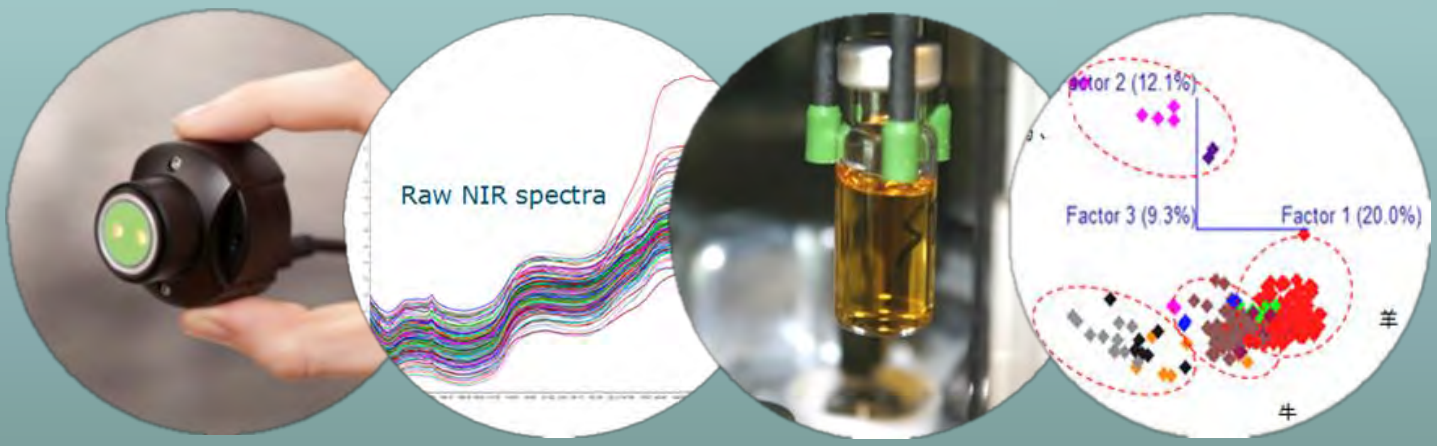
内蒙古营养学会会刊

营养与食品安全国际讲坛

International Lectures on Food Authenticity and Nutrients

食物真实性与营养素安全



支持　内蒙古科学技术协会

　　中华人民共和国国家外国专家局

主办　内蒙古科学技术协会、内蒙古营养学会

承办　内蒙古农业大学食品科学与工程学院

2015 年 9 月　呼和浩特

WAGENINGEN UR
For quality of life

欢迎访问学习

瓦赫宁根大学全称瓦赫宁根大学及研究中心 简称 Wageningen UR、WUR，是荷兰 14 所 U 类大学之一，在荷兰高等教育指南上高居榜首，在生命科学领域是欧洲大学的领头羊之一.

Wageningen University and Research Center 瓦赫宁根大学与研究中心

Food Safety Institute, RIKILT 食品安全研究所

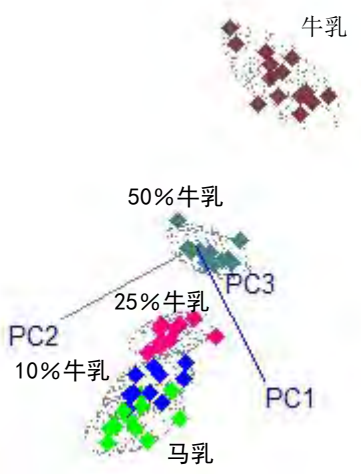
食品安全研究所（RIKILT）拥有约 200 名员工，致力于对食品的安全性和可靠性进行独立研究；在测量各类食品成分，如兽药、杀虫剂和包括二恶英、多氯联苯和重金属在内的污染物方面，拥有广泛和专业的分析方法；当发生食品紧急情况和环境事件时，RIKILT 随时准备为针对环境事件和食品危机进行部署，在有关的国家机构中扮演重要角色。

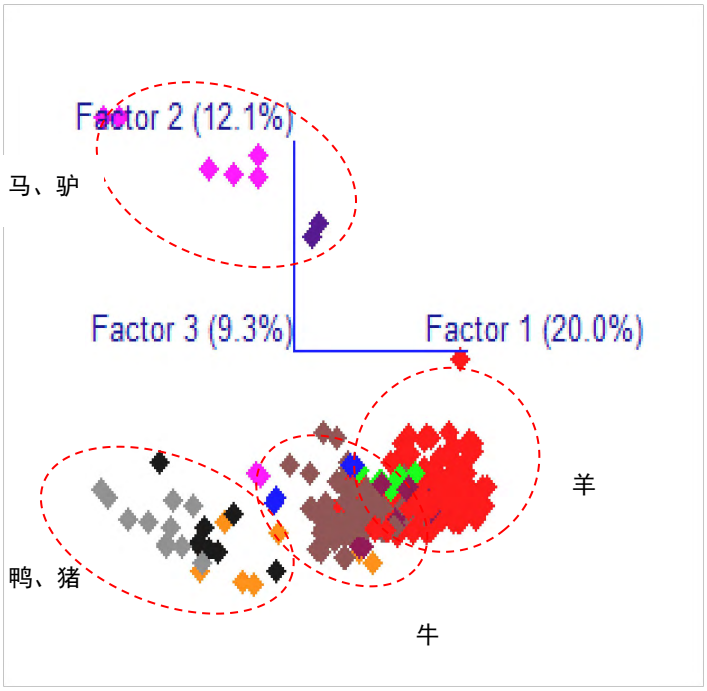
特色：专注测量物质、检测食品成分及检测食品欺诈
研究营养成分构成和影响
食品安全生产知识
参考实验室；全天候的危机处理功能
客户包括（国外）政府、企业和非政府组织

www.wageningenUR.nl/en/rikilt

目录

我们的化学计量学研究始于 2012





DI YANNICK WEESEPOEL
RIKILT WUR
NETHERLANDS

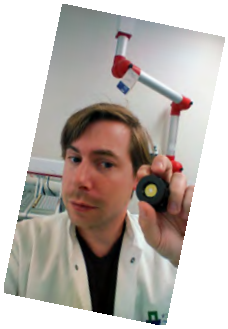
2015 食品安全和高级食品分析拓展课

免费课，莫失良机！

WAGENINGEN UR
For quality of life

Tuesday 8th Sept 9 月 8 日 周二 上下午，西区图书馆 “书缘”会议室

- Introduction RIKILT, Wageningen UR 瓦大和食品安全研究所介绍
- Introduction to Food Fraud 食物造假
- Authentication of organic foods 有机食品鉴别技术
- Portable spectroscopics for food authentication 便携式光谱仪检测食物造假
- Current research on Antibiotics 抗生素研究进展
- Residue analysis within EU law 欧盟法律框架下的化学残留检测
- Detection of GMO's 食物中人工基因的检测
- Quality and quality control 质量与品质控制



Wednesday 9th Sept 9 月 9 日 周三

- Class7-8: Food fraud, authenticity and analytical techniques – Part 1
  食物真实性鉴别技术 第一部 (博学楼 309 4:40-6:30)
- Class 9: Introduction to chemometrics 化学计量学入门 ★

· Class 10: Hands-on with The Unscrambler: Data visualization and principal component analysis 化学计量学软件 Unscrambler: 数据可视化和主成分分析

第 9-10 节，博学楼 309 晚 7:30-9:20）★ 互动课 最好带笔记本电脑，充好电！

Thursday 10th Sept 9 月 10 日 周四 博学楼 1-2 节 博学楼 209，9-10 节 309

- Class 1-2: Food fraud, authenticity and analytical techniques – Part 2
- Class 9-10: Hands-on with The Unscrambler: Data pre-treatment and PCA outliers 化学计量学软件 Unscrambler ★ 互动课最好带笔记本电脑，充好电！

Friday 11th Sept (lets discuss on Monday) 9 月 11 日 星期五 乳品楼早 8:00~

- Portable spectroscopics: **Star Trek** in our Pockets 口袋式光谱仪 Star Trek
- Another lecture on Food Fraud 其他食物造假检测技术
- More Chemometrics, Hands-on 化学计量学深入★

内蒙古营养学会、食品科学与工程学院食品质量与安全系

咨询与联络：郭老师 0471-4317891

9月8日 上午9:00-9:30，Yannick Weesepoel 博士主要介绍欧洲的食品安全监督管理体系、瓦大食品安全研究所RIKILT在荷兰和欧盟的作用，以及主要工作和研究内容。

RIKILT Wageningen UR **瓦赫宁根大学RIKILT研究中心**
Institute of Food Safety **食品安全研究所**

Dr Yannick Weesepoel, Researcher at RIKILT
Yannick Weesepoel 博士，RIKILT Researcher

RIKILT Wageningen UR
RIKILT简介

Research institute within Wageningen UR
瓦格宁根大学研究中心下设的研究机构
History of 117 years
拥有117年的发展历史
Located on the campus in Wageningen
坐落于瓦赫宁根大学校园内
> 230 coworkers including PhD students and foreign guests
超过230名工作人员，包括博士生及国外访问学者
Annual turnover 23 M€
年收入2300万欧元

Wageningen in The Netherlands

Wageningen UR mission

'to explore the potential of nature to improve the quality of life'

The Wageningen UR domain: healthy food and living environment

Two partners

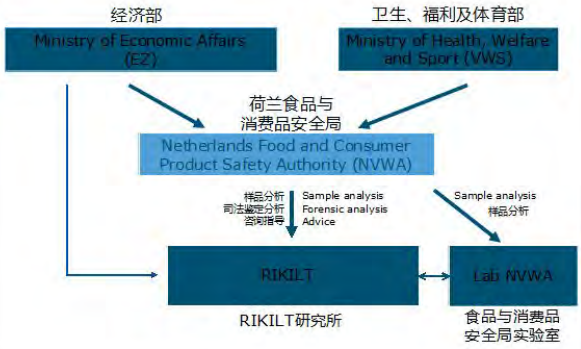
Main roles 主要工作

Reference Institute 参考标准制定
Official control laboratory 官方实验室
Analysis & Advice 分析&建议
Food Safety Research 食品安全研究
Forensic Research 司法鉴定研究
Training 培训教学
24/7 Incident Service 全天候事故应对服务

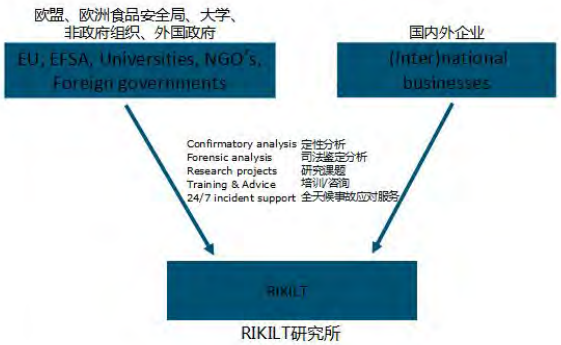
Themes **研究方向**

Chemical contaminants 化学污染
Veterinary drugs 兽药
GMOs 转基因生物
Natural toxins 天然毒素
Authenticity & nutrients 鉴别真伪/营养
New risks 新的风险

Position RIKILT (1) RIKILT的职能（1）



Position RIKILT (2) RIKILT的职能（2）



Position RIKILT as Statutory task unit
RIKILT作为法定单位的职能

RIKILT is not allowed to perform any possibly conflicting activity for industry

RIKILT不能从事任何可能对产业造成负面影响的活动

RIKILT is obliged to immediately inform the NVWA about any suspected or above (action) limit sample analysis result

一旦在样品检测中出现任何可疑或超标结果，RIKLT必须立即向食品消费品安全局汇报

Director RIKILT reports to: RIKILT主任提交报告给：

Managerial: the President of Wageningen UR
管理方面：瓦赫宁根大学校长
For all governmental tasks: the Minister of EZ
政府下达的所有任务：经济部部长

Interaction with Wageningen University
与瓦格宁根大学的关系

Two part-time professorships RIKILT employees: 兼职教授两名：

Prof. Dr. Michel Nielen （Michel Nielen 教授）
Detection of chemical food contaminants
化学性食品污染物的检测

Prof. Dr. Ir. Saskia van Ruth （Saskia van Ruth教授）
Food authenticity 食品认证

Double appointments: 双职务：

Dr. Peter Hollman: RIKILT and Human Nutrition
Peter Hollman博士: RIKILT及人类营养研究组

Dr. Ine van der Fels: RIKILT and Business Economics
Ine van der Fels博士: RIKILT及商业经济学研究组

10 joint PhD students 联合培养博士生10名

Several MSc students 硕士研究生若干

Main roles 主要工作

Reference Institute 参考标准制定

Official control laboratory 官方实验室

Analysis & Advice 分析&建议

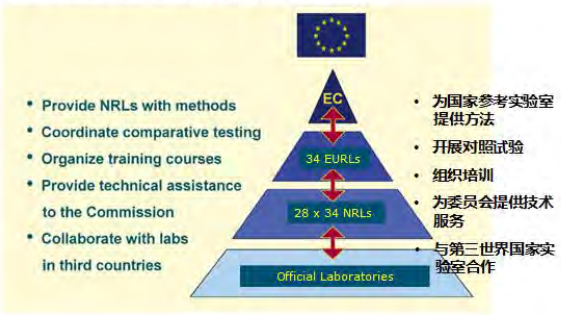
Food Safety Research 食品安全研究

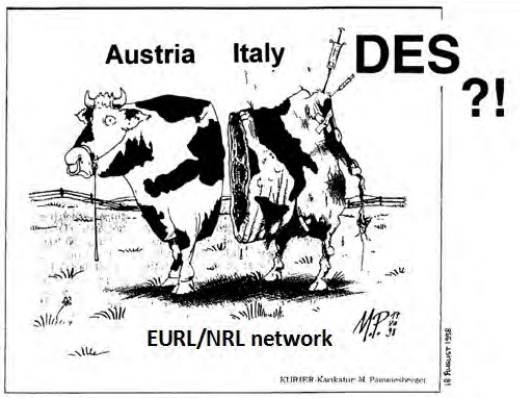
Forensic Research 司法鉴定研究

Training 培训教学

24/7 Incident Service 全天候事故应对服务

Harmonization in EU feed/food control
负责协调欧盟饲料/食品控制工作





RIKILT is NRL and EU-RL
RIKILT是国家参考实验室和欧盟参考实验室

National Reference Laboratory 国家参考实验室

(Bio)chemical NRL for The Netherlands (23 tasks)
荷兰（生物）化学参考实验室（23项任务）

NRL Validation of Alternative Methods
替代方法的国家参考实验室验证

Quality assurance of the official laboratories
官方实验室的质量保证

EU Reference Laboratory (EU-RL) 欧盟参考实验室

Residues of food of animal origin动物源食品残留
Hormonal growth promoters
激素类生长促进因子
Drugs 药物
Mycotoxins 霉菌毒素

European Union Reference Laboratory

EU Reference Laboratory 欧盟参考实验室

Confirmatory analyses for many countries, f.e. Ireland, Sweden, Belgium, Serbia, Croatia, Chile, Ecuador, ...

