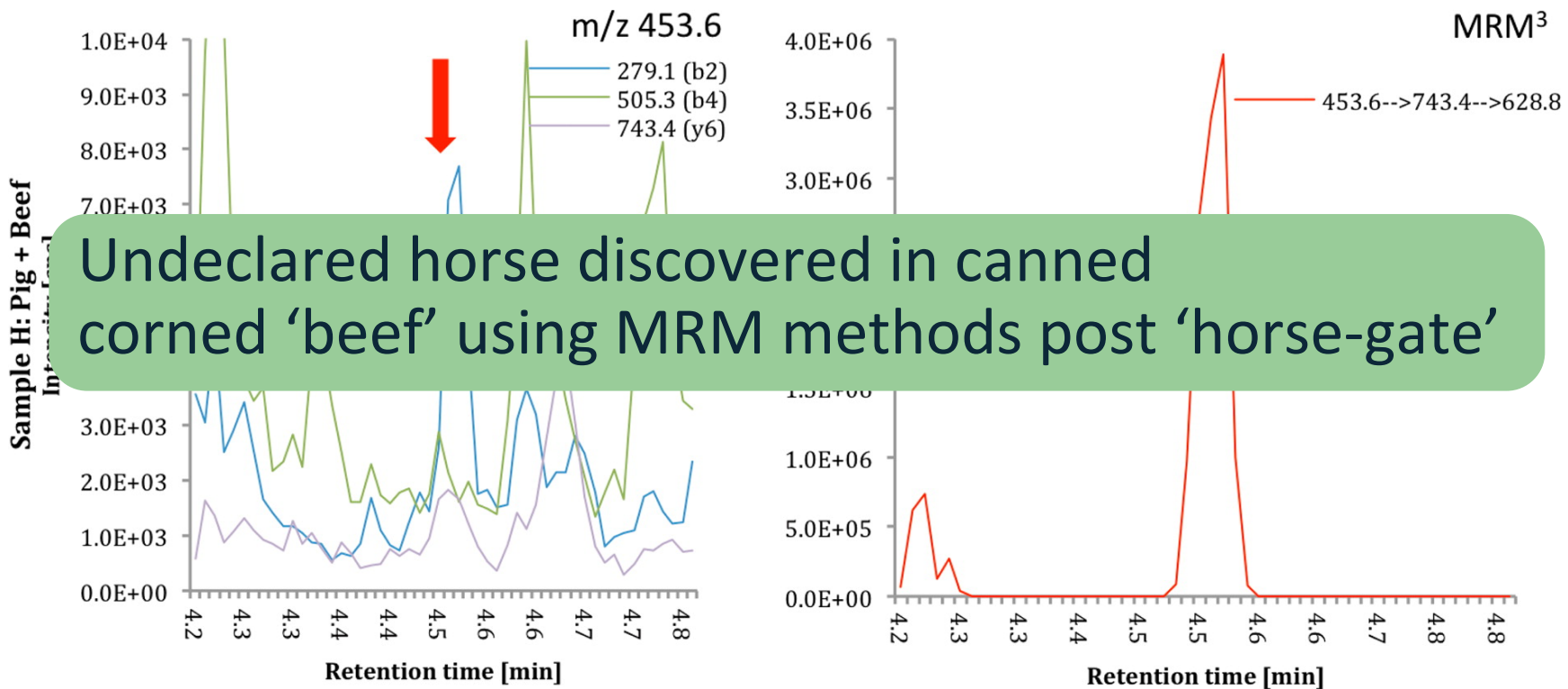


(Watson et al, Anal Chem (2015); Gunning et al, JoVE, in press)

0.13 % w/w Pork in Beef (raw meat)

