

Detection of food fraud: the analytical challenge

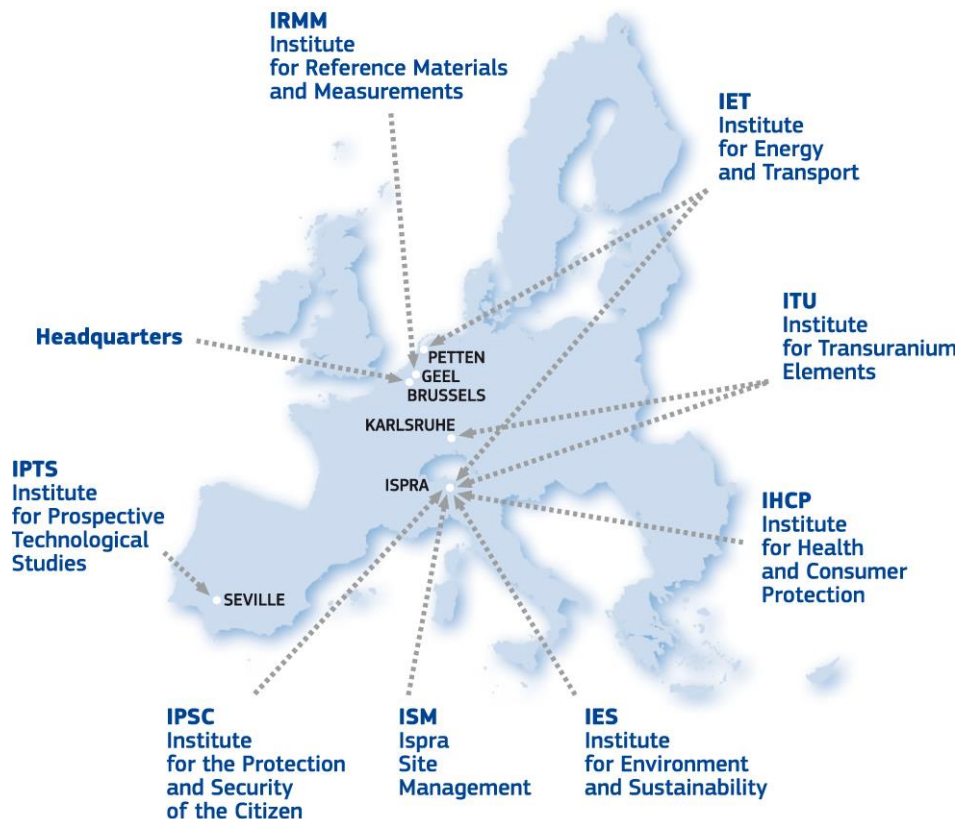
F. Ulberth

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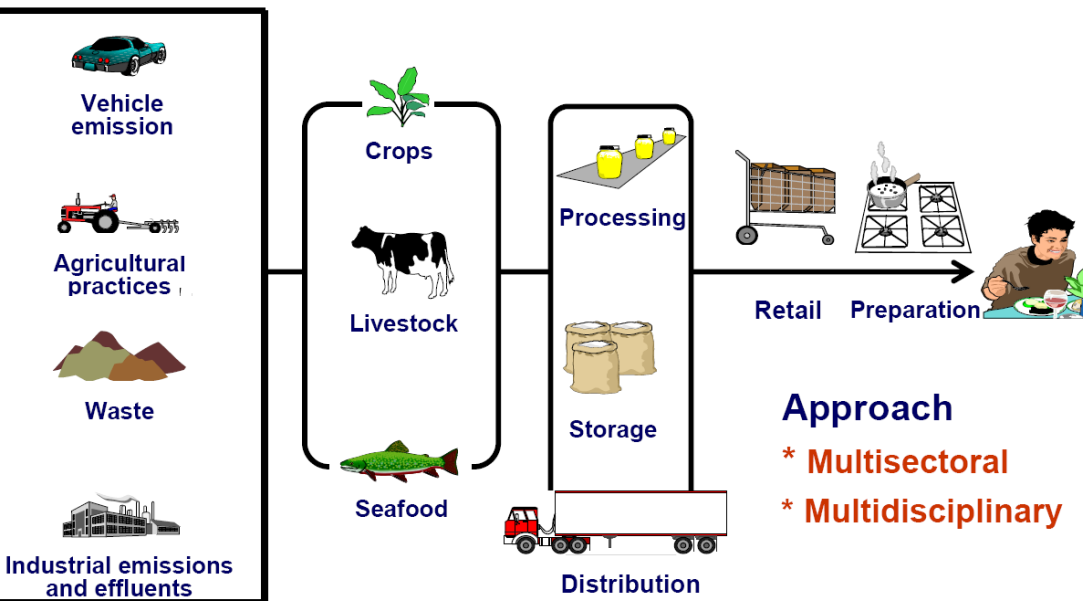


