Chemical and biological analysis: Lets go fishing molecules

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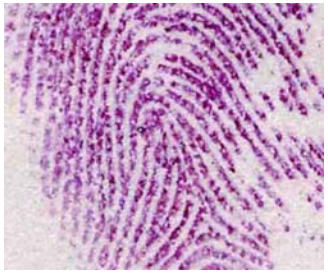
A simple test to distinguish between similar looking liquids

- Water / Isopropyl alchohol / detergent water
- Water – Won't spread on wax paper
- Alcohol and detergent water will spread
- Alcohol mark has a smooth edge and detergent will have an irregular edge
- Alcohol evaporates faster, detergent evaporates the slowest

Many similar experiments can be found on the American Chemical Society Website www.acs.org

Forensic Science – Finger prints with ninhydrin reaction

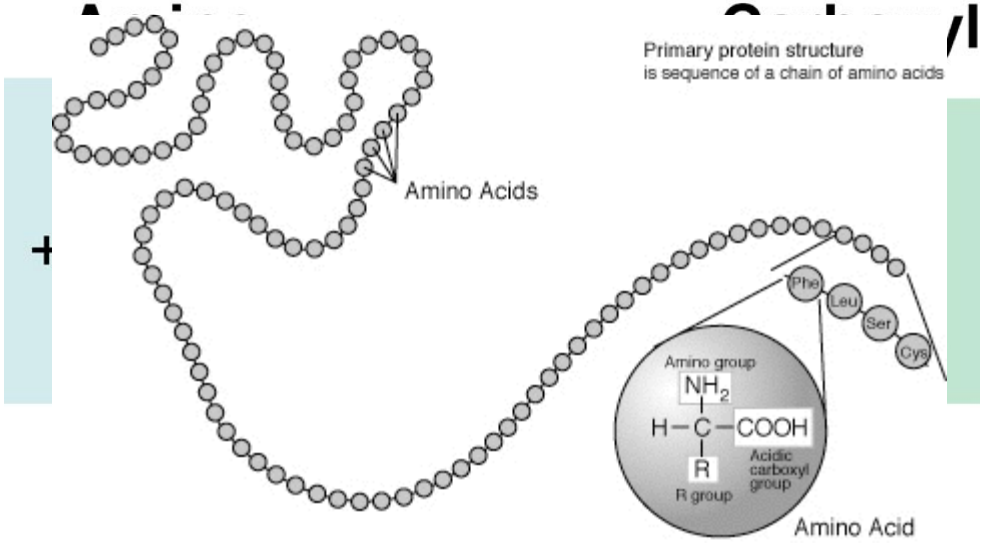


Live demo of ninhydrin revealing fingerprints

Amino acids, peptides and proteins

Amino Acid Structure

Hydrogen



R-group
(variant)

www.langara.bc.ca/.../Assets/aminoAcidStruc.jpg
http://en.wikipedia.org/wiki/File:Protein-primary-structure.png

Milk

- 87% H_20
- True Protein 3%
- Crude protein 3.1%
- Casein 2.6%

Protein content in Milk determined by Kjeldahl method that measures Nitrogen present

http://chem.vander-lingen.nl/articles/The_melamine_milk_scandal/id/126/itemid/380

BBC

Tainted milk trial opens in China

Friday, 26 December 2008

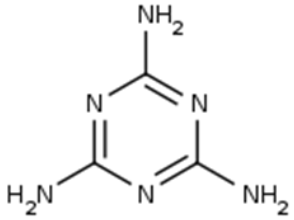
Tainted milk made thousands of Chinese babies ill Six men have gone on trial in China accused of making and selling the chemical at the centre of the tainted milk scandal.The tainted milk is blamed for killing at least six children and making 300,000 other people ill.The men are accused of adding melamine to raw milk to make it appear high in protein.

Melamine found in Cadbury goods

Monday, 29 September 2008

The recall affects mainland China, Hong Kong, Taiwan and Australia Preliminary tests have found melamine in Cadbury's Chinese-made chocolates, the company says.At least 50,000 Chinese babies have fallen ill and four been killed by milk tainted with the industrial chemical.Cadbury had earlier recalled 11 chocolate types from mainland China, Hong Kong, Taiwan and Australia because of fears of contamination.It remains unclear how much melamine was in the recalled products, a Cadbury spokesman told the BBC.