One step further – fragments of fragments

Current demonstrated limit of detection approx. 0.1%

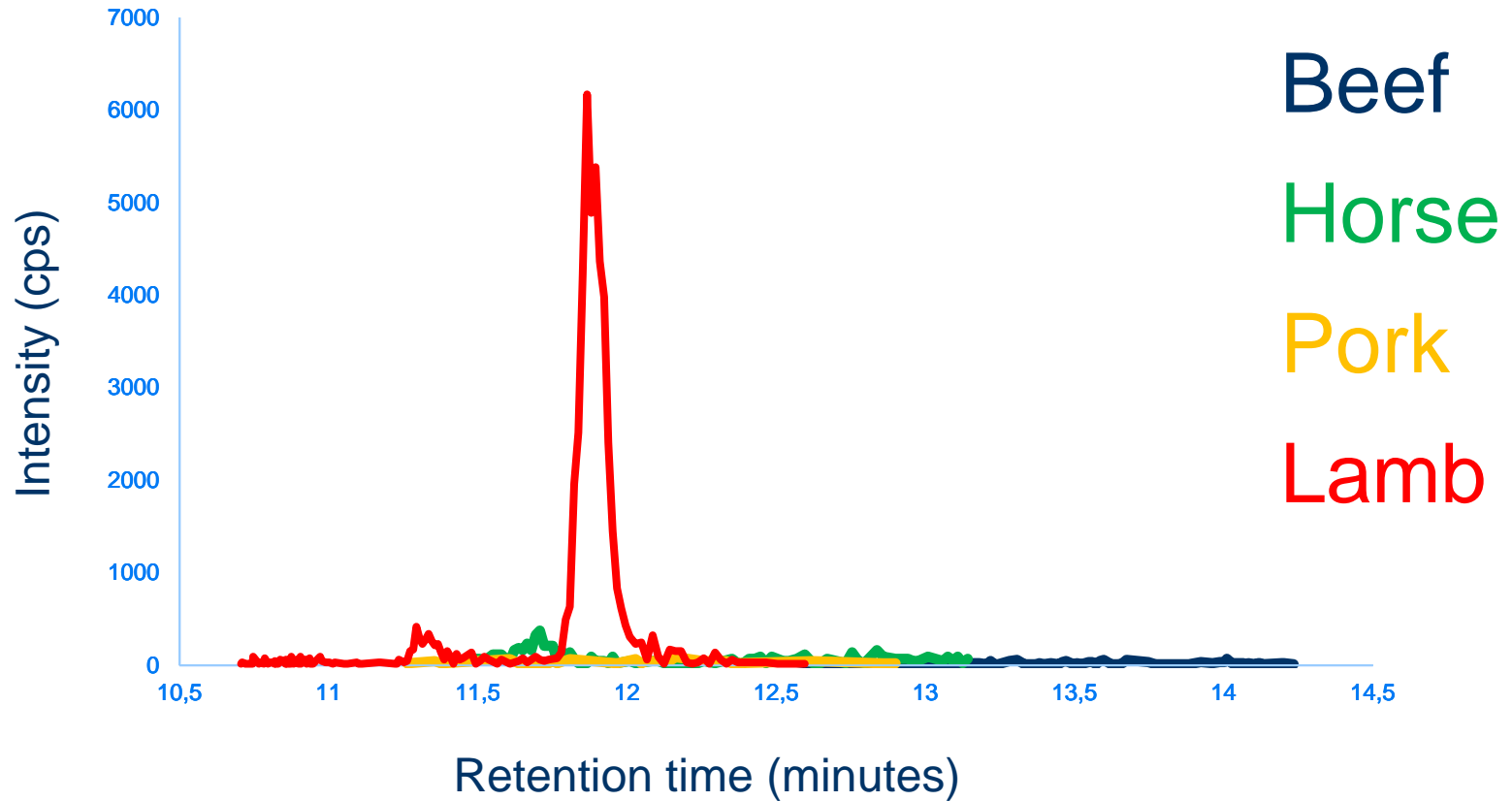


Undeclared horse discovered in canned corned 'beef' using MRM methods post 'horse-gate'

(von Bargaen et al J. Ag Food Chem (2013))

(Marker peptide YDIINLR from troponin T)

Supermarket lamb curry



Consortium Outputs

von Bargaen et al, J. Ag Food Chem (2013), **61**, 11986

von Bargaen et al, J. Ag Food Chem (2014), **62**, 9428

Watson et al, Analytical Chem (2015), **87**, 10315

Gunning et al, JoVE, in press



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