The Joint Research Centre (JRC)



- European Commission's in-house science service
- Supporting EU policies with independent, evidence-based scientific and technical support
- ~ 3.000 staff (2014)
- 6 locations

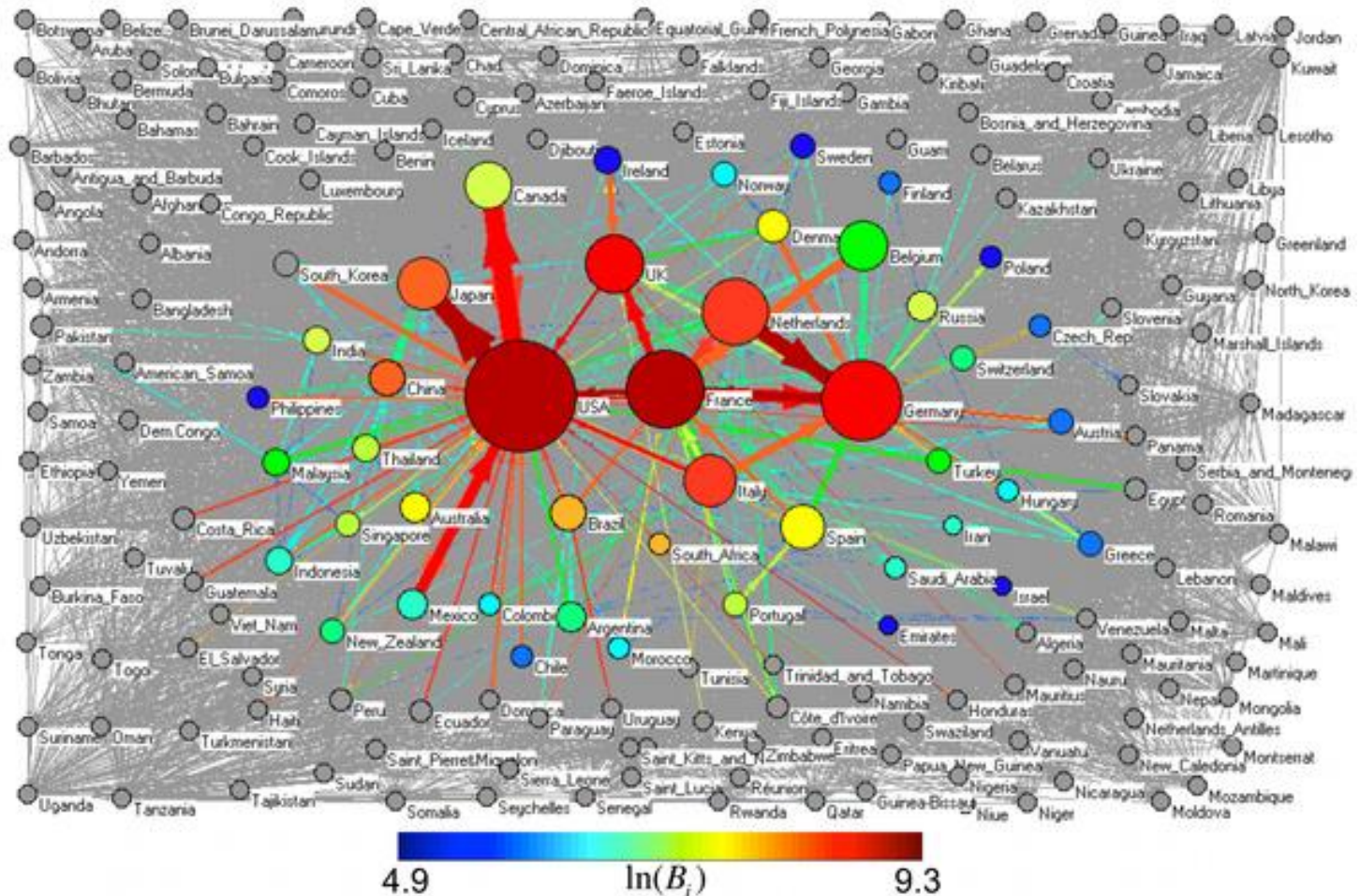
Food supply chain



- Numerous possible routes for illicit manipulations
- Each link in the chain is responsible for the quality and safety of its products
- Coordination of intervention and control strategies
- Communication between many stakeholders