为多国提供验证分析，例如，爱尔兰、瑞典、比利时、塞尔维亚、克罗地亚、智利、厄瓜多尔

Training national reference laboratories in EU, Middle East, SE Asia, Latin America

负责欧盟、中东地区、东南亚地区、拉美地区国家参考实验室的培训

Interim NRL for Chile

作为智利的临时国家参考实验室

International reference activities
国际参考标准相关工作

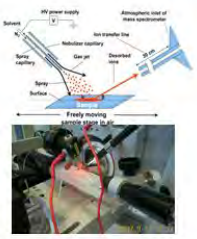
Analysis of分析检测项目包括

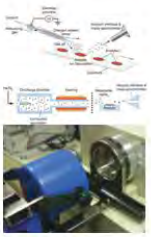
Contaminants 污染物
Animal Drugs & Residues 动物药品和残留
Antibiotics 抗生素
Pesticides 杀虫剂
Heavy Metals 重金属
Food bioactives 食品生物添加剂
GMOs 转基因生物
Nanomaterials 纳米材料
Allergens 过敏原
Isotopes 同位素
Authenticity 真伪鉴别
Food quality 食品质量
Natural toxins 天然毒素

Mainly in主要分析:

- Primary agricultural products (crops, meat, dairy products, fish, ...)
  初级农产品（作物、肉、奶制品、鱼等）
- Feed 饲料
- Food and feed additives
  食品和饲料添加剂

Ambient Mass Spectrometry常压敞开式离子源质谱技术





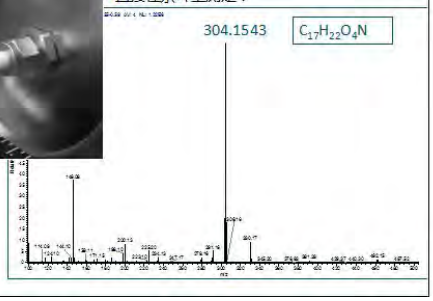
Chemical identification on surfaces 表面化学鉴定

Banknotes, clothes, powder, drugs, documents, skin, plants, food products, forensic samples, etc.

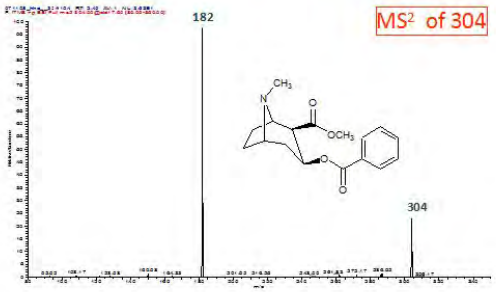
钞票、服装、粉剂、药物、单据、皮肤、植物、食品、法医样品等

DART Orbitrap MS of a herb tea
一片茶叶的实时直接分析质谱

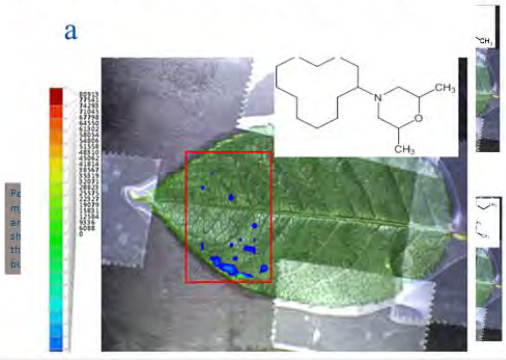
- Measure direct on a tea leave !
- 直接在茶叶上测定！



DESI MS^n of a herb tea 茶叶电喷雾电离质谱分析结果



LAESI imaging TOFMS of rose leaf
玫瑰叶片的喷雾技术飞行质谱成像结果



Emerging risks 逐渐显露的风险

Safety of new technologies 新技术是否安全
- GMO 转基因生物
- Nanotechnology 纳米技术

Natural toxins 天然毒素
- Mycotoxins 真菌毒素
- Plant toxins 植物毒素
- Marine toxins 海产毒素

Effects of the changing climate on food safety
气候变化对食品安全的影响

Plant toxins 植物毒素

An enormous group of chemicals 化学品的庞大集团
Some very potent toxins 一些非常有效的毒素
Difficult chemistry 难化学
Challenging analytics 具有挑战性的分析
RIKILT has developed analysis methods for several types
RIKILT开发了几种类型的分析方法

Plant toxins 植物毒素

Digitalis recently killed 75 calves
damage
近期发生的洋地黄毒死75头犊牛事件

Ragwort causes liver
泽菊造成肝损损伤

植物毒素：实例

In 2013 another tea incident in NL
This time pollution with atropine originating from accidental exchange of Marshmallow root with *Atropa belladonna* root
2013年有一发生在荷兰的阿托品污染茶叶事故，其起因是无意间将药蜀葵根换做了颠茄根

Illicium verum	**大茴香**	Illicium anisatum	**白花八角**
Chinese star anise	**八角茴香**	Japanese star anise	**毒八角**
Tea herb	**茶叶**	Very toxic	**极毒**

Cooperation 合作

Netherlands Food and Consumer Product Safety Authority
荷兰食品与消费品的安全性

European Food Safety Authority (EFSA) panels & working groups 欧洲食品安全局 专门小组和工作组

European projects 欧盟项目

Private industry: Food & Feed 私营行业：食品、饲料等

Chile food safety authority 智利食品安全局

CAAS 中国农业科学院 /SAAS 上海市农业科学院 /AQSIQ 国家质量监督检验检疫总局 /YILI 伊利

Thank you for your attention

感谢您的关注！

Yannick.weesepoel@wur.nl
www.wageningenur.nl/en/rikilt

9 月 8 日 上午 9:30-10:15 Yannick 博士介绍了食品造假的相关内容和瓦大食品安全研究所化学计量学鉴别技术的现有成果，及之后培训课内容的安排。

Yannick Weesepoel, RIKILT Wageningen UR
IMAU, Hohhot, China – September 8th 2015
(yannick.weesepoel@wur.nl)

'De Agri Cultura' (169 BC): Marcus Cato, first method to determine whether wine was authentic (had not been watered).

Livre des métiers (1268): Everything that may be harmful to the public . . . all that may cause deception and falsification . . . especially to those ignorant in the matter" must be prevented or suppressed.

Frederick Accum (1820):
'Treatise on adulteration of food'

Fines, Guild expulsion or corporal punishments:

Exposure "before a fine large fire" of a seller of adulterated butter with the butter placed upon his head until it melted.

"Any man who sells watered milk shall have a funnel placed in his throat and the said watered milk poured down until a doctor or a barber declares that the man cannot swallow any more without danger."

Emphasis on food quality standardization started in the second half of the 19th century

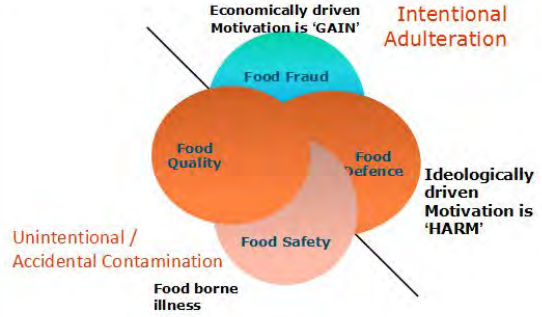
Aiming at the compositional authenticity of food, looking for single markers, e.g. water content, protein content, etc.

Definition of food fraud

USP defines food fraud as the "deliberate substitution, addition, tampering or misrepresentation of food, food ingredients or food packaging, or false or misleading statements made about a product for economic gain."

No official EU definition of food fraud

How does food fraud differ from safety, quality and defence issues?



Food fraud: nothing new

- Food fraud cases date back to ancient Rome (wine adulterated with lead)
- 800 new records in 2011-2012 based on USP database on food fraud

...and it is just the tip of the iceberg!

Sneak peak of this afternoon:

1. Authentication of organic and non-organic foods:
   a. Eggs
   b. Meadow milk
   c. Coffee
   d. Wheat
2. Portable spectroscopics for on-site suspect sample discrimination
3. Current research on antibiotics
4. Q&A – Other topics, audience choice!

1a. Organic egg fraud – LC analysis

German

More than a
organic or fr

88% of Organic Food is Fake

By Nathan Schwartzman Dec 03, 2007 9:59AM UTC

16 Comments and 0 Reactions

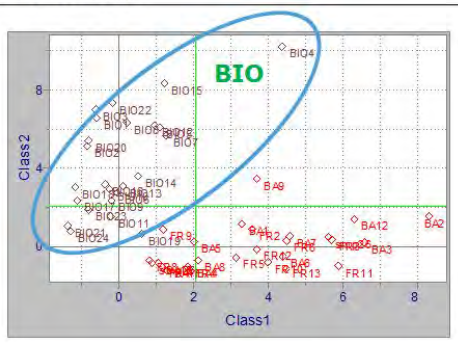
Original Article.

"Organic tofu," "organic jam," "organic olive oil."

A study has found that the majority of 'organic' farm products sold in Korea are fake. The Korea Food Research Institute announced on the 29th that "88% of domestic organic farm products have been marked as organic by their manufacturers, not the government." Unlike in foreign countries, organic products in Korea do not need government certification, creating these abuses. Organic products are 2.82 times as expensive as their non-organic counterparts. Consumers are buying expensive "organic" products without knowing what they truly are.

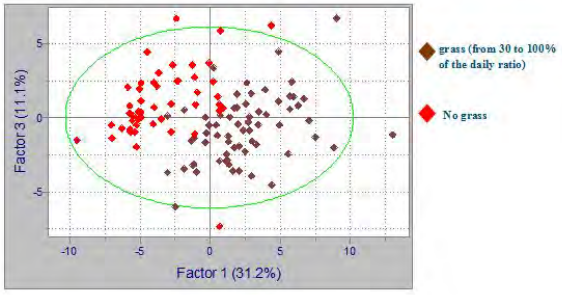
Instrumental method (HPLC) based on yellow pigments: carotenoids

Multivariate analysis of carotenoids present in eggs



1b. Meadow milk

Fatty acid profiling of meadow and non-meadow milk, combined with chemometrics

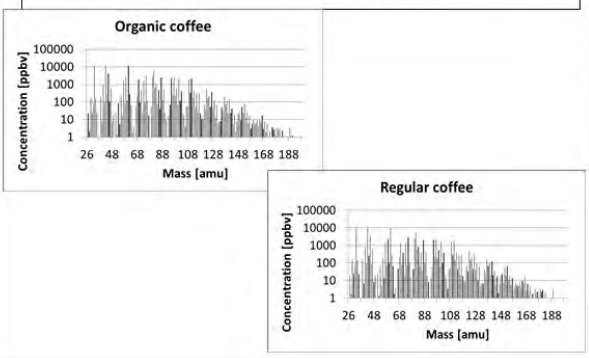


1c. Coffee – headspace analysis

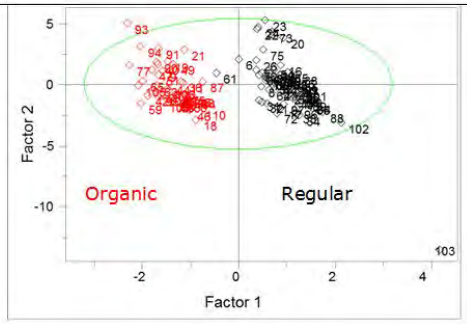
Is it possible to chemically prove the speciality production of coffees?

	Fair trade certified	Not certified fair trade	Total number of samples
Organic certified	20	23	43
Not certified organic	34	33	67
Total number of samples	54	56	110

Do organic coffees differ enough in VOCs for discrimination from conventionally produced coffees?

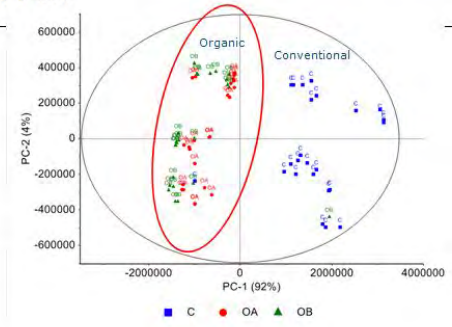


PLS-DA classification separates in production system by PC1



1d. Wheats – LC analysis

Yes you can! – Phytonutrient LC analysis with PCA



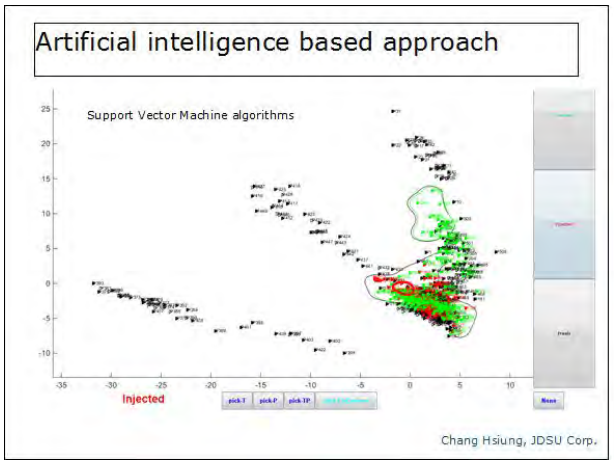
2. Portable spectroscopics for authentication

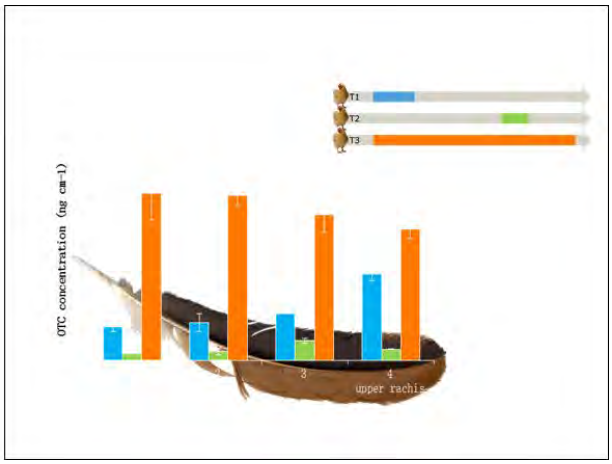
Measuring trough packages for routine check of chicken fillets

Fresh or thawed meat?

Additives?

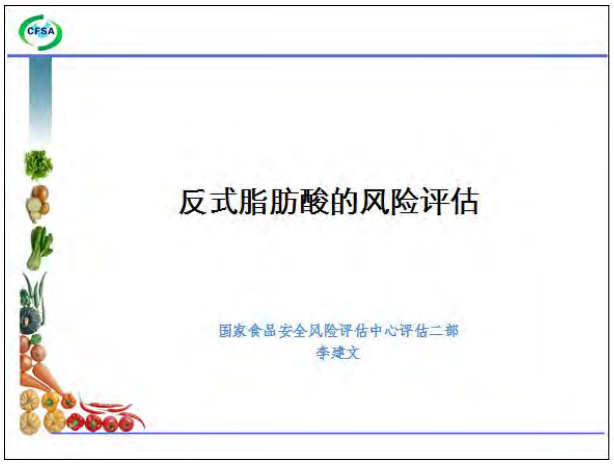
Violation of legal limits

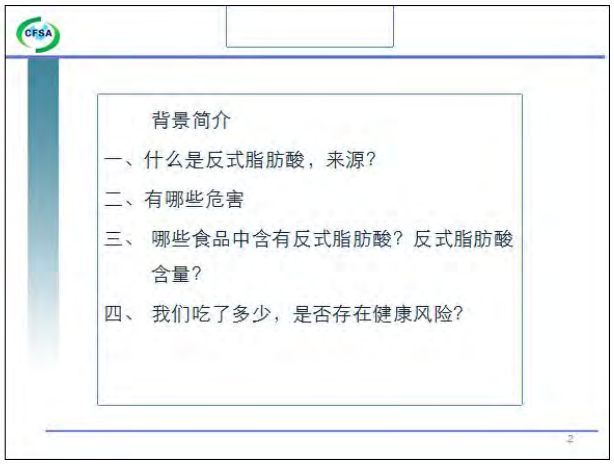


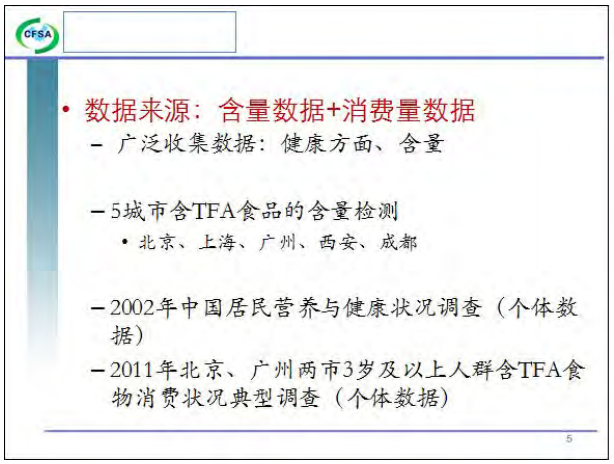


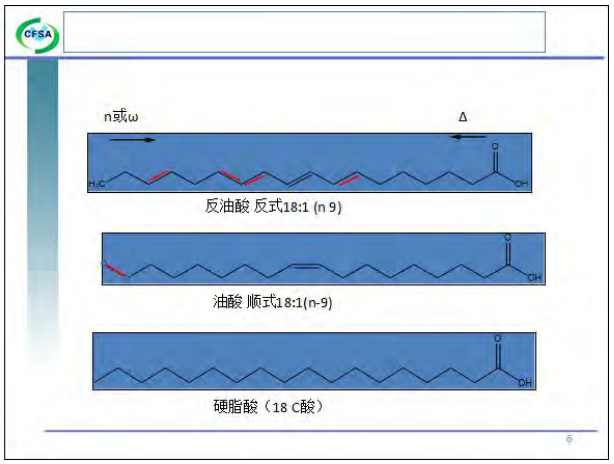
本次会议宣传海报-瓦大食品安全研究所 研究员 Yannick Weesepoel 博士