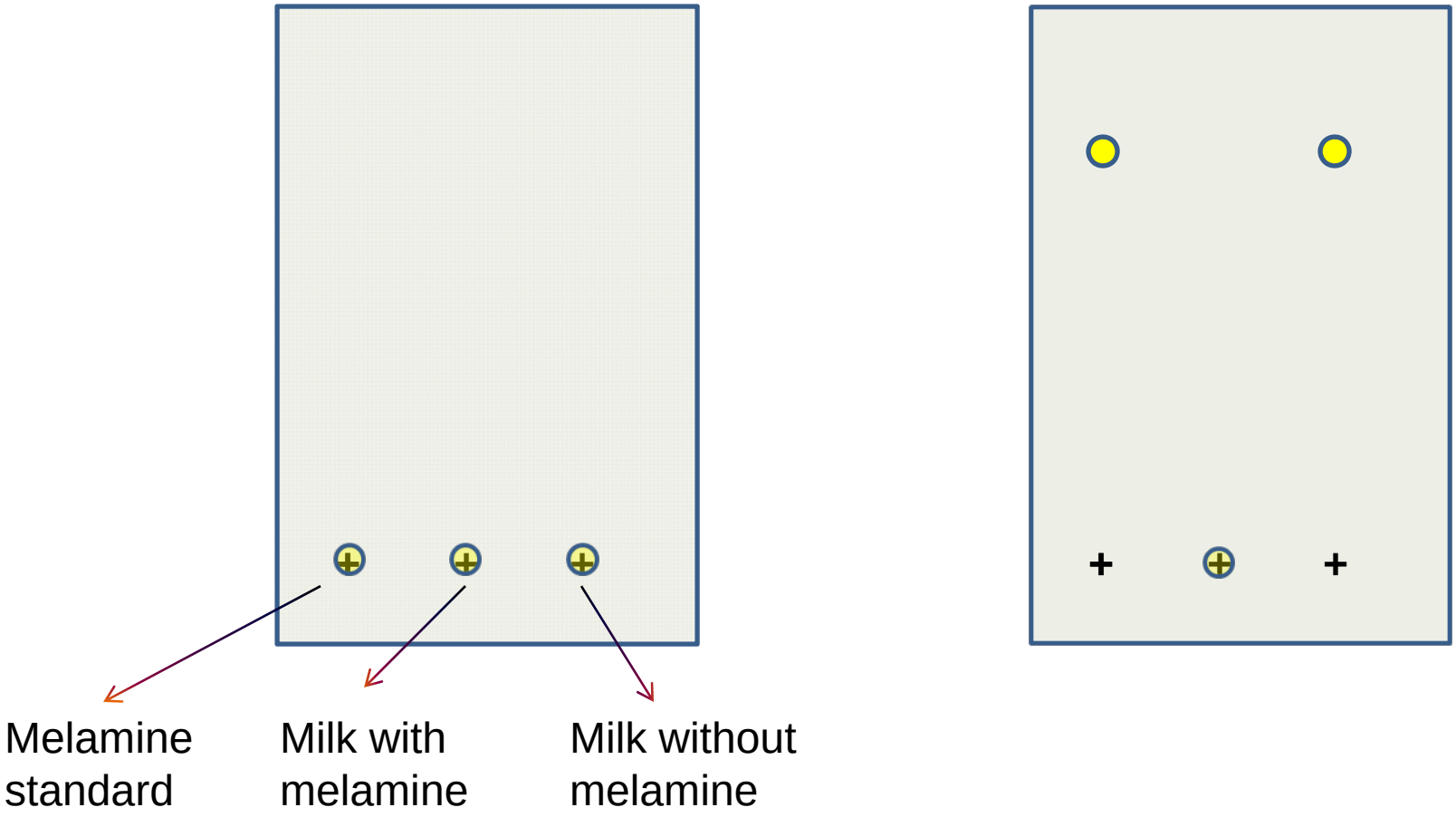
Source for the news items: http://news.bbc.co.uk



Melamine

- Used in plastics and fertilizers
- Scrap melamine is unusable left over product containing 70% melamine and other derivatives including cyanuric acid
- In China, melamine scrap and low cost soya protein powder were added