European
Commission



Source: Ercsey-Ravasz M, Toroczkai Z, Lakner Z, Baranyi J (2012) Complexity of the International Agro-Food Trade Network and Its Impact on Food Safety. PLoS ONE 7(5): e37810. doi:10.1371/journal.pone.0037810, p.2.

Key characteristics of food fraud:

- 1. non-compliance with food law and/or misleading the consumer**
- 2. which is done intentionally**
- 3. for reasons of financial gain.**

Main types of food fraud

- sale of food which is unfit for consumption and potentially harmful,
- knowingly selling goods which are past their 'use by' date,
- deliberate misdescription of food, such as: products substituted with a cheaper alternative, for example, farmed salmon sold as wild, and Basmati rice adulterated with cheaper varieties
- making false statements about the source of ingredients, i.e. their geographic, plant or animal origin

Recent examples

Adulterant	Analytical solution
Sudan dyes in spices	Chromatography
Melamine in milk powder	Chromatography
Horsemeat in beef	PCR
Gelatine in chicken breast	Proteomics
Misdescription of fish species	PCR, DNA bar coding
Conventional food/organic food	HPLC, stable isotopes, etc
Seed oils in olive oil	Chromatography
Cow's milk added to sheep's milk	Electrophoresis
Adulteration of fruit juices	Chromatography, stable isotopes, SNIF-NMR
Adulteration of wine	NMR, stable isotopes



What we need

Chemistry

Suitable, validated analytical method(s)
Reference materials/substances/data

Forensics

Criminological characteristics of food fraud
Horizon-scans and intelligence gathering
Whistle blowing



Management

Vulnerability analysis
Risk management



Strategies to detect fraud

Fundamental difference

Empirical difference

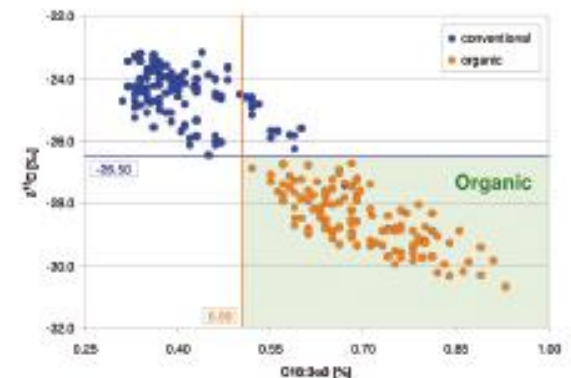
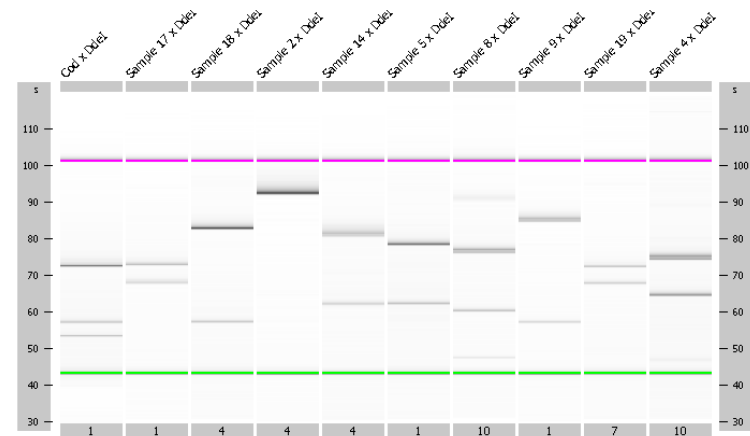


Fig. 4: Correlation ($r = -0.93$) between the C18:3ω3 content and δ¹³C of fat from retail milk.