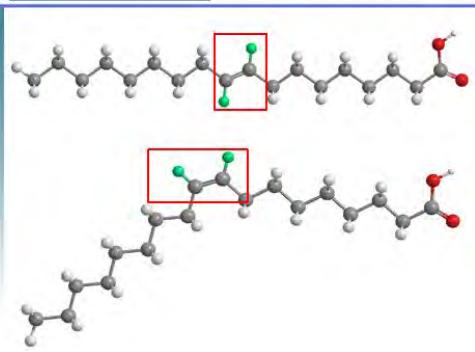
9月8日 上午10:20-11:20 李建文博士对食品中反式脂肪酸含量及其健康风险进行阐述。











TFA与代谢性危险因素

- 代谢性危险因素是指增加代谢性疾病发生风险的因素，如脂代谢异常、高血压、高血糖、肝脂肪变性、胰岛素抵抗等
- **胆固醇**
  - **实验研究**
    - ↑ 血清总胆固醇（TC），↑低密度脂蛋白胆固醇（LDL-C）（或不变）
    - 但↓高密度脂蛋白胆固醇（HDL-C），使TC/HDL-C↑
    - ↑增加小而致密胆固醇（sLDL）→与心血管疾病风险存在正相关关系
  - **meta分析及系统评价结果**
    - TFA替代膳食中*cis*-MUFA，LDL-C↑，HDL-C↓
    - 供能比>3%，TFA和LDL-C/HDL-C比值存在线性剂量反应关系
  - **横断面流行病学证据**
    - TFA摄入或其代谢标志物，与血清血脂谱关联虽弱，但具有统计学上的显著性
  - **均是高TFA摄入下的实验，低水平甚少，有学者认为：**
    - TFA对对胆固醇的影响可能存在阈值

TFA与代谢性危险因素

- 甘油三酯
  - 空腹甘油三酯（TG）浓度升高与心血管疾病的风险**呈正相关关系**
  - **等能量下**：*trans*-MUFA可 升高空腹TG水平（**对照***cis*-不饱和脂肪酸），**存在线性剂量反应关系**
- 脂蛋白(a)
  - 高水平的脂蛋白(a)与心血管疾病的风险相关
  - 富含TFA的膳食可导致Lp(a)水平升高

- **LDL氧化敏感性、凝血功能、胰岛素敏感性、血压**
  - 无影响或
  - 影响不具有显著性或
  - 研究结果相矛盾，有待进一步研究

1、Mozaffarian D, Katan MB, Ascherio A, Stampfer MJ, Willett WC: **Trans fatty acids and cardiovascular disease.** *New England Journal of Medicine* 2006, **354**:1601-1613.

- 供能比为1%-3%时，TFA即可对健康造成不良影响。
  - ↑ LDL-C/HDL-C、↑ TC/HDL-C
  - 增加心血管疾病的发病风险

2、Ascherio A, Katan MB, Zock PL, Stampfer MJ, Willett WC: Trans fatty acids and coronary heart disease. N Engl J Med 1999, 340:1994-1998.

- 摄入TFA的供能比之绝对增量为2%时，LDL-C/HDL-C将增加0.1

3、Stampfer MJ, Sacks FM, Salvini S, Willett WC, Hennekens CH: A prospective study of cholesterol, apolipoproteins, and the risk of myocardial infarction. N Engl J Med 1991, 325:373-381.

- 而LDL-C/HDL-C值每增加1，冠心病的发病风险将增加53%

- 共识：过量摄入TFA，可增加患心血管疾病的风险
- 没有明确证据：
  - 2型糖尿病
  - 早期生长发育
  - 癌症
  - 血压等
- 天然来源的TFA与健康

各国/组织关于TFA的膳食建议

国家或组织	年份	TFA膳食建议（占膳食能量的比例）
英国	1999、2007	<2%
荷兰	2001	尽可能的低
北欧国家	2004	SFA+TFA<10%
法国	2005	<2%
美国	2005	尽可能的低
德国、奥地利、瑞士	2008	<1%
WHO/FAO	2009	<1%（氢化来源）
FAO	2010	<1%
WHO	2003	<1%

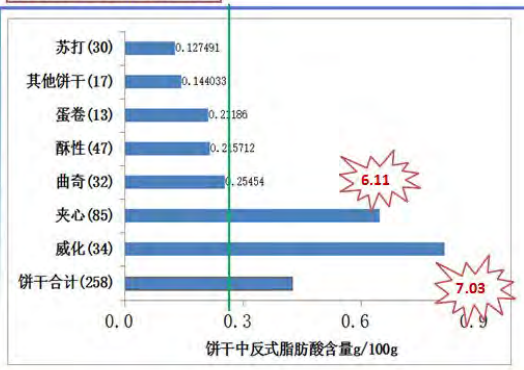
本次评估使用的标准

13大类食品中反式脂肪酸含量

食品种类	样本量	TFA含量（g/100g）		
		均值	中位数	最大值
焙烤食品	682	0.41	0.11	8.64
调味品	98	0.35	0.06	4.12
冷冻饮品	99	0.09	0.05	0.53
膨化食品	224	0.16	0.04	7.01
巧克力、糖果	135	0.89	0.16	15.60
乳及乳制品	262	0.83	0.20	10.34
速食食品	274	0.11	0.04	3.92
小吃	86	0.24	0.12	2.74
畜肉及制品	92	0.30	0.10	2.14
饮料类	115	0.25	0.07	3.42
植物油	451	0.86	0.65	4.68
禽肉制品	53	0.16	0.07	1.86
油饼油条	42	0.31	0.13	3.64
总计	**2613**	**0.46**	**0.11**	**15.60**

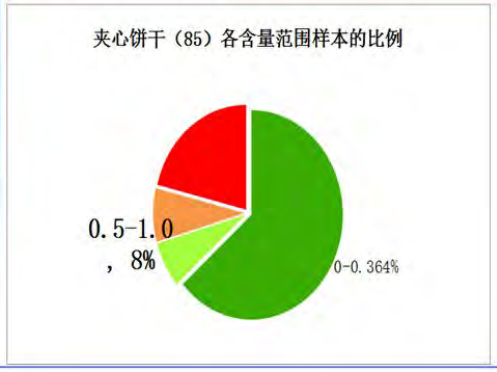
13

焙烤食品-饼干



14

夹心饼干（85）

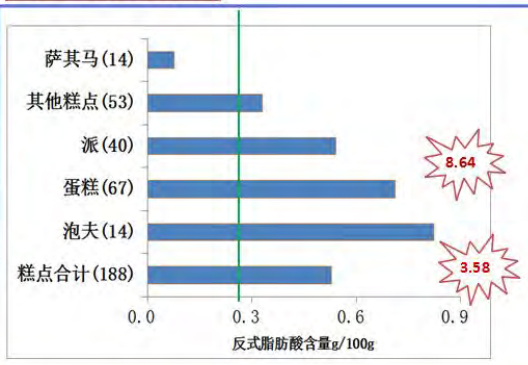


15

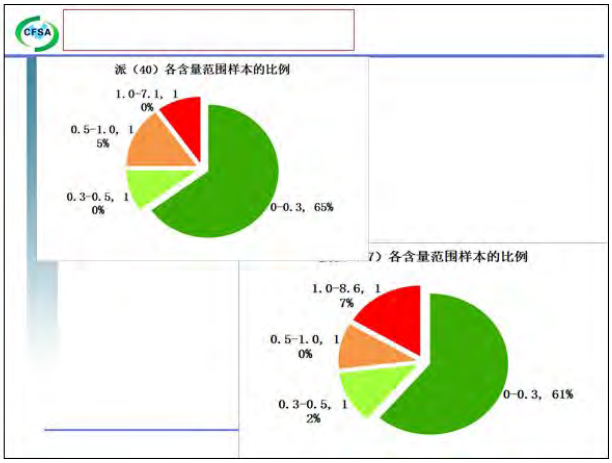
威化饼干（34）

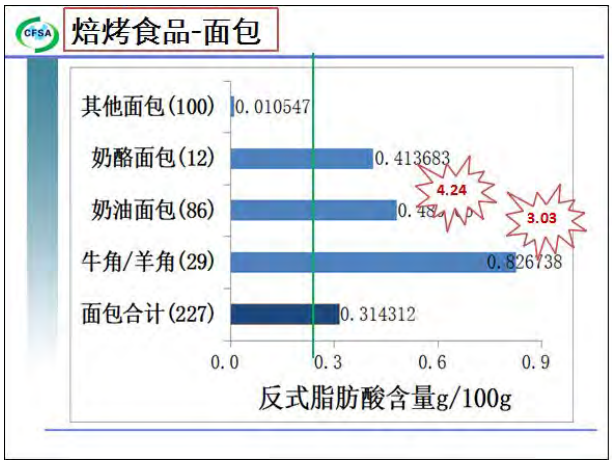
16

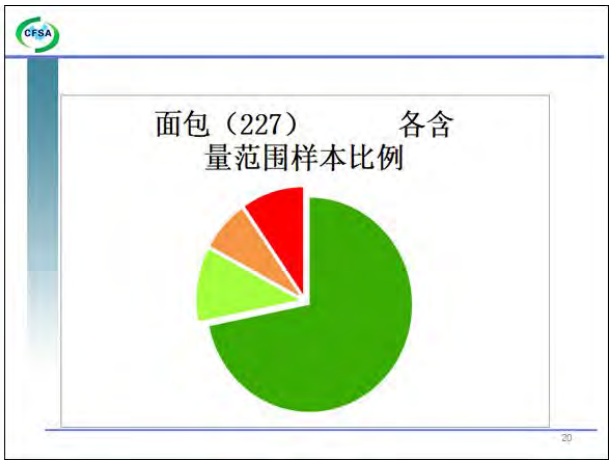
焙烤食品-糕点

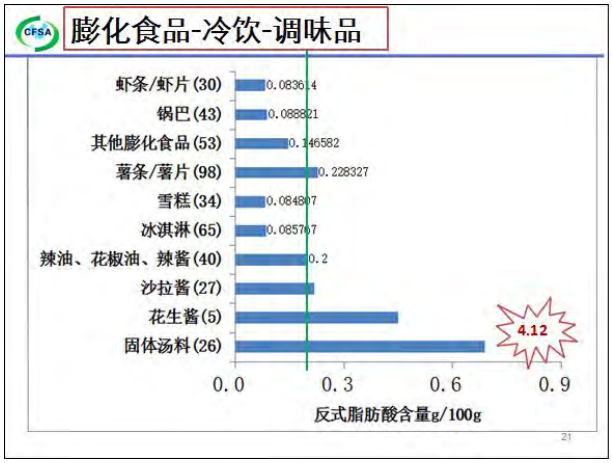


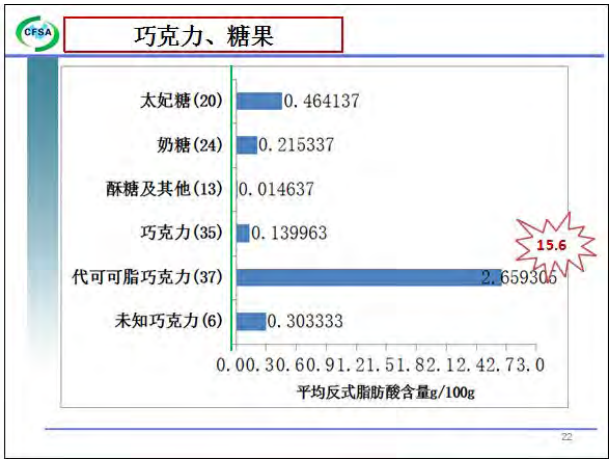
17

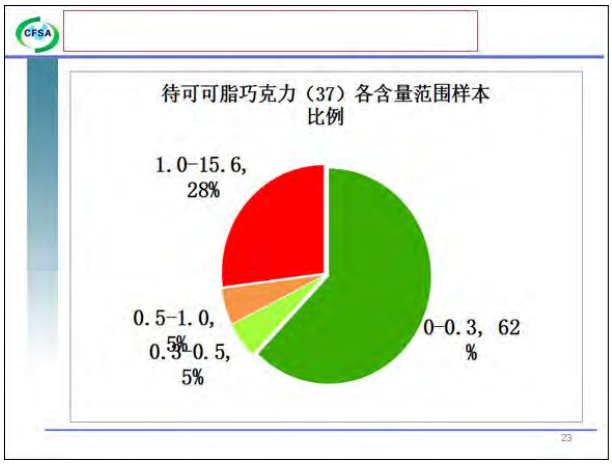


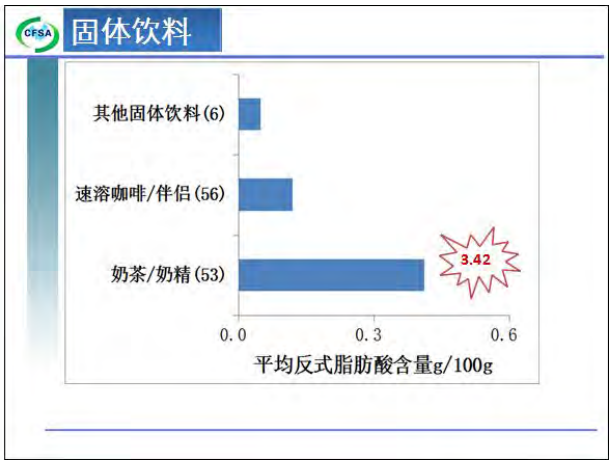

焙烤食品-面包
其他面包(100)
0.010547
奶酪面包(12)
0.413683
奶油面包(86)
0.48
牛角/羊角(29)
0.826738
面包合计(227)
0.314312
4.24
3.03
0.0
0.3
0.6
0.9
反式脂肪酸含量g/100g


面包（227）各含量范围样本比例
20


膨化食品-冷饮-调味品
虾条/虾片(30)
0.083614
锅巴(43)
0.088821
其他膨化食品(53)
0.146582
薯条/薯片(98)
0.228327
雪糕(34)
0.084807
冰淇淋(65)
0.085767
辣油、花椒油、辣酱(40)
0.2
沙拉酱(27)
花生酱(5)
固体汤料(26)
4.12
0.0
0.3
0.6
0.9
反式脂肪酸含量g/100g
21


巧克力、糖果
太妃糖(20)
0.464137
奶糖(24)
0.215337
酥糖及其他(13)
0.014637
巧克力(35)
0.139963
代可可脂巧克力(37)
2.659306
未知巧克力(6)
0.303333
15.6
0.0
0.3
0.6
0.9
1.2
1.5
1.8
2.1
2.4
2.7
3.0
平均反式脂肪酸含量g/100g
22