Chromatographic separation of melamine in milk



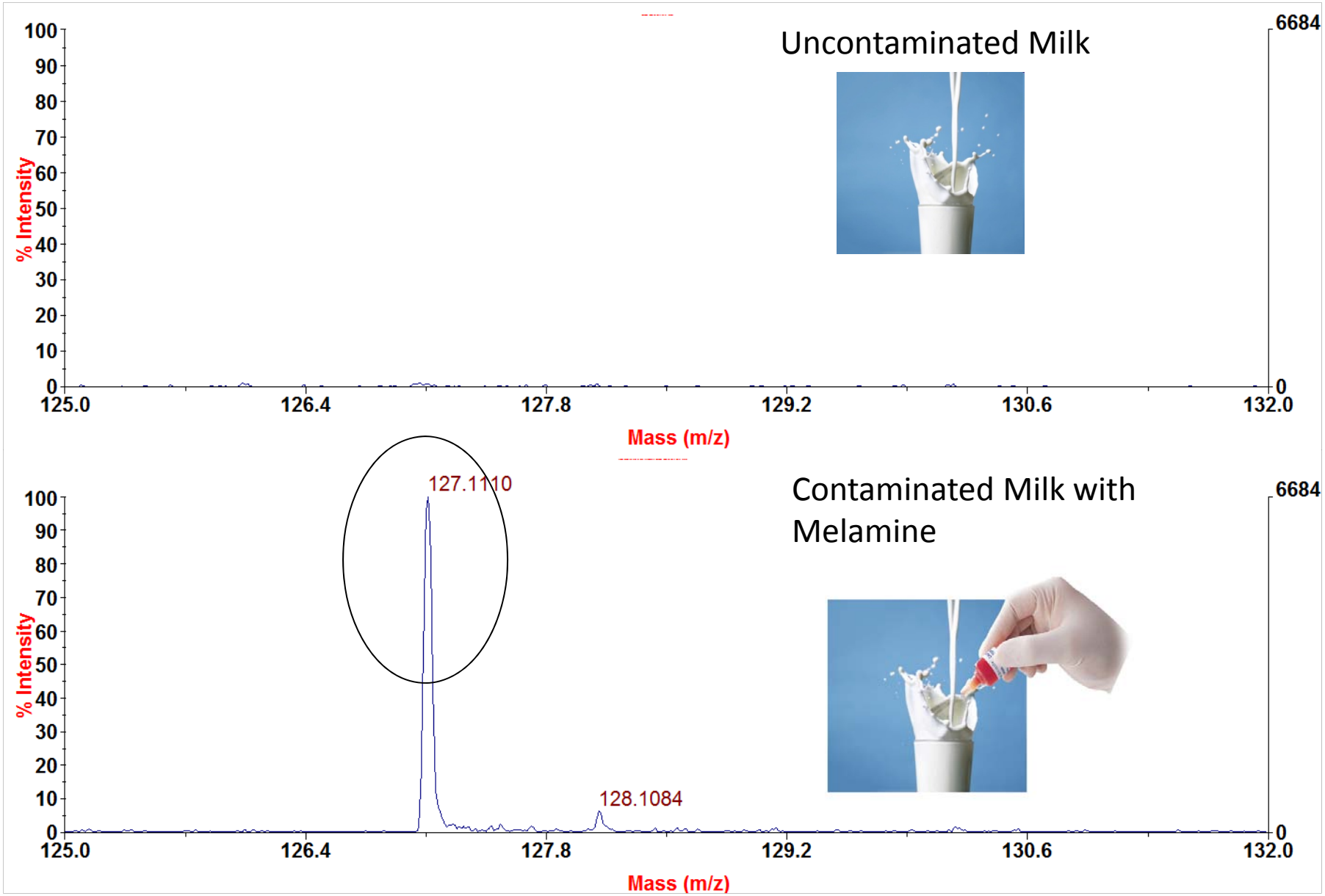
Need for a separation - Chromatography

- Principle of chromatography & TLC
- Chlorination – the amine gps will be chlorinated; In the presence of starch, iodine replaces Cl and gives color (WHY?) -