Targeted – untargeted analysis



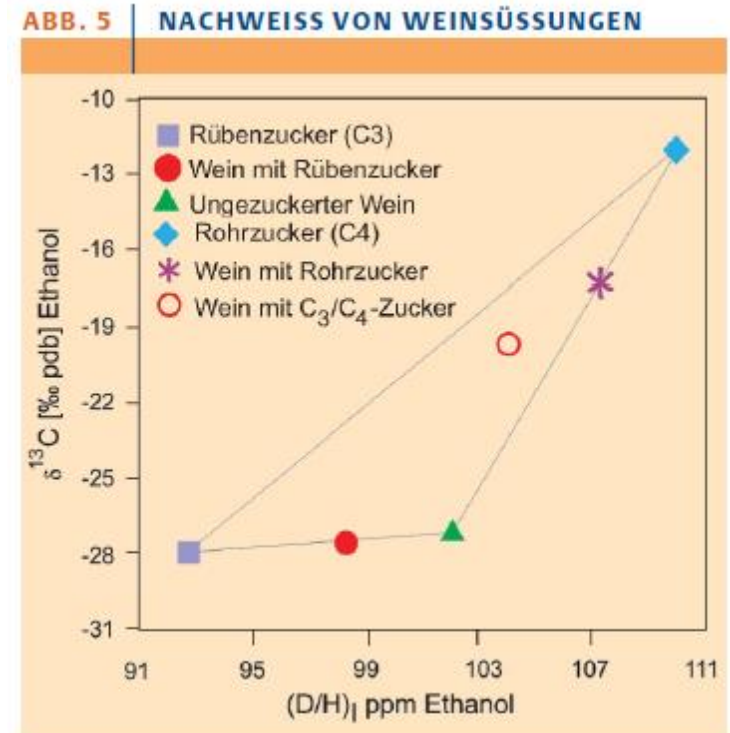


European Reference Centre for Control in the Wine Sector (DG AGRI)

Adulteration of wine

- Isotopic analysis for detection of sugaring (chaptalisation) and watering of wine, and geographical origin of wine
- SNIF[®]-NMR: determination of the
- $\delta^{13}\text{C}$ of ethanol
- $\delta^{18}\text{O}$ of wine water

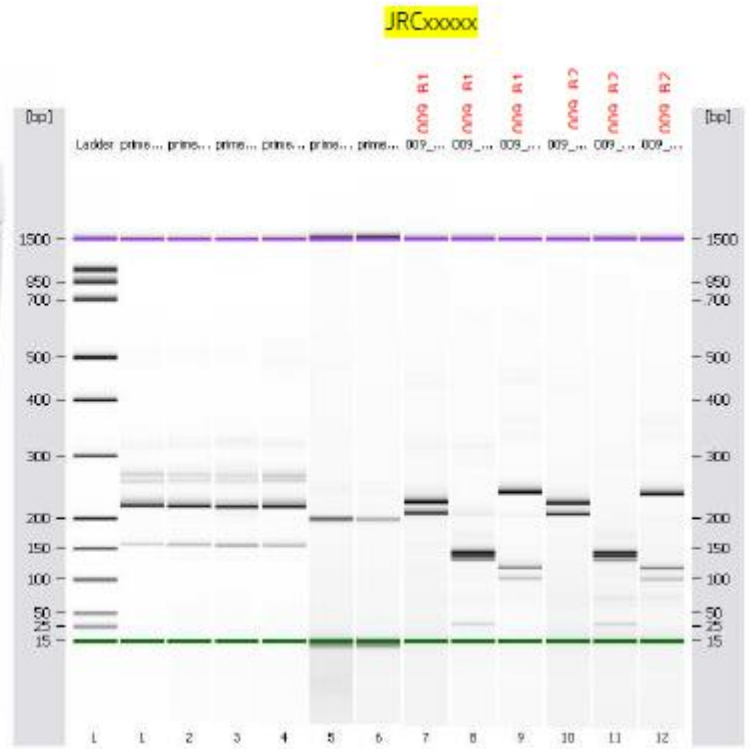
**European Reference Centre for
Control in the Wine Sector
(operated by JRC)**