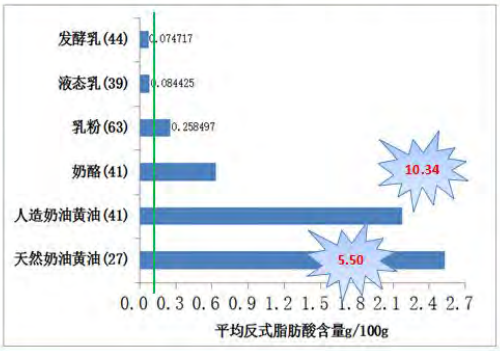

待可可脂巧克力（37）各含量范围样本比例
1.0-15.6, 28%
0.5-1.0, 5%
0.3-0.5, 5%
0-0.3, 62%
23


固体饮料
其他固体饮料(6)
速溶咖啡/伴侣(56)
奶茶/奶精(53)
3.42
0.0
0.3
0.6
平均反式脂肪酸含量g/100g

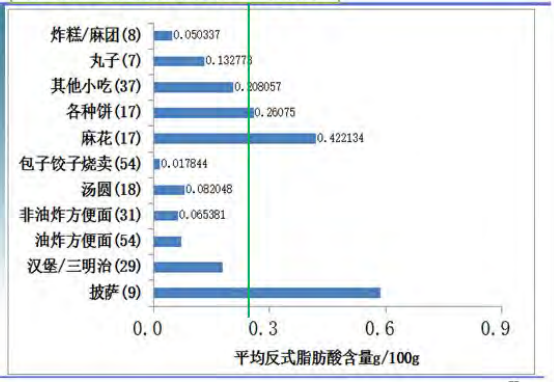
速溶咖啡/伴侣（56份）

■咖啡伴侣（9份）
- ➢5份含量为0
- ➢其它4份0.11 、0.10、0.04、0.004 g/100 g；

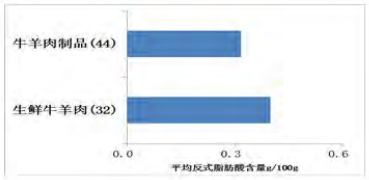
乳及乳制品中的反式脂肪酸含量



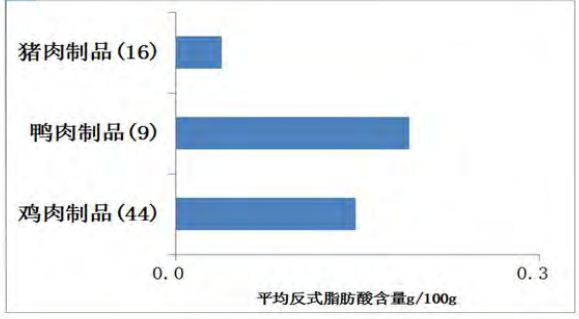
小吃、速冻食品、快餐



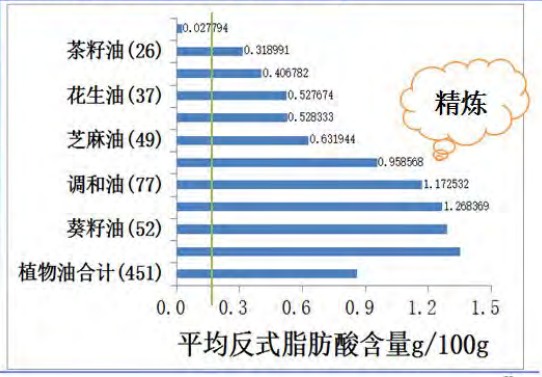
反刍动物肉类及制品



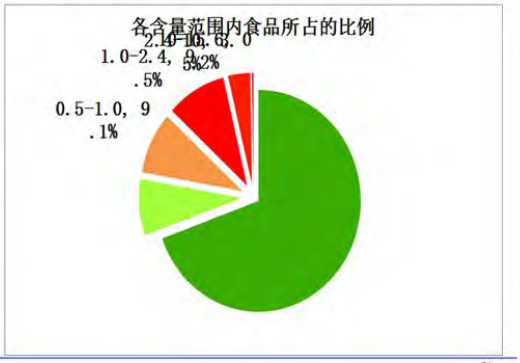
其他肉类制品



植物油中的反式脂肪酸含量



所有2613份食品中反式脂肪酸含量分布



31

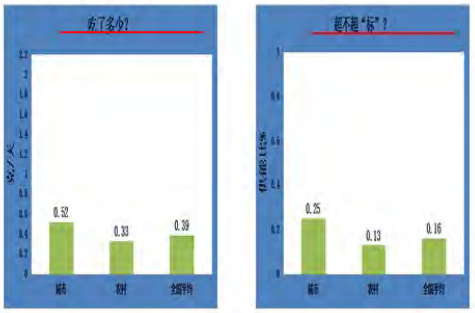
四、反式脂肪酸

1. 我们每天会吃多少?
2. 会不会影响健康?

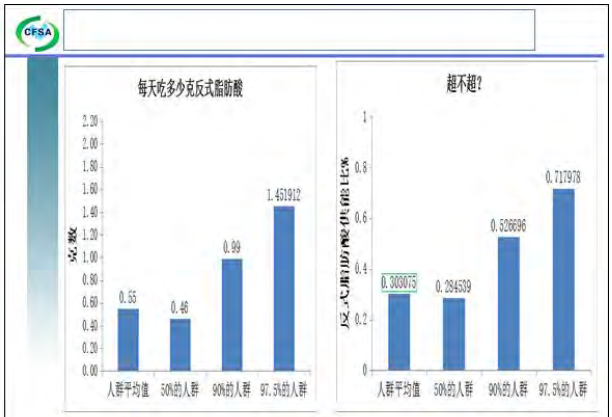
32

全国-2002年的食物消费量数据

如何计算出“吃了多少”？

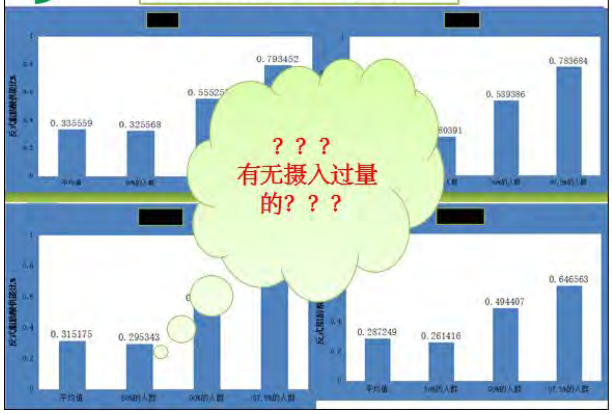


33

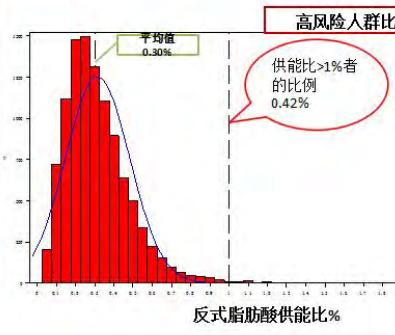


34

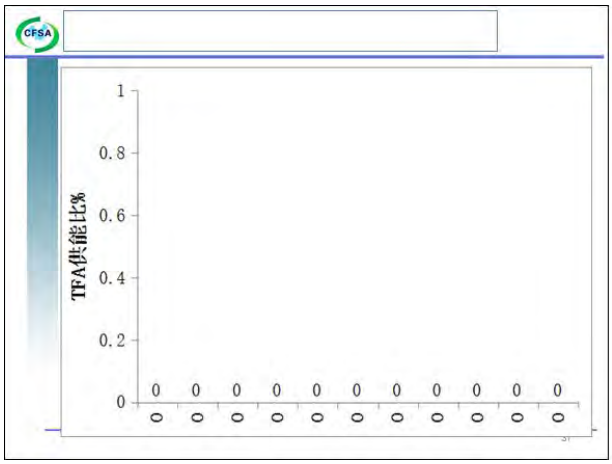
北京、广州各年龄段的人群

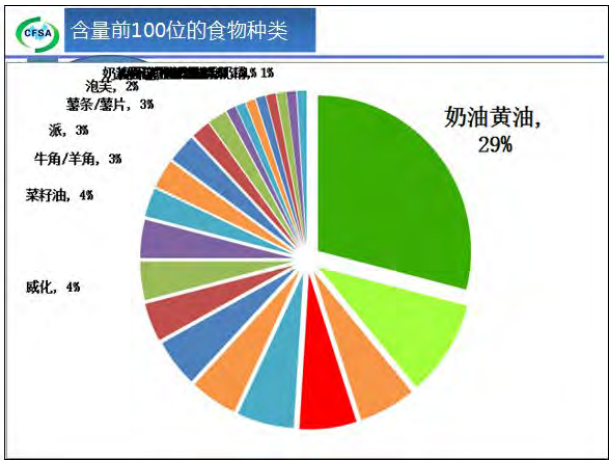


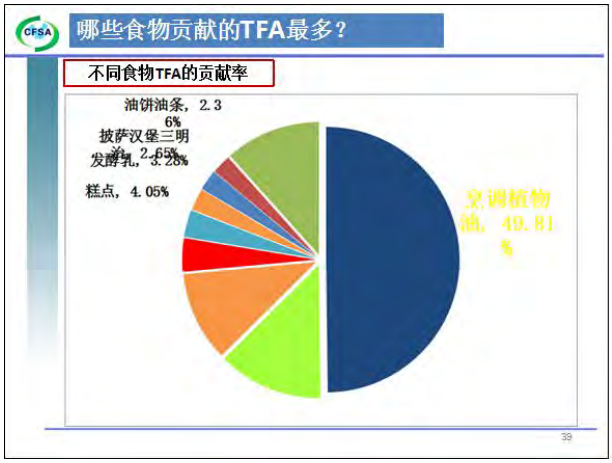
TFA供能比有没有超过建议值1%的？

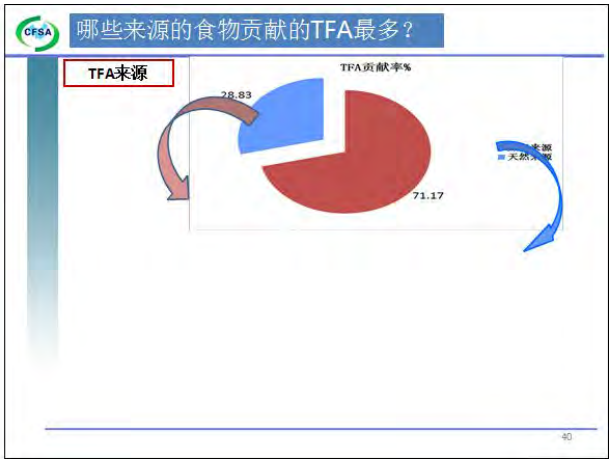


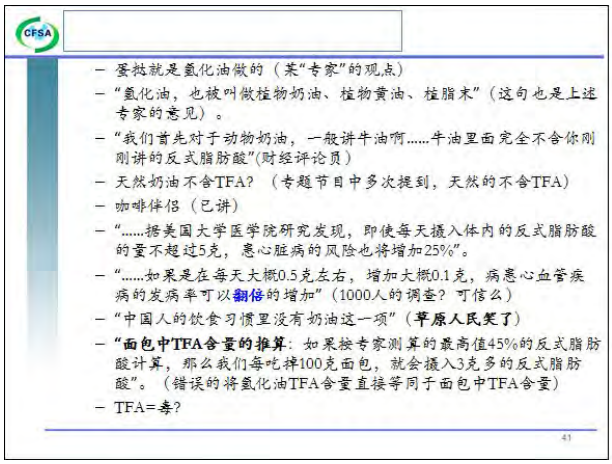
35

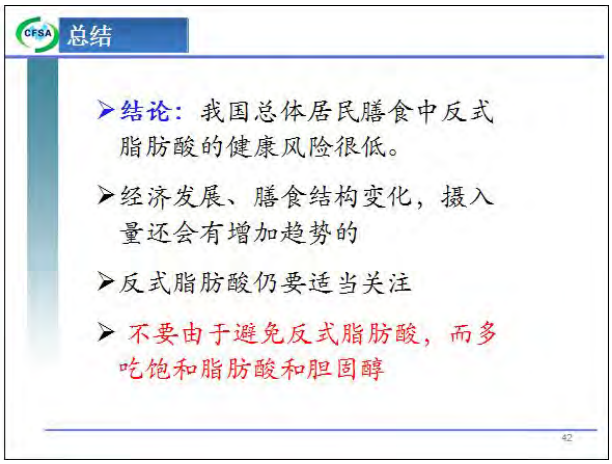

TFA供能比%
1
0.8
0.6
0.4
0.2
0


含量前100位的食物种类
奶油黄油，29%
泡芙，2%
蛋糕/蛋片，3%
派，3%
牛角/羊角，3%
菜籽油，4%
氢化，4%

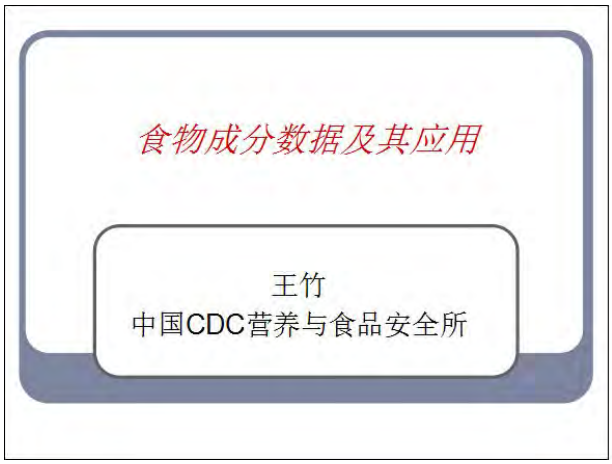

哪些食物贡献的TFA最多？
不同食物TFA的贡献率
油饼油条，2.3
6%
披萨汉堡三明
发酵乳，3.28%
糕点，4.05%
39

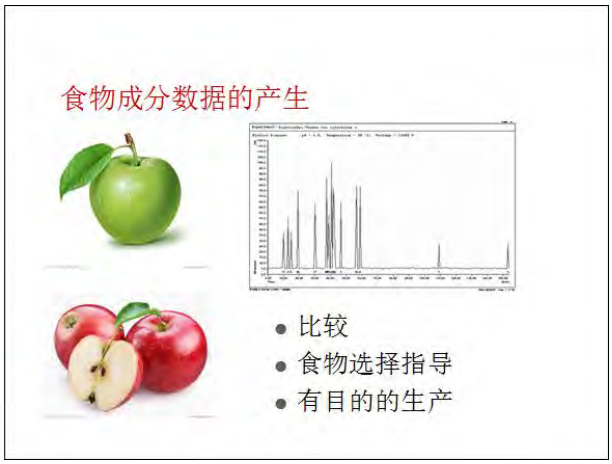

哪些来源的食物贡献的TFA最多？
TFA来源
TFA贡献率%
28.83
71.17
40

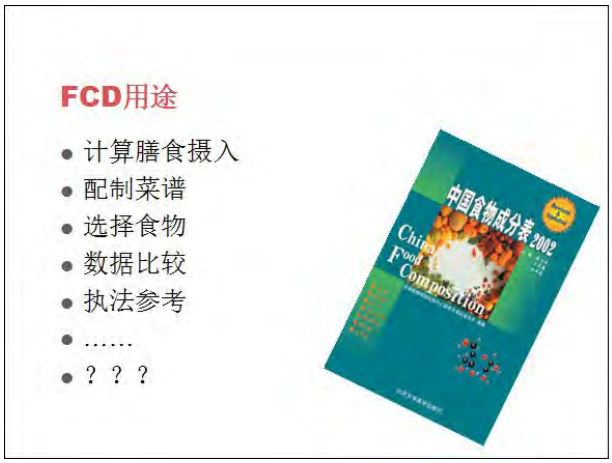

– 蛋挞就是氢化油做的（某"专家"的观点）
– "氢化油，也被叫做植物奶油、植物黄油、植脂末"（这句也是上述专家的意见）。
– "我们首先对于动物奶油，一般讲牛油啊……牛油里面完全不含你刚刚讲的反式脂肪酸"(财经评论员)
– 天然奶油不含TFA？（专题节目中多次提到，天然的不含TFA）
– 咖啡伴侣（已讲）
– "……据美国大学医学院研究发现，即使每天摄入体内的反式脂肪酸的量不超过5克，患心脏病的风险也将增加25%"。
– "……如果是在每天大概0.5克左右，增加大概0.1克，病患心血管疾病的发病率可以翻倍的增加"（1000人的调查？可信么）
– "中国人的饮食习惯里没有奶油这一项"（苹原人民笑了）
– "面包中TFA含量的推算：如果按专家测算的最高值45%的反式脂肪酸计算，那么我们每吃掉100克面包，就会摄入3克多的反式脂肪酸"。（错误的将氢化油TFA含量直接等同于面包中TFA含量）
– TFA=毒?
41