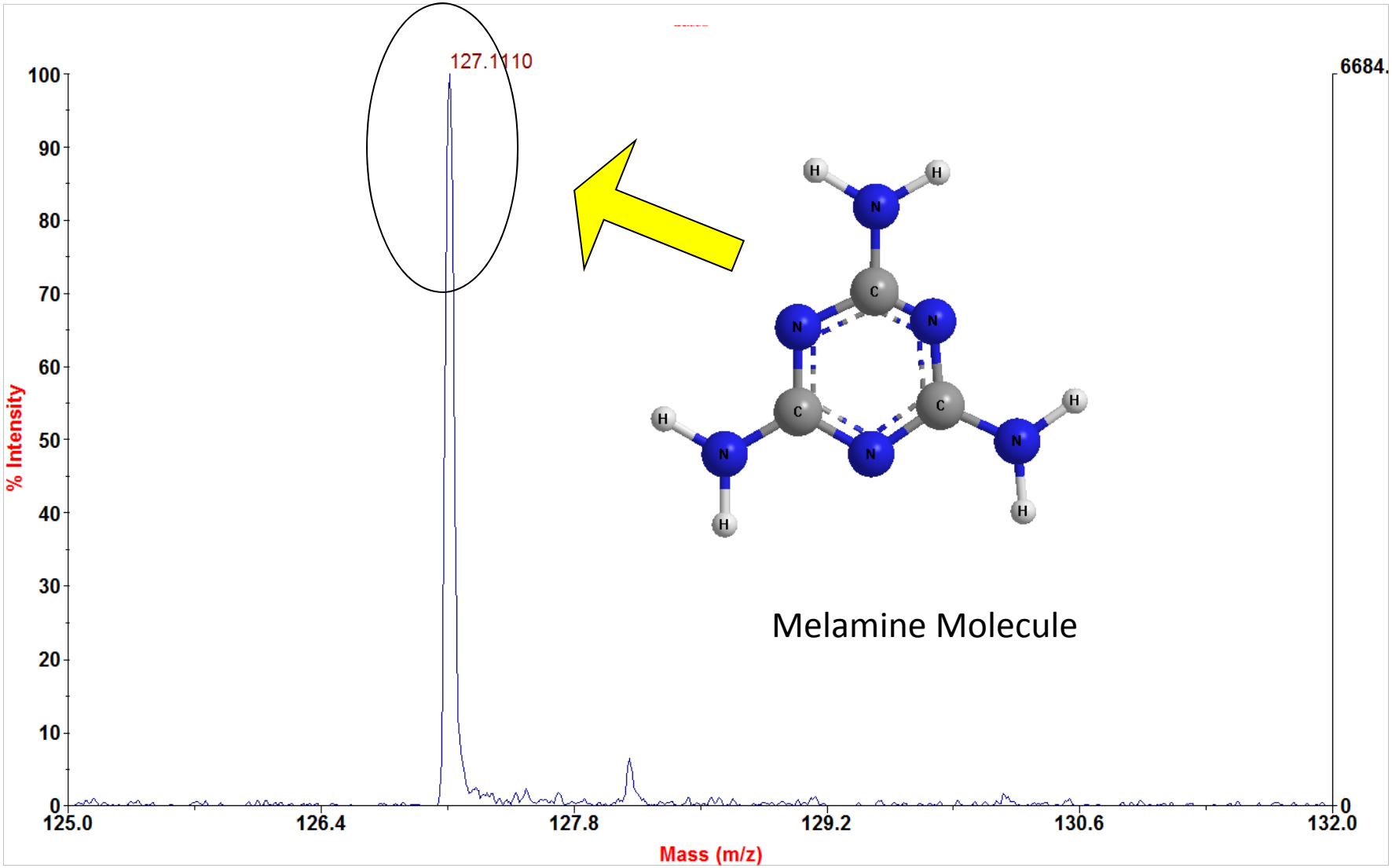
Methods to analyze melamine in milk sample