Schmidt et al, 2005



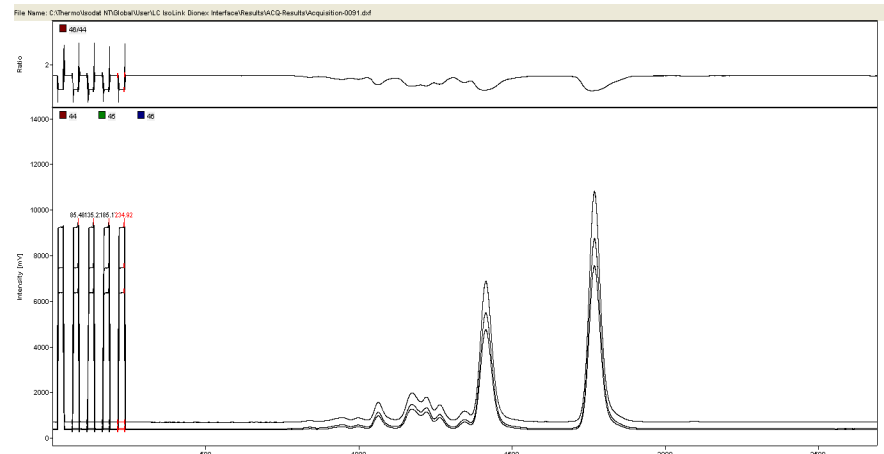
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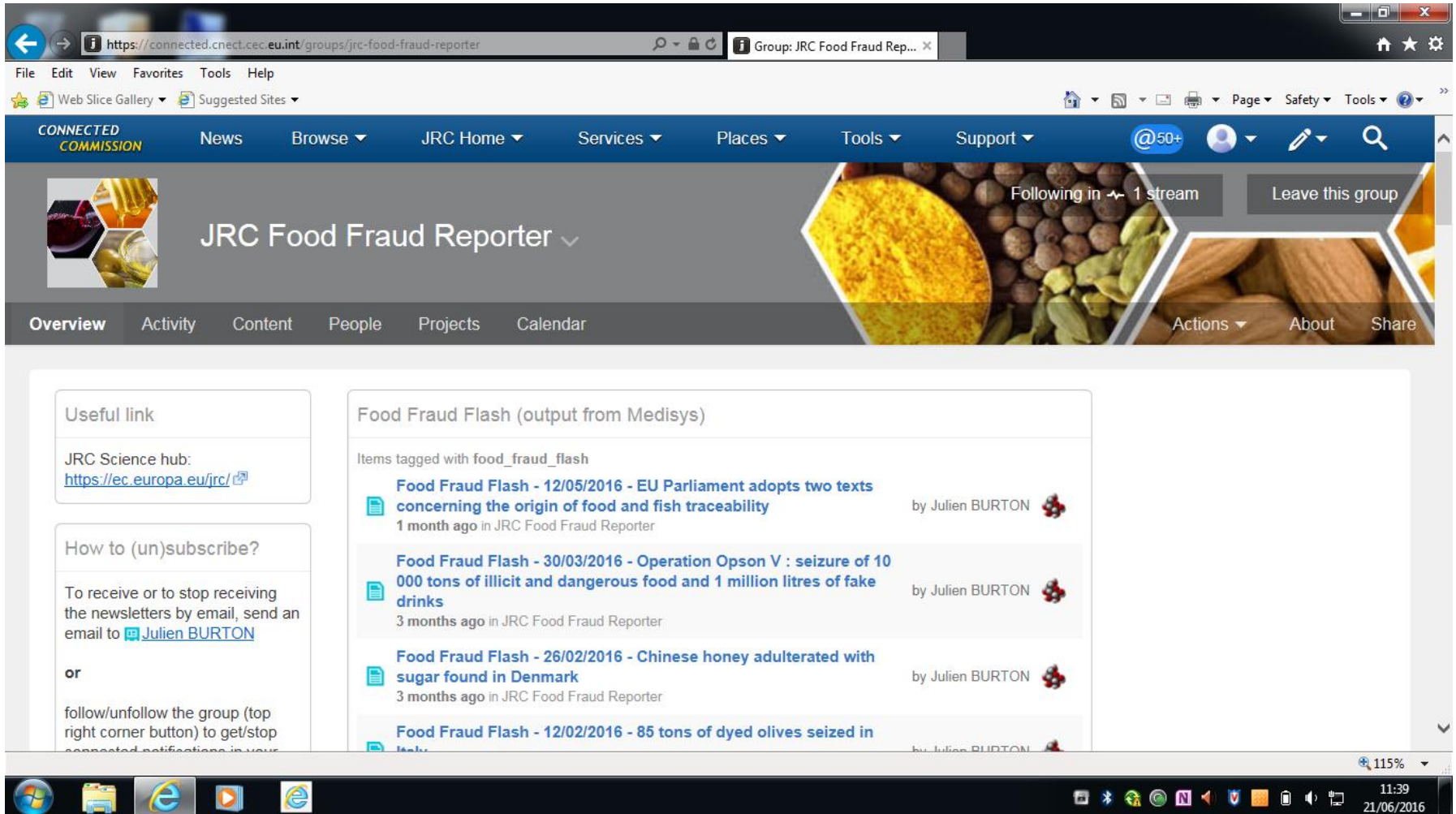