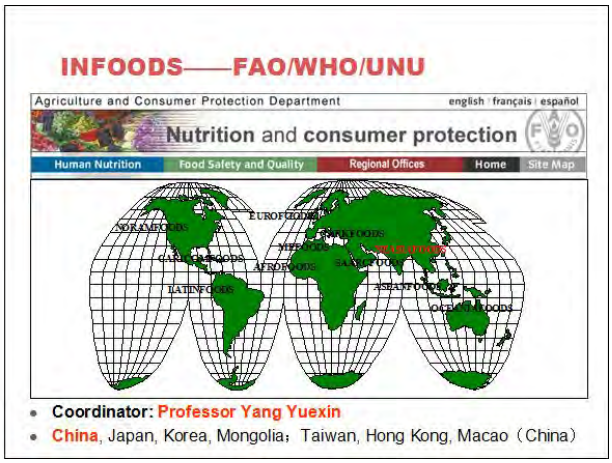

总结
➢结论：我国总体居民膳食中反式脂肪酸的健康风险很低。
➢经济发展、膳食结构变化，摄入量还会有增加趋势的
➢反式脂肪酸仍要适当关注
➢ 不要由于避免反式脂肪酸，而多吃饱和脂肪酸和胆固醇
42

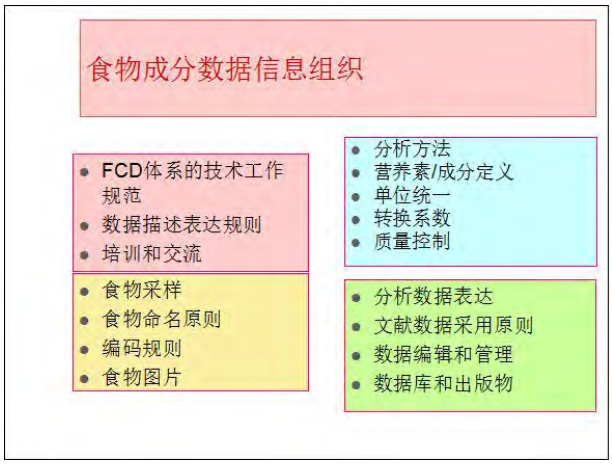
9月8日 上午11:30-12:30 中国CDC营养与健康所博士/研究员 王竹 具体阐述了建立营养素数据库的科学性和必要性，以及在实验数据测定过程中应该注意的问题。

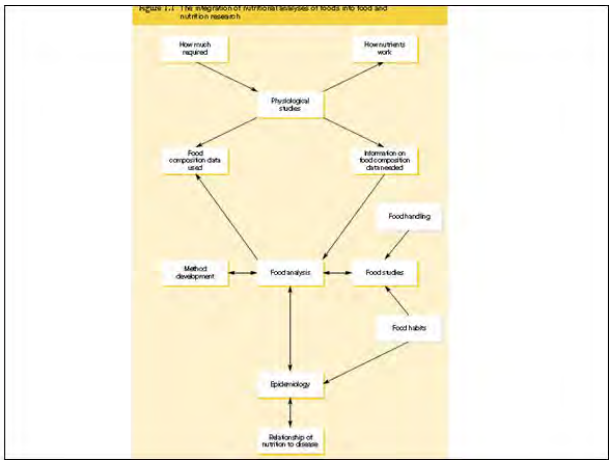












一个食物成分数据背后的故事

- 数据是怎么来的？
  - 测的是什么

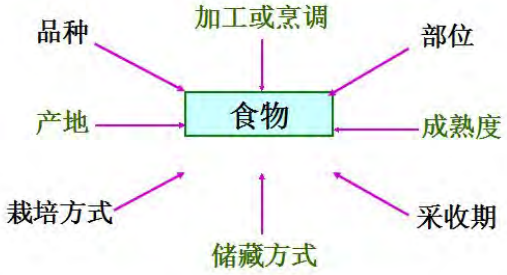
食品分类及名称

- 通用名
- 俗名
- 英文名
- 拉丁名

- 商品名
- 育种编号

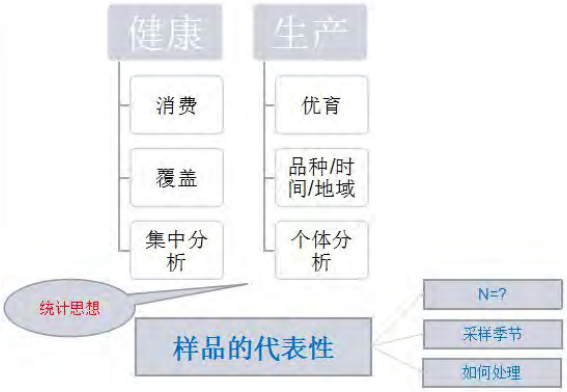
食物描述信息和分类

影响食物营养的主要因素



一个食物成分数据背后的故事

- 数据是怎么来的？
  - 谁来测，为谁测



- 籼米和粳米的蛋白质、钙、铜、锰、锌的含量情况

	籼米		粳米		P
	N	平均含量	N	平均含量	
蛋白质(g/100g)	350	7.0±0.79	79	6.9±0.55	.084
钙(mg/100g)	350	7.0±7.7	79	6.2±3.0	.348
铜(mg/100g)	350	0.22±0.08	79	0.21±0.03	.05
锰(mg/100g)	350	1.08±0.31	79	1.07±0.46	.972
锌(mg/100g)	350	1.49±0.26	79	1.28±0.29	.000

一个食物成分数据背后的故事

- 数据是怎么来的？
- 怎么测的

测定

- 前处理
  - 水分变化
  - 重量变化
- 测定
  - 灵敏度
  - 特异性
- 定量
  - 不确定度
  - 检出限
- 表达
  - 营养概念
  - 活性形式

可食部的计算

- 称原重（M1）
- 去皮、除核
- 再称重 （M2）
- 计算

$$可食部 = \frac{去皮后重量(M_2)}{原重(M_1)} \times 100\%$$

- 可食部直接记录到样品记录表，不需要对结果进行折算

重量因子折算

- 样品原重
- 加水后总重
- 重量折算：

$$重量折算 = \frac{原重}{加水后总重} \times 100\%$$

- 测定结果必须对重量因子进行折算

营养成分定义及与分析技术的关系

- 蛋白质
  - 含氮有机化合物、以氨基酸为基本组成
- 测定方法
  - 总氮、 N折算系数
  - 氨基酸

混合食品、没有明确折算系数的食品6.25？

氮折算系数

食物	折算系数	食物	折算系数
全小麦粉	5.83	核桃、榛子、芝麻、葵花籽	5.30
麦糠麸皮	6.31	鸡蛋（整）	6.25
麦胚芽	5.80	蛋黄	6.12
麦胚粉	5.70	蛋白	6.32
燕麦	5.83	肉类和鱼类	6.25
大麦、黑麦粉	5.83	动物明胶	5.55
小米	6.31	乳及乳制品	6.38
玉米	6.25	酪蛋白	6.40
大米及米粉	5.95	人乳	6.37
巴西果	5.46	大豆（黄）	5.71
花生	5.46	其它豆类	6.25
杏仁	5.18	其它食品	6.25

部分食物中蛋白质的真消化率 （%）

食物名称	真消化率	食物名称	真消化率
酪蛋白	99	肉、鱼	94
鸡蛋	97	大豆	78
牛肉	98	大豆分离蛋白	95
牛奶、奶酪	95	花生	94
全麦	91	小麦	93

碳水化合物

- 糖、寡糖、多糖总和
- 可利用糖+不可利用糖
  - 可利用糖=糖+淀粉/糖原
  - 不可利用糖=膳食纤维
- 计算方法
  - 减法=100-水分-灰分-蛋白质-脂肪
  - 加法

未知成分？

各国碳水化合物的计算方法

国别	方法	计算公式
美、日、韩、泰、菲	减差法	碳水化合物＝100 —（水分＋蛋白质＋脂肪＋灰分）
越、中	减差法	碳水化合物＝100 —（水分＋蛋白质＋脂肪＋灰分＋膳食纤维）
德国	加法	单糖、寡糖、多糖等之和。（多用）
	减差法	碳水化合物＝100 —（水分＋蛋白质＋脂肪＋灰分＋膳食纤维+有机酸）
意大利	加法	单糖、寡糖、多糖等之和。（多用）
	减差法	碳水化合物＝100 —（水分＋蛋白质＋脂肪＋灰分）
英、新	加法	淀粉+ 糖

碳水化合物分类

类别（DP）	组 成	分子形式
	单糖	葡萄糖、果糖、半乳糖
糖	双糖	蔗糖、乳糖、麦芽糖
DP1-2	糖醇	山梨醇、甘露醇
寡糖	麦芽低聚糖	麦芽糊精
DP 3~9	其他低聚糖	低聚果糖
多糖	淀 粉	直链，支链，改性淀粉
DP≥10	NSP	纤维、半纤维，果 胶

提出者和 或年份	事件或定义内容
Hipsley 1953	第一次提出"膳食纤维"，最初指纤维素、半纤维素和木质素等不消化的植物细胞壁成分[1]。
Trowell 等1972	人消化酶不能消化的植物细胞壁残余物[2]
Englyst 等1982	膳食纤维应定义为非淀粉多糖[3]
Cummings 1981	从化学角度将DF定义为：非淀粉多糖和木质素[4]
1994	纤维指在人类上消化道中消化酶不能将其降解为可吸收物质的低聚糖、多糖及其衍水衍生物，包括木质素[5]
Asp 1995	建议在营养标签中采用如下的膳食纤维的定义：DF 指那些用标准方法（如用酶—重量法）分析得到的不消化碳水化合物，以及满足如下标准的物质。 一次入类小肠中不能消化 一具有一种或几种DF 所具有的典型生理作用 一能够在未知食物中用同单合理的方法分析[6]
2001 美国	总纤维的定义：总纤维是添加纤维和膳食纤维之和。1）DF 指来源于植物的内源性不消化碳水化合物和木质素；2）添加纤维（后来称为功能性纤维）指那些经过分离的对人生理有益的不消化碳水化合物[7]
AACC 2001年	生理学定义：DF是具有抗消化特性且在小肠中不能消化的碳水化合物或其类似物。DF包括一部分不能消化的多糖、低聚糖，以及其它植物综合物。DF在生理方面对人有益处，降低血中的胆固醇和葡萄糖等健康作用[8]
食品法典委员会 2004	膳食纤维指小肠内不能消化吸收，聚合度不小于3[或10]的碳水化合物聚合物。膳食纤维应该至少具有以下特点之一： • 天然存在于所消费食物中的可食用的碳水化合物聚合物。 • 可以由食物原料中经物理、酶或化学法获得的碳水化合物聚合物。 膳食纤维通常应具有以下特性： • 降低通过时间和增加粪便量 • 促进肠道发酵作用 • 降低血总胆固醇和或LDL胆固醇水平 • 降低餐后血糖和或胰岛素水平[9]

膳食纤维

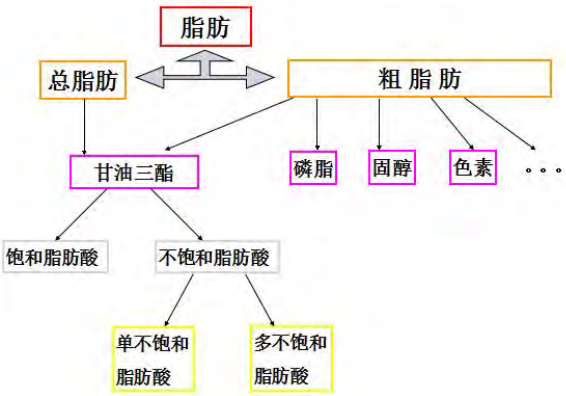
- 健康人小肠内不消化的碳水化合物（生理）
- 低聚糖、非淀粉多糖、抗性淀粉（结构？）
- 可溶性、不溶性

- 测定方法
  - 洗涤剂法（不溶性）：SIO2
  - 酶重量法：排除低分子质量可溶性
  - 酶重量法+化学法：解决单体成分
  - 改良酶重量法

与酶重量法的关系：交叉、包含、无关

脂肪

- 脂肪酸的表达
  - 百分法
  - 单体脂肪酸 %总脂肪酸
- 分析方法
  - 归一化法
  - 直接测定法
- 转化因子
  - 各国应用不一致
  - 数据有限
  - 混合油如何应用？



关键因子的建立提高数据可靠性/可扩展性

包括：
- —能量
- —蛋白质
- —脂肪酸
- —维生素A
- —维生素E
- —叶酸
- —Na等
- 共计60余个换算系数。

脂肪酸转化因子

野茶油	0.951	角油	0.888
茶油	0.949	大麻油	0.872
山茶油	0.931	香油	0.869
纯橄榄油	0.959	大蒜油	0.892
特级纯橄榄油	0.928	生姜油	0.915
初榨橄榄油	0.967	茴香油	0.903
亚麻籽油	0.906	花椒油	0.909
红花籽油	0.950	椒油	0.900
红花籽食用油	0.958	芥末油	0.895
大豆油	0.969	京荠油	0.923

能量

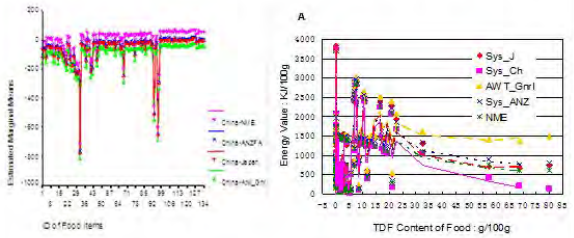
- 燃烧能
- 代谢能
- 净代谢能

食物能量系数系统的计算公式

能量系数系统	计算公式
阿特沃特氏通用食物能量系数	$ME_{atwater}$=protein×17kJ/g+fat×37kJ/g+TC×17kJ/g +alcohol×29kJ/g
食物特异能量系数系统	$ME_{specific}$ = protein$_1$×f_{pro1}+fat$_1$×f_{fat1}+TC$_1$×f_{TC1}+…… +protein$_n$×$f_{pro\ n}$+fat$_n$×$f_{fat\ n}$+TC$_n$×$f_{TC\ n}$+alcohol×29kJ/g
欧式通用能量系数系统	ME_{Europe} = protein×17kJ/g+fat×37kJ/g+AC×16kJ/g +alcohol×29kJ/g
改进的代谢能为基础的能量系数系统	ME_{Europe} = protein×17kJ/g+fat×37kJ/g+AC×16kJ/g +DF×8kJ/g+alcohol×29kJ/g
净代谢能为基础的能量系数系统	NME=protein × 13.3kJ/g + fat × 36.6kJ/g + AC × 16.7kJ/g + DF×6.2kJ/g+alcohol×26kJ/g