- Thin layer chromatography (movie)
- HPLC (movie)
- Mass spectrometry

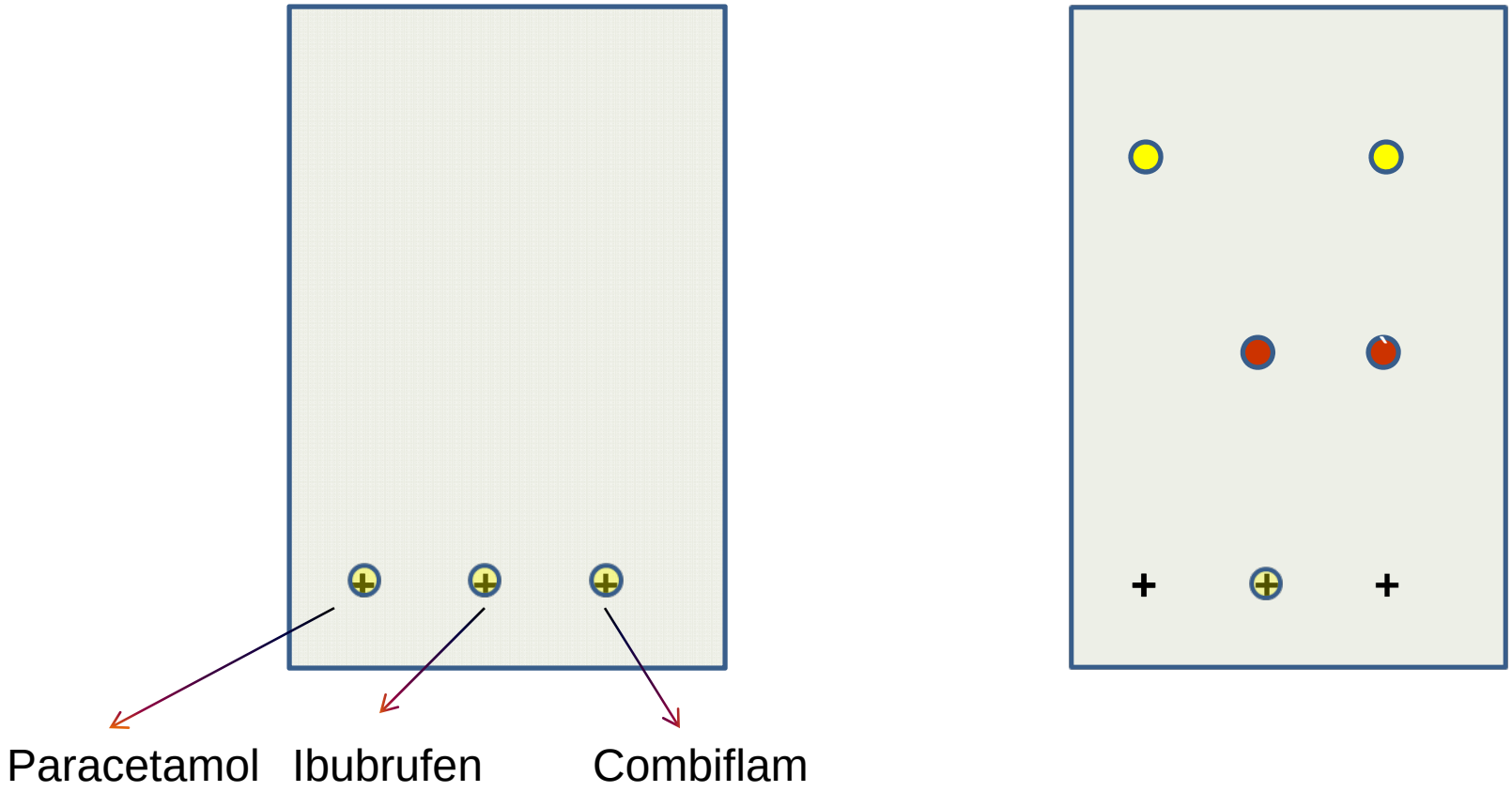
Mass Spectrometric Analysis of Milk and Contaminated Milk