Fish substitution



Honey extension





https://connected.cnect.cec.eu.int/groups/jrc-food-fraud-reporter

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JRC Food Fraud Reporter

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Useful link

JRC Science hub:
<https://ec.europa.eu/jrc/>

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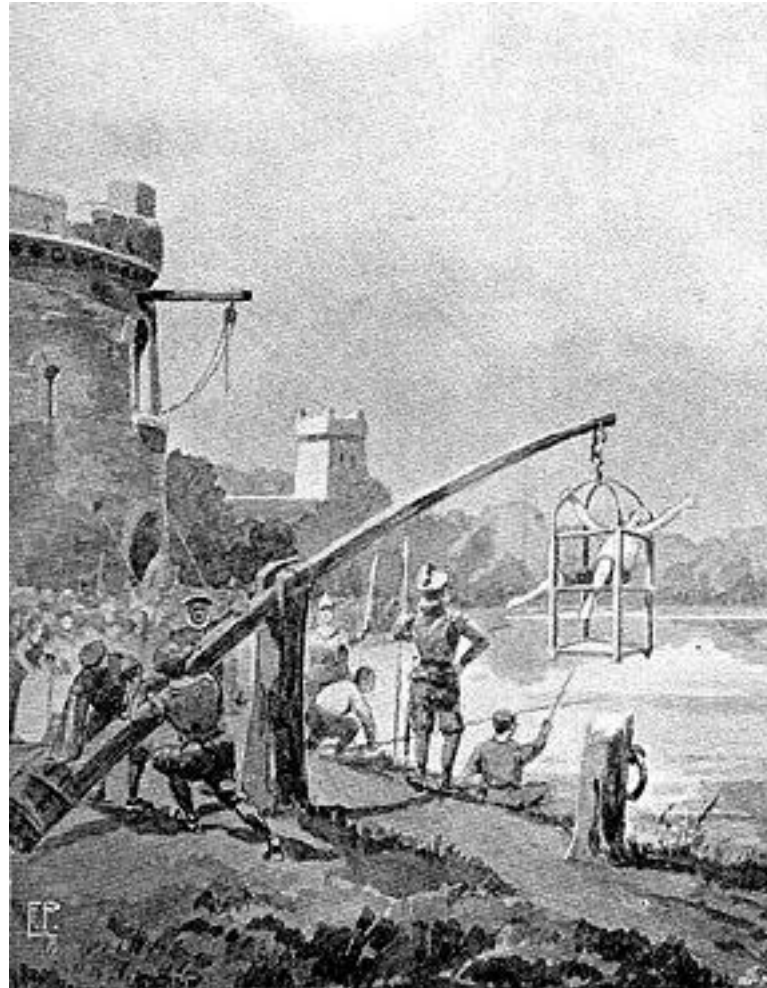
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Food Fraud Flash (output from Medisys)

Items tagged with food_fraud_flash

- Food Fraud Flash - 12/05/2016 - EU Parliament adopts two texts concerning the origin of food and fish traceability by Julien BURTON 1 month ago in JRC Food Fraud Reporter
- Food Fraud Flash - 30/03/2016 - Operation Opson V : seizure of 10 000 tons of illicit and dangerous food and 1 million litres of fake drinks by Julien BURTON 3 months ago in JRC Food Fraud Reporter
- Food Fraud Flash - 26/02/2016 - Chinese honey adulterated with sugar found in Denmark by Julien BURTON 3 months ago in JRC Food Fraud Reporter
- Food Fraud Flash - 12/02/2016 - 85 tons of dyed olives seized in Italy by Julien BURTON

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