食物的代谢能

- 利用稳定同位素技术揭示膳食纤维与能量关系



五种能量系数系统对食物能量值的影响

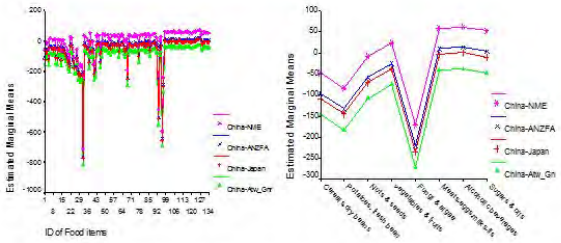
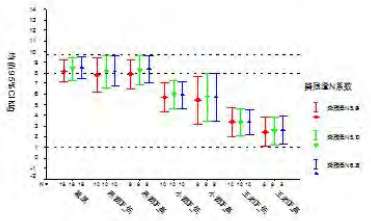


图4 不同能量换算系统与中国采用系统能量值绝对差的修正均数图

阿特氏能量系数倾向于给予食物最高的能量值，食物特异系数系统和改进的代谢能系统可获得适中的能量值，而欧式通用系数和净代谢能系统给予食物最低水平的能量值。我国采用通用系数获得的食物能量值分别比其他系统获得能量值低7~36%。

利用人体代谢实验观察膳食纤维的能量赋值



- 32天
- 不同种类、剂量DF

蔬菜、燕麦纤维、小麦麸皮纤维和玉米麸皮纤维的能量系数分别为 8.4 kJ/g、8.2 kJ/g、5.8和3.0 kJ/g。混合膳食纤维能量值平均为 6.7 kJ/g

蔬菜、燕麦纤维和玉米纤维的消化能系数、即代谢能系数

能量换算系数kcal(kJ)

- 蛋白质 4 (17)
- 脂肪 9 (37)
- 碳水化合物 4(17)
  - 膳食纤维 2 (8)
- 有机酸 3 (13)
- 乙醇 7 (29)
- 糖醇 2 (8)

维生素及其衍生物换算关系

- 视黄醇当量：
  - 维生素A、胡萝卜素、类胡萝卜素
- α-生育酚：α,β,δ,γ
- 叶酸当量：
  - 叶酸、叶酸盐、活性叶酸
- 烟酸当量：
  - 烟酸、烟酸当量

一个食物成分数据背后的故事

- 数据是怎么来的？
  -
  -
  - 怎么测的
  - 怎么表达的

tagname

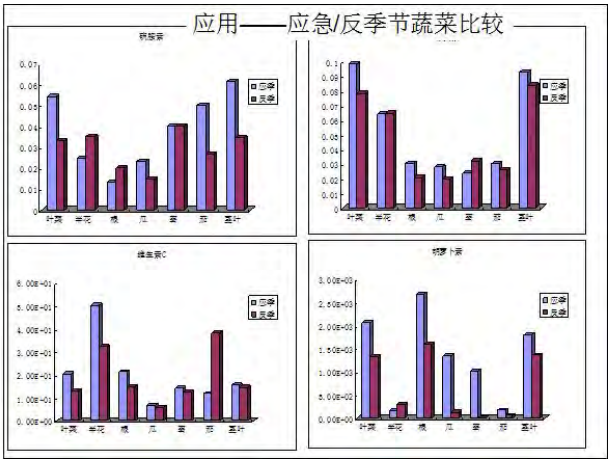
- 一种食物成分的表达与分析方法、表达方法有关

营养成分	tagname	表达单位	备注
能量	ENERC	kJ	计算法：能量=Σ（各供能营养素×相应的能量折算系数）。
	ENERC<unit:kcal>	kcal	
水分	WATER	g	—
蛋白质	PROT	g	凯氏定氮法：蛋白质=总氮×蛋白质折算系数
	PRO-	g	检测方法未知
脂肪	FAT	g	—
碳水化合物	CHOCDF	g	减法：包括膳食纤维
	CHOCSM	g	加法：包括糖类、淀粉、低聚糖和膳食纤维
	CHO-	g	检测方法未知
	CHOAVLDF	g	减法：不包括膳食纤维

对结果判断的要求

- 数据代表性
- 误差来源分析
- 不确定度扩展度

应用——应急/反季节蔬菜比较



应用——中VE的测定

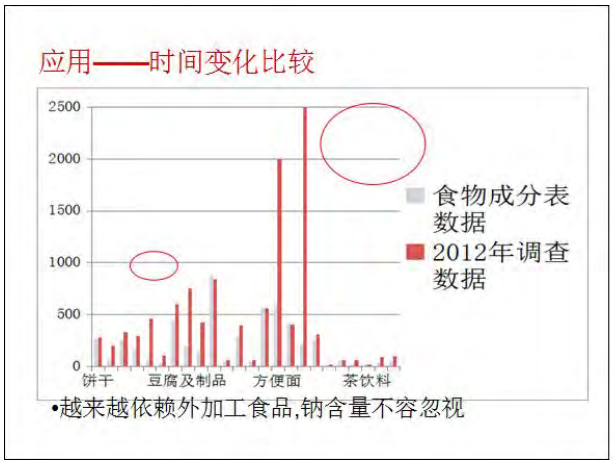
Table 3 The contents of tocopherols in edible vegetable oils (mg/kg)

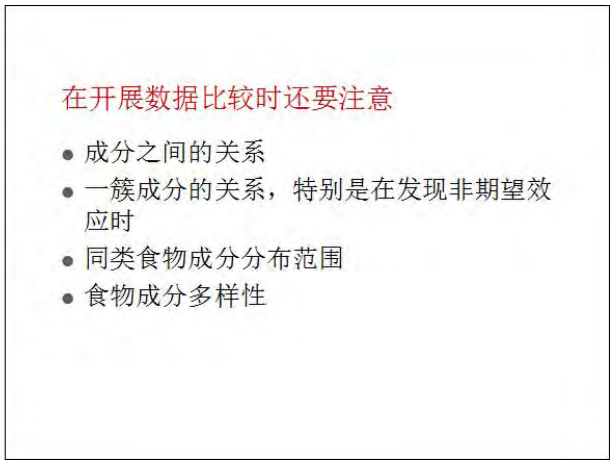
Edible vegetable oil	Item	Contents of tocopherols (mg/kg) α- Tocopherol	β- Tocopherol	γ- Tocopherol	δ- Tocopherol	Total content	α-TE	Content (mg/30g oil)
Soybean oil (n=20)	Average	86	18	624	220	949	160	4.8
	STDEV	16	6	94	32	124	29	0.9
	Max	106	40	781	296	1154	207	6.2
	Min	61	12	368	164	606	105	3.2
Rapeseed oil(n=16)	Average	139	6	393	23	538	182	5.4
	STDEV	44	8	110	27	147	59	1.8
	Max	203	37	534	122	887	276	8.3
	Min	51	2	275	11	163	80	2.4
Blend oil (n=33)	Average	103	15	576	180	875	170	5.1
	STDEV	35	6	119	79	173	51	1.5
	Max	202	30	802	301	1219	300	9.0
	Min	63	0	360	0	548	99	3.0
Peanut oil (n=4)	Average	150	22	247	11	430	186	5.6
	STDEV	43	20	262	3	260	79	2.4
	Max	190	48	639	15	810	278	8.3
	Min	89	6	90	8	222	101	3.0
Sunflower oil (n=6)	Average	362	18	19	2	401	373	11.2
	STDEV	30	16	18	4	36	37	1.1
	Max	407	37	45	9	446	430	12.9
	Min	324	12	6	0	358	331	9.9
Camellia seed oil (n=14)	Average	186	7	7	2	201	190	5.7
	STDEV	126	5	4	3	133	129	3.9
	Max	448	16	15	10	466	458	13.7
	Min	83	1	2	0	88	84	2.5

- 大豆油（94.9mg/100g）、菜籽油、玉米胚芽油γ-生育酚为主
- 葵花油（56.4mg/100gm TE）、花生油、山茶油、**橄榄油(10.2mg/100g)**、棕榈油、米糠油α-生育酚为主
- 从膳食油中摄入VE 2.5～11.2mg，可占VE推荐摄入量的17～78%

应用——含量水平比较

	华南（n=72）	西南(n=63)	华中(n=146)	华东(n=69)
蛋白质(g/100g)	6.4±0.71	7.0±0.70	7.3±0.58	7.2±0.95
钙(mg/100g)	6.9±12.0	6.2±2.73	7.4±6.91	7.2±6.68
铜(mg/100g)	0.22±0.08	0.13±0.05	0.23±0.06	0.28±0.08
锰(mg/100g)	0.96±0.27	0.86±0.19	1.20±0.28	1.13±0.34
锌(mg/100g)	1.65±0.29	1.31±0.20	1.45±0.19	1.59±0.26

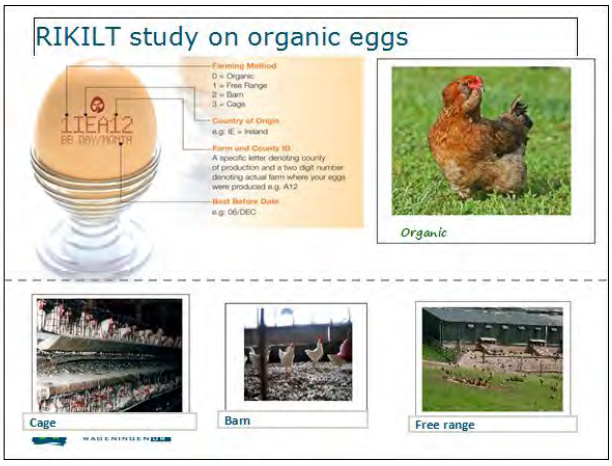




内农大食品安全系实验室为完成内蒙古地区特色食物营养成分数据库课题，对所采肉样进行液氮粉碎处理

食品安全系实验室为完成内蒙古地区特色食物营养成分数据库课题采集的部分乳样（2014 年 9 月-2015 年 4 月）

9 月 8 日下午 2:30，Yannick 博士介绍了化学计量学技术在鉴别造假或不同类别食品等方面的应用。以鉴别有机/非有机鸡蛋方法为例，从样品的采集、处理到检测和数据分析都做了详细的阐述；之后简单介绍了利用牛乳脂肪酸判别饲养方式、有机/普通小麦以及不同类别咖啡的鉴别方法。

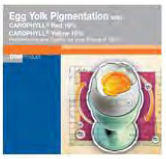


Instrumental method based on yellow pigments: carotenoids

Carotenoids

- Natural carotenoids
  - Lutein
  - Zeaxanthin

- Feed additives
  - Canthaxanthin
  - Apocarotenoic ester
  - Citranaxanthin



Instrumental, fingerprint method for egg authentication

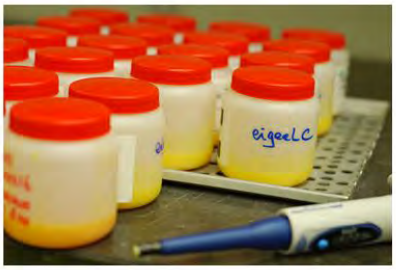
Farms in the Netherlands, balanced for location and farm size:

- 24 organic farms
- 26 conventional farms: 12 free-range, 12 barn farms, 2 w-3 barn farms

Analyses:

- Carotenoid profiling
- Fatty acid profiling
- Isotope ratio analysis, NZ national isotope centre

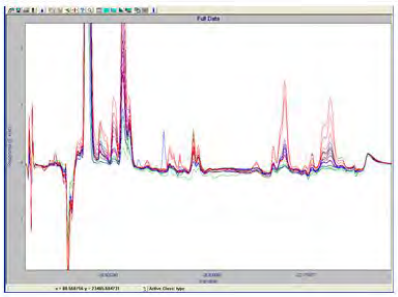
~750 eggs



~200 pooled samples

~250 samples to be analysed

Chromatographic analysis of carotenoid pigments

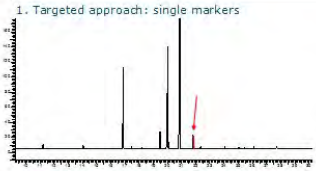


Lots of data

Raw results

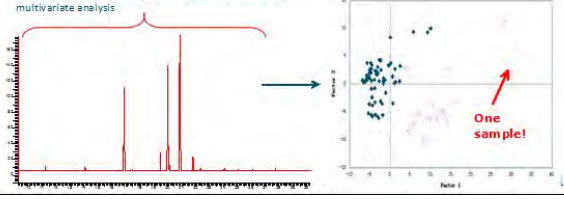
Two approaches to chemically verify production systems

1. Targeted approach: single markers

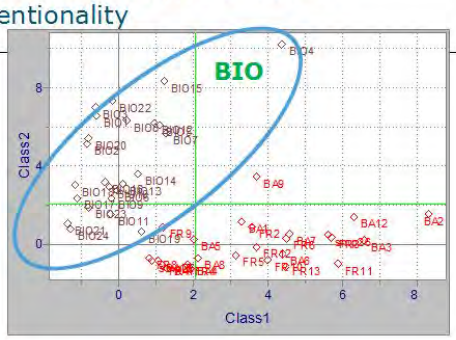


- Protein content of milk
- Moisture/protein content of meat
- Methylglyoxal in Manuka honey

2. Multiple markers, untargeted analysis, chemometrics, multivariate analysis



Multivariate analysis to reduce dimentionality



Prediction egg identity: (KNN)

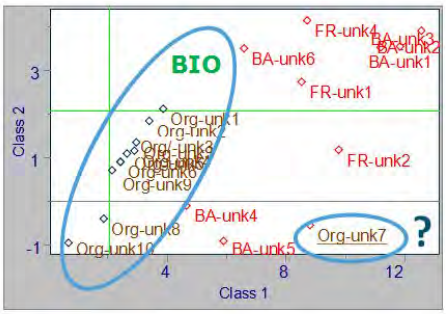
	Correct prediction	Incorrect prediction	% correctly predicted
Real organic	24	0	100
Real regular	24	2	92%

Scientific validation

- Cross-validation with training set: all organic and 24 out of 26 non-organic egg samples were correctly classified
- Validation with new eggs from 12 organic and 12 conventional farms from
  - The Netherlands
  - New Zealand

  =>All samples were correctly classified

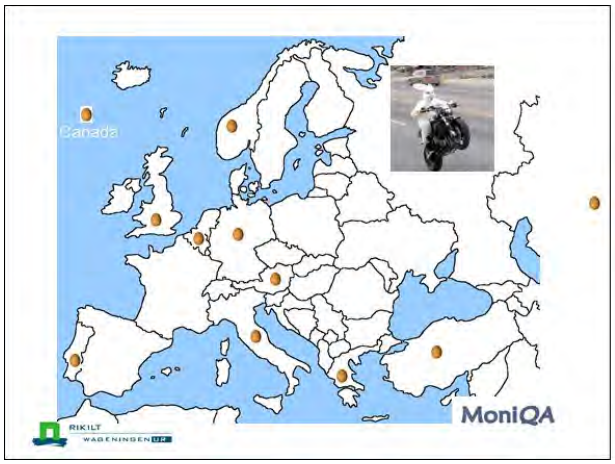
Validation with newly collected eggs



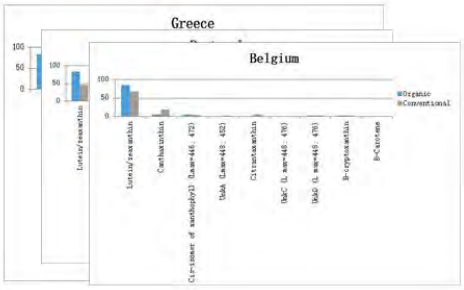
Carotenoid fingerprint method for egg authentication

- 2009: Study with farms in the Netherlands

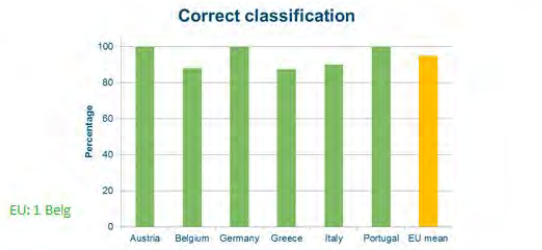
- 2010: Validation with eggs from the Netherlands and New Zealand