Mass Spectrometric Analysis of Melamine

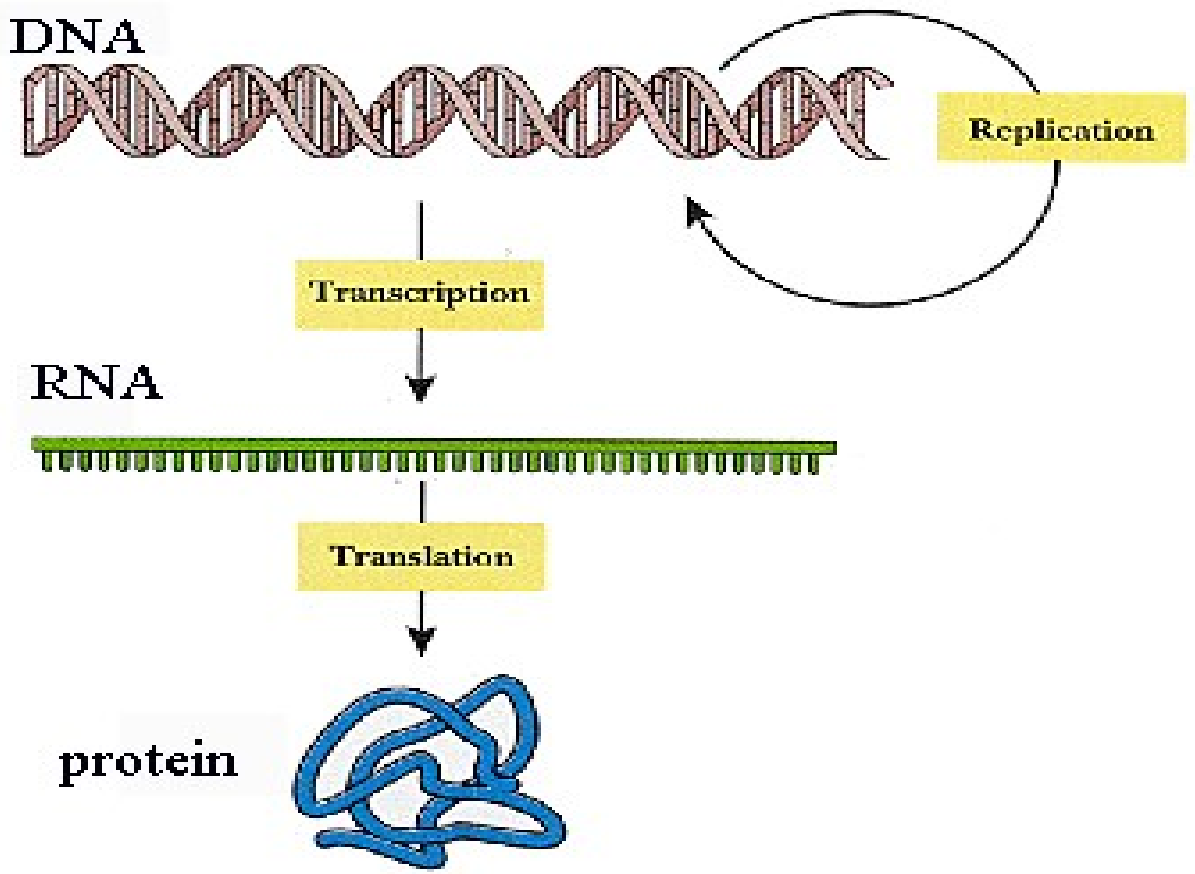


Combiflam



Combiflam separation by TLC – Live demo

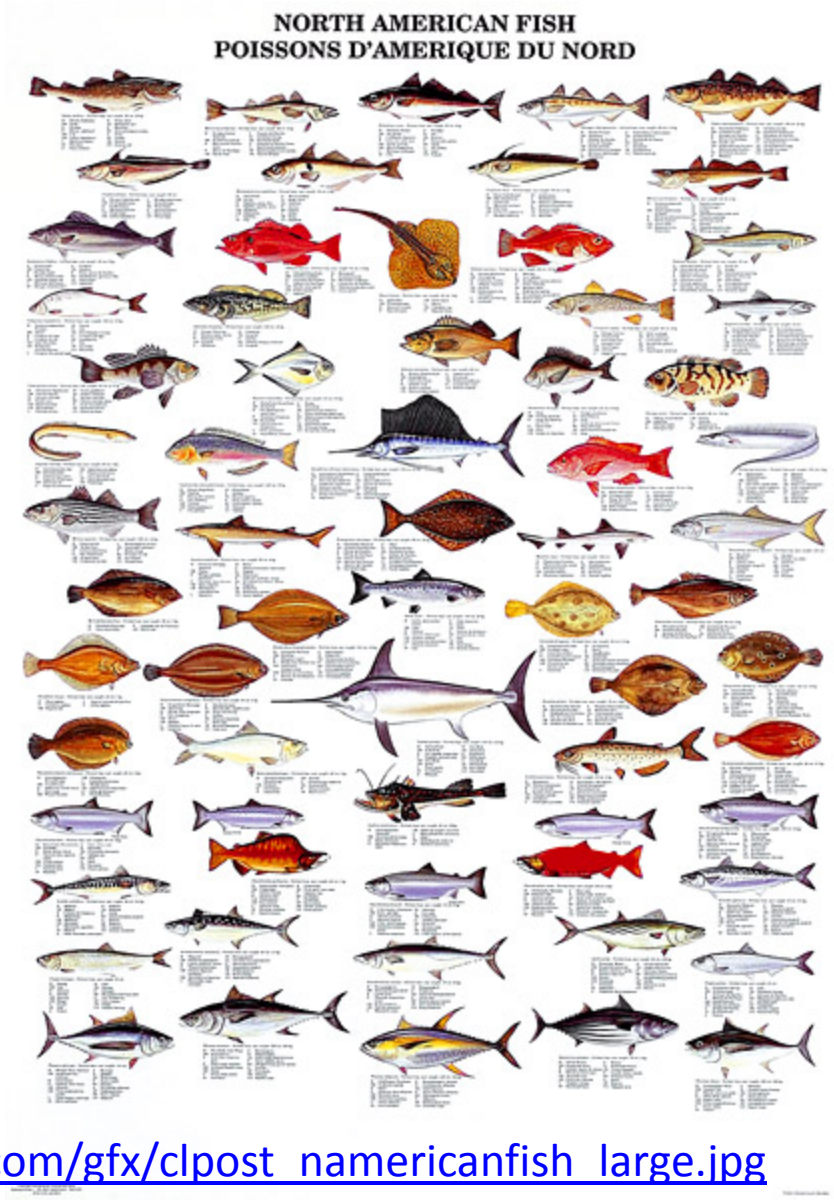
Genomics to Proteomics



Human Proteome: ~22,000 Genes ------→ ~1 million proteins

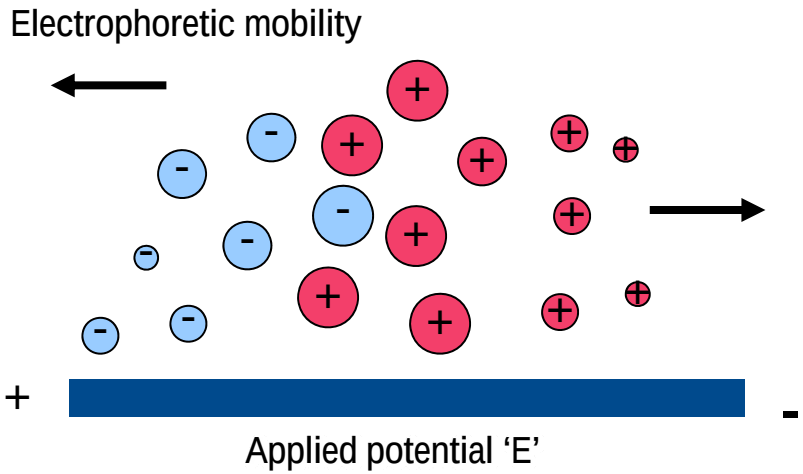
Figure Adapted from Biochemistry, Mathews, Addison Wellesley

Proteomics: Fishing the ‘Unknown Fishes’



http://www.scandfish.com/gfx/clpost_namericanfish_large.jpg

Gel electrophoresis



- Gel acts as a sieving media
- Separation based on mass

What am I working on?

- Protein separation, isolation and detection
  - Agricultural applications
  - Biomarker discovery and medical diagnostics
  - Fundamental understanding
- Protein encapsulation and delivery

Take home messages…

- Analytical science – can involve
  - Simple chemical reactions
  - Complicated physiochemical phenomenon
  - Separation, purification, isolation
  - Simple color detection to complicated signal generation and detection [Electrochemical, mass spectral analysis]
  - Discovery of analytes to tackle problems relating to human diseases
- Covers wide range of applications
- Encompasses many areas – Science, Engineering and Medicine
- Known fish can be caught (from a fish tank)
- Plenty of scope to fish in the ‘high seas’ – rich dividends to reap