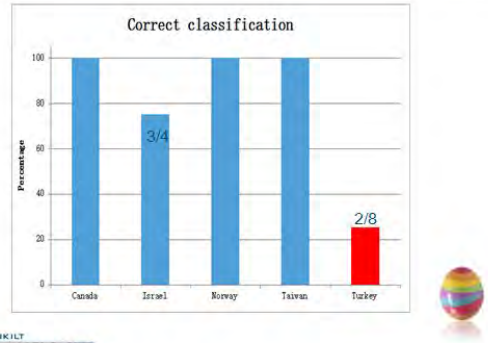
Carotenoids in eggs: EU



Organic egg classification based on model for Dutch eggs



Organic egg classification based on model for Dutch eggs



Quality Assurance and Safety of crops & foods, March 2013; 5 (1): 7-14

Wageningen Academic Publishers

Eggspectation: organic egg authentication method challenged with produce from ten different countries

S.M. van Ruth[1], A.H. Koot[1], S.E. Brouwer[1], N. Boivin[2], M. Carcea[3], C.N. Zerva[4], J.-E. Haugen[5], A. Höhl[6], D. Köroglu[7], I. Mafra[8] and S. Rom[9]

2. Meadow milk project

Authentication of pasture feeding and outdoor grazing for cows' milk by multivariate analysis of:

Fatty acids and triglycerides profile

Proteome (SELDI-TOF-MS)

FTIR spectra

Meadow milk project: sampling plan

120 cows' milk samples collected:

30 farms

4 different months: April, May, June and February

Different amount of hours spent outdoor: 0, 8 or 24 Hours

Different % fresh grass in the diet (30-100%)

Meadow milk project: update

Samples analysis and data processing:

115 samples analysed

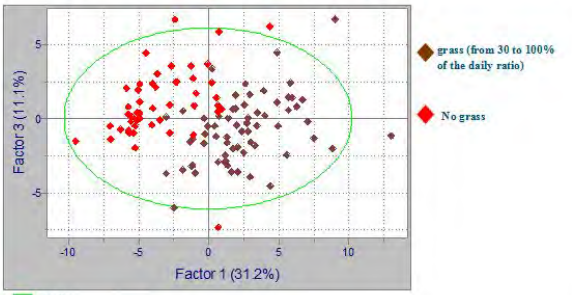
All the analysis are completed

First data processing complete for FA, SELDI-TOF and FTIR

Data processing for TG ongoing

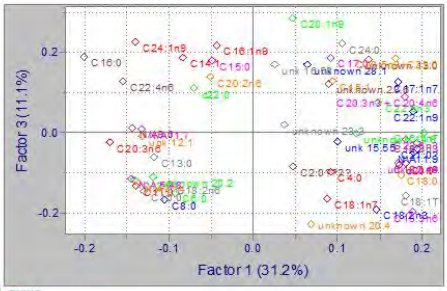
Fatty acids profile: Discrimination between grass/no grass feeding

PCA scores plot (normalized peak areas autoscaled data)



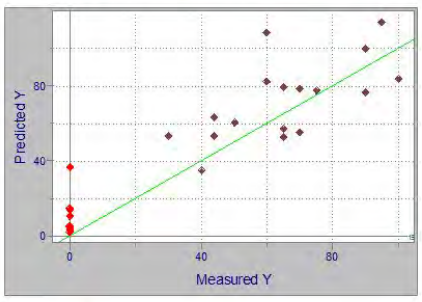
Fatty acids profile: Discrimination between grass/no grass feeding

PCA loadings plot (normalized peak areas autoscaled data)



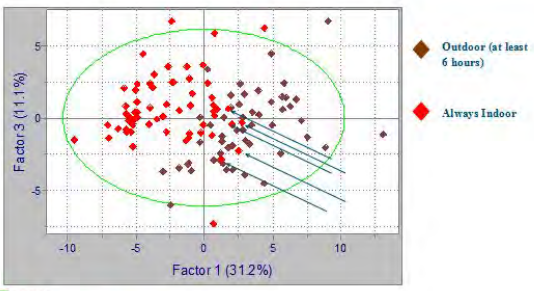
Fatty acids profile: Prediction of % grass in the diet

PCR (normalized peak areas autoscaled data)

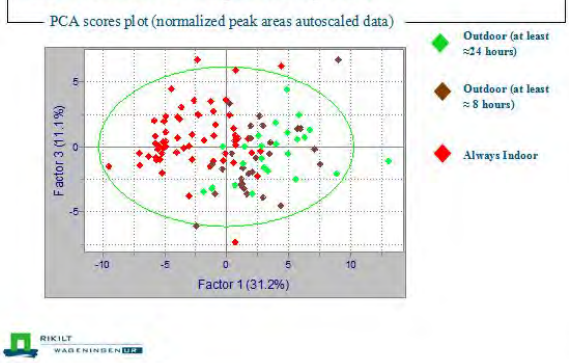


Fatty acids profile: Discrimination between outdoor/indoor management system

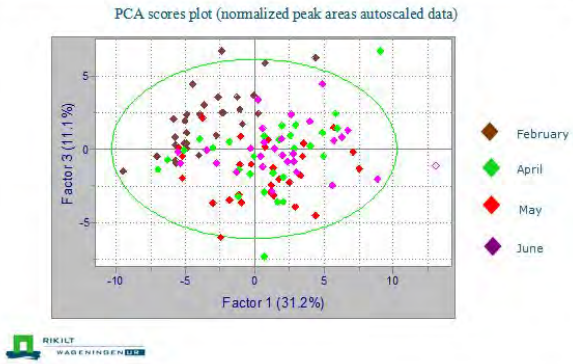
PCA scores plot (normalized peak areas autoscaled data)



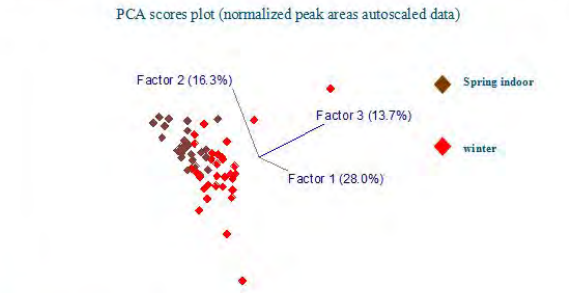
Fatty acids profile: Discrimination between outdoor/indoor management system



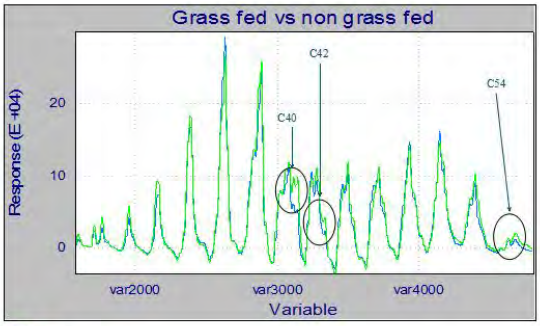
Fatty acids profile: Discrimination between months



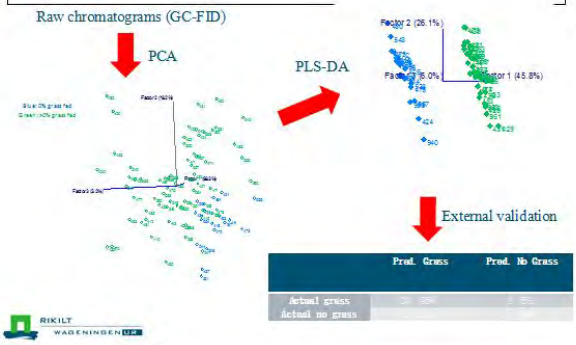
Fatty acid profile: winter versus spring indoor milk



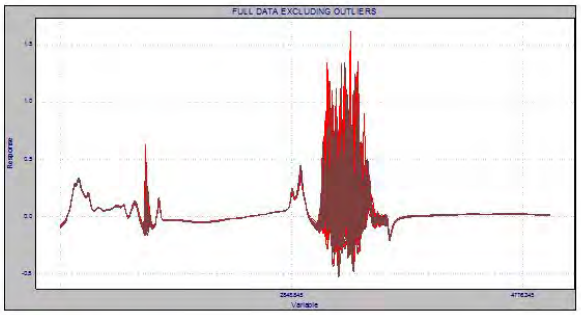
TG profile: Discrimination between grass/no grass



TG profile: Discrimination between grass/no grass feeding

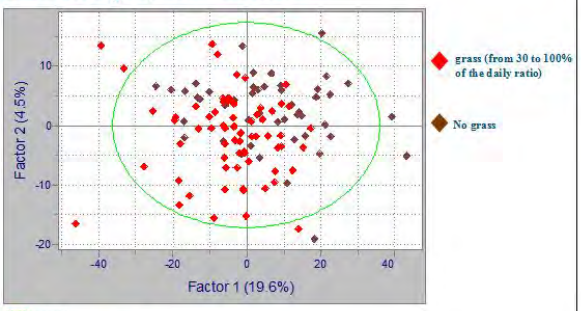


FTIR: spectra before preprocessing



FTIR: Discrimination between grass/ no grass feeding

PCA scores plot, autoscaled data



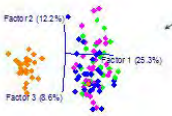
FTIR: PLS-DA Model

	Pred. No grass	Pred. Grass	Pred. No match
Internal validation			
No grass	35	0	0
Grass	0	50	0
External validation			
No grass	12	0	0
Grass	1	16	0

SELDI-TOF

February samples

Spring samples



PCA models created for

- each "chip" (CM10, H50 and IMAC)
- both raw data and normalized data (total ion current).

Conclusions

- Prediction of grass feeding (Y/N) is possible with good success rate by FA, TG and FTIR
- Prediction of % grass fed rather inaccurate
- Prediction of outdoor grazing (and "meadow" nature) more problematic
- At the moment, little information in proteomic data

3. Is it possible to chemically prove if wheat was organically produced or conventionally?

Sample overview – Danish origin

Locations	Growing year	Growing systems	Repetition
Flakkebjerg	2007 - 2008	Conventional, Organic A Organic B	1 – 2
Foulum	2007 - 2008	Conventional, Organic A Organic B	1 – 2
Jyndevad	2007 - 2008	Conventional, Organic A Organic B	1 – 2

- 3 Locations
- 2 growing years
- 3 growing systems
- 2 repetitions
  = 36 samples

Locations in Denmark

Two analytical techniques were explored

1. Liquid chromatography with UV-Vis detector (LC-DAD)
   - Phytonutrient extracts: small phenolic compounds
     - *e.g.* gallic, ferulic, syringic, *p*-coumaric, caffeic, vanillic acids
   - Matrix bound and unbound extracted
   - Detection at 280 and 320 nm
   - Destructive technique, labour intensive
2. Proton reaction transfer mass spectrometry (PTR-MS)
   - Headspace volatiles
   - Full scan mass range obtained (26 to 160 amu)
   - Non-destructive, fast

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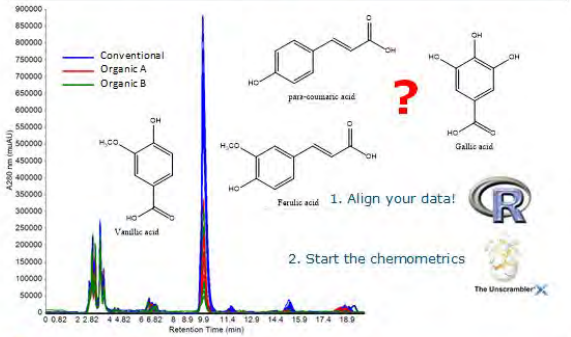
50

1. Liquid chromatography – phenolics 280 nm



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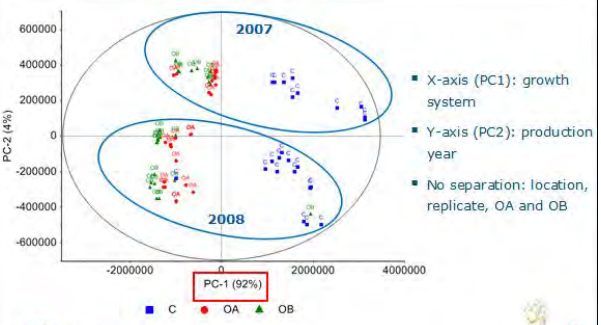
Column: Zorbax 300Extend-C18 4.6x250mm 5µm; Precolumn: UChrosorb C18 4.6x7.5mm 5µm

51

Principal component analysis indicates almost perfect C vs OA/OB separation in PC1



- X-axis (PC1): growth system
- Y-axis (PC2): production year
- No separation: location, replicate, OA and OB

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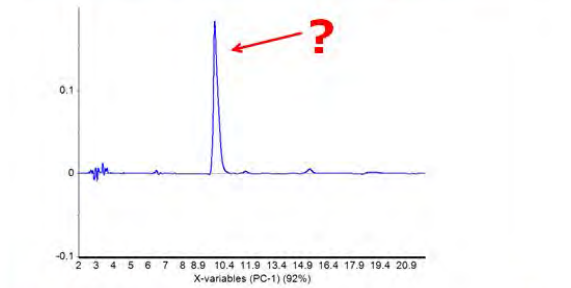
52

PC1 almost exclusively depends on one compound as shown in loadings plot



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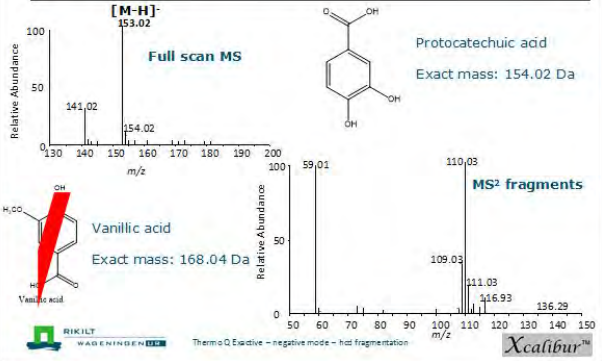
53

Mass spectrometry indicates protocatechuic acid as the single marker compound



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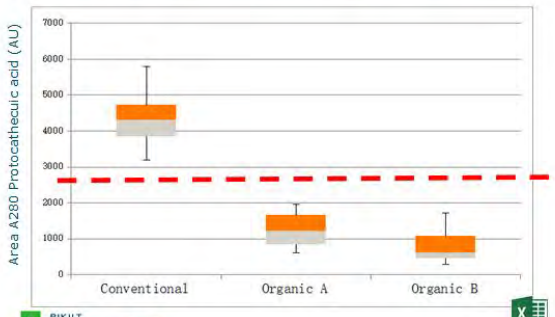
Thermo Q Exactive – negative mode – hcd fragmentation

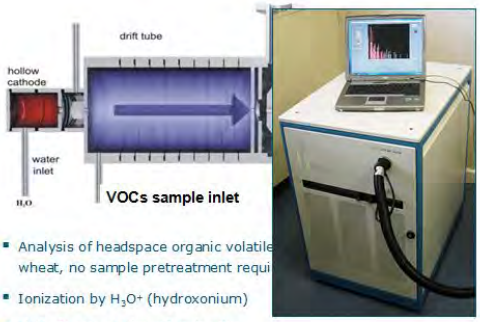
Xcalibur™

Protocathechuic acid levels differ enough to use it as a potential single marker



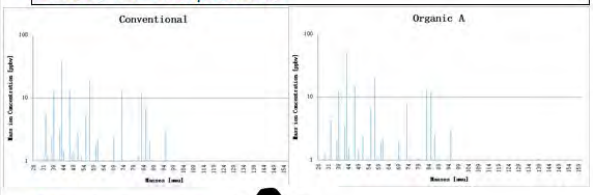
55

2. Proton transfer reaction mass spectrometry (PTR-MS)



- Analysis of headspace organic volatile
  wheat, no sample pretreatment requi
- Ionization by H_3O^+ (hydroxonium)
- Little fragmentation of molecules

PTR-MS data contains lots of information, but is very difficult for interpretation

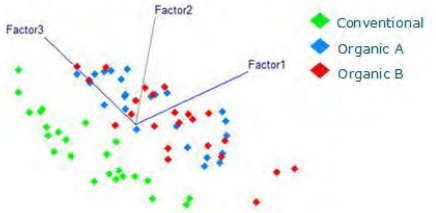


- How do you compare a matrix of 36 x 135 subsets?
- Counting by hand?

Back to chemometrics!

57

Differences between C and O were best resolved with a PLS-DA algorithm



- Alternative to PCA: Partial least squares discriminant analysis (PLS-DA)
- Other working alternatives: neural networks and pareco/10log PLS-DA

Autoscale PLS-DA, m/z 32, 33 (MeOH), 37 omitted, 1 sample extreme outlier, CCR = 100%

Conclusions

- **LC-DAD**
  - Protocatechuic acid was tentatively identified as a potential single marker for distinguishing O from C produce
  - Very unique case that a single marker can distinguish O from C produce
- **PTR-MS**
  - Potential alternative as a fast and non-destructive method
  - May be used on-site in the future

Almost Diner time!

Prospectus

- Expansion of the database
  - Confirm results with conventional and organic produced wheat grown in other countries
- On-site determination of single markers?
  - Portable spectoscopic equipment:
  - Colour reaction:

Just a bit!

Is it possible to chemically prove the speciality production of coffees?

	Fair trade certified	Not certified fair trade	Total number of samples
Organic certified	20	23	43
Not certified organic	34	33	67
Total number of samples	54	56	110

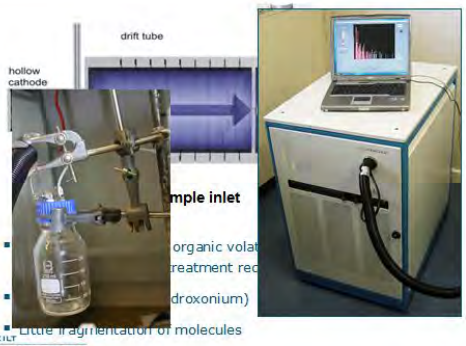
1. Origin:
   - South America (26)
   - Central America (12)
   - Africa (16)
   - Asia (7)
   - Mixture of origins (49)

2. Type
   - Espresso
   - Regular
   - Kopi Luwak

Certified by Max Havelaar, UTZ or Rainforest Alliance

61

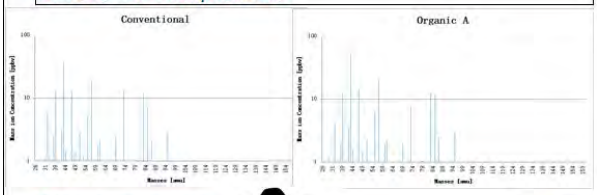
Proton transfer reaction mass spectrometry (PTR-MS) (2)



mple inlet

- organic volat
  reatment rec
  droxonium)
- Little if agrmentation of molecules

PTR-MS data contains lots of information, but is very difficult for interpretation

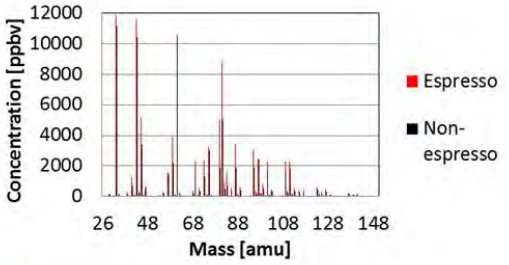


- How do you compare a matrix of 110 x 135 subsets?
- Counting by hand?

Chemometrics!

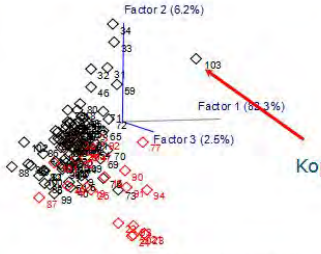
63

What is the influence on the roasting process → Espresso vs regular coffee



64

Roasting does slightly influence sample clustering in PCA analysis



Espresso

Non-espresso

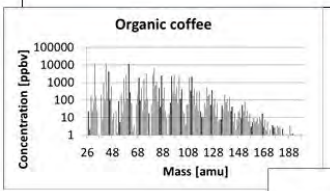
Kopi Luwak coffee

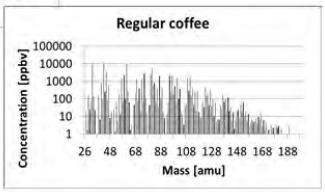
m/z 32 and 37 excluded

Non significant contribution m/z 33, 34, 35, 36, 38, 43, 44, 51, 57, 58, 61, 62, 75, 76, 77, 97

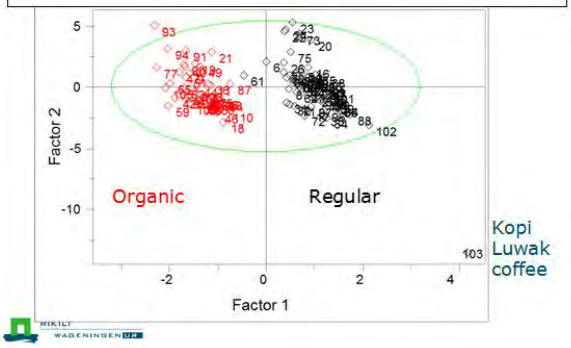
55

Do organic coffees differ enough in VOCs for discrimination from conventionally produced coffees?





PLS-DA classification separates in production system by PC1



Leave-10%-out cross validation is effective

Sample set	Prediction		
	Organic	Regular	No match
Full set			
Organic	42 (98%)	0	1 (2%)
Regular	1 (1%)	63 (95%)	3 (4%)
Single brand			
Organic	18 (100%)	0	0
Regular	0	6 (100%)	0

Conclusions

1. Large set of ground coffee samples profiled by PTR-MS
2. Characteristic profiles recorded for espresso coffees and Kopi Luwak
3. Organic coffee can be distinguished from regular counterparts by PLS-DA models

doi:10.1016/j.foodres.2013.05.013

Thank You (Coffee)!

@Rikilt:

Prof. Saskia van Ruth

Scientists:
Özgül Özdestan
Martin Alewijn

Technician:
Alex Koot

Samples:

Authentic Kopi Luwak

Ministry of Economic Affairs of the Netherlands

Autonomous Province of Trento, Italy (PAT-AP 2012)

Thank You (Wheat)!

@Rikilt:

Prof. Saskia van Ruth

Martin Alewijn
Sam Heenan
Marco Blokland
Alex Koot, Tjerk Venderink,
Rita Boerrigter-Eenling

Sample production:

Joergen E. Olesen *et al.*

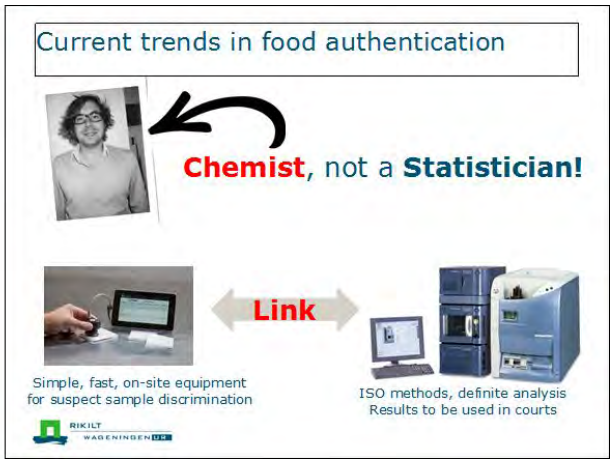
UNIVERSITY OF COPENHAGEN

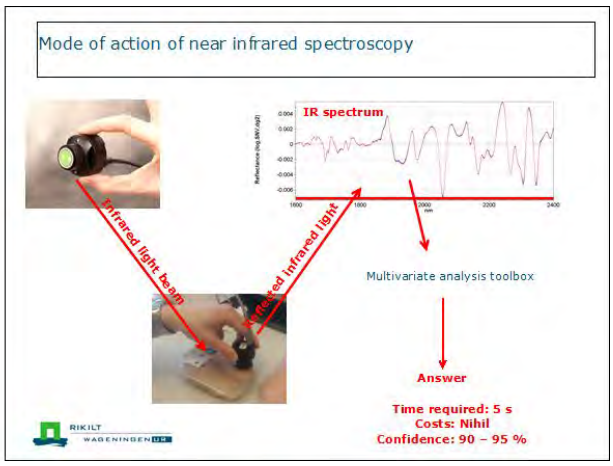
AARHUS UNIVERSITY

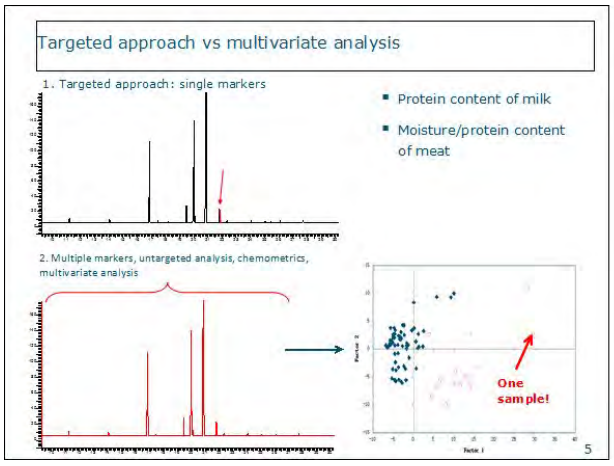
Kristian Holst Laursen
Søren Husted

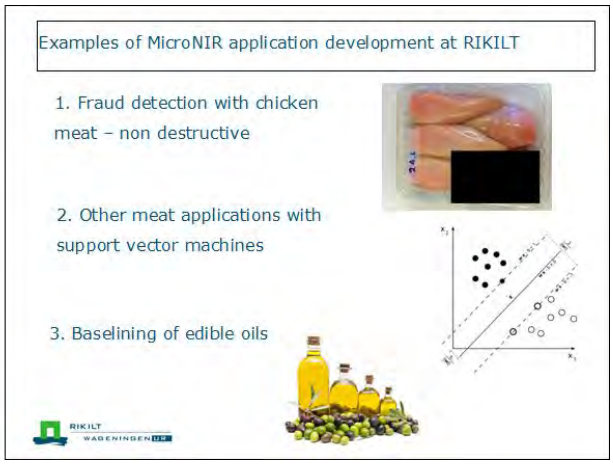
AUTHENTIC FOOD

9 月 9 日 下午 4:40-6:30，Yannick 博士为内蒙古农大食品院博、硕士生和双语教学本科生讲授化学计量学基础知识，展示了便携式光谱仪在鉴别食品中的应用，其特点为在不破坏食品包装的条件下，即可采集其光谱数据，利用化学计量学对数据进行分析处理后建立食物真假判别模型。









1. Chicken fillets – risks of increasing prices

Consumer demands animals which had a 'happier' life:

'Basic' chick	'New standard' chick	'Free range' chick	'Biological' chick
€ 5 – 7 / kg	€ 6 – 9 / kg	€ 11 – 13 / kg	€ 25 – 27 / kg

Motivation for fraud!

1. Fresh – Thawed filets ☐ Microbial risk, devaluation of product
2. Addition of foreign proteins (*e.g.* gelatin, plant proteins) and salts (NaCl,phosphates)
3. Exceeding the legal water-protein ratio

☐ Total laboratory costs for one sample: about €1000 – 1500, sample: destroyed

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Poultry meat production and import (EU28)

Country	Production 2012 (tonnes)
France	1,929,336
Germany	1,604,419
Italy	1,276,880
Netherlands	1,041,014
(non-EU)	
Hungary	444,553
Portugal	313,205
EU 28 total	13,222,369

FAO statistics

Year	Import from non-EU
2010	866,333
2013 (Jan-Aug)	559,590 (similar to 2012)

COMEXT statistics

Port of Rotterdam

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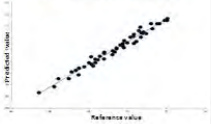
Pilot experiment – Create your own fraud samples!

1. Samples → Freezing (-24oC) for 24 h. → De-frosting for 24 h.
2. Samples

MircoNIR measurements

Chemometric analysis



3. Reference methods for:
   - Moisture content (NEN-ISO 1442:1997)
   - Protein content (NEN-ISO 937:1992)

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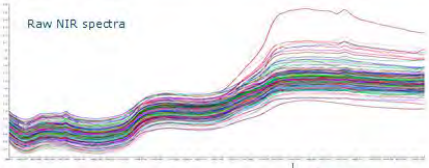
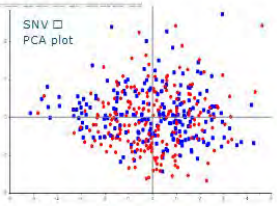
Apply classical chemometrics

Raw NIR spectra



SNV ☐
PCA plot



Very random data was obtained
Classical 'Principal component analysis' does not work!

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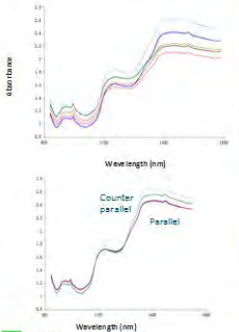
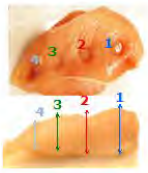
Non-destructive measurements are a direct cause for random data





- Spot-to-spot variation
- Background
- Fibre direction

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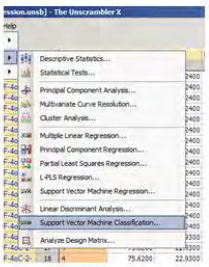
Solution: Support vector machine classification!

'New' generation self learning algorithms:



50/50 Training Validation:

Actual \ Predict.	Fresh	Injected	Thawed
Fresh	187	1	7
Injected	2	54	0
Thawed	1	0	70

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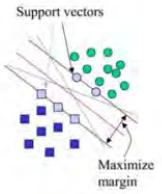
Support Vector Machine Classification

Definition:

- SVM is a pattern recognition method that is used widely in data mining applications, and provides a means of supervised classification. SVM was originally developed for the linear classification of separable data, but is applicable to nonlinear data with the use of kernel functions.

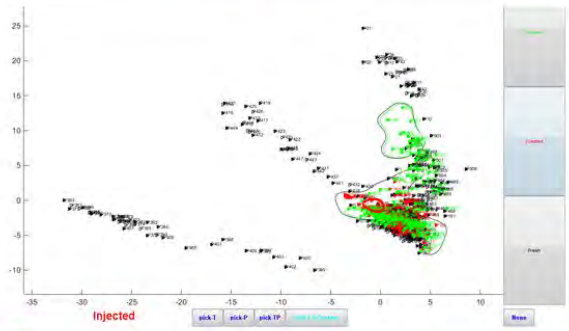
- SVMs maximize the margin around the separating hyperplane.
- The decision function is fully specified by a subset of training samples, the support vectors



JDSU

Chris Pederson, JDSU Corp.

Visualization of SVM models



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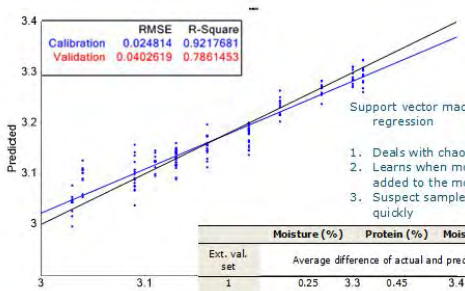
Chang Hsiung, JDSU Corp.

Self learning quantitative models



Support vector machine regression

1. Deals with chaotic data
2. Learns when more data is added to the model
3. Suspect samples are identified quickly

	Moisture (%)	Protein (%)	Moisture/Protein (-)
Ext. val. set	Average difference of actual and predicted values		
1	0.25	0.45	0.07
2	0.18	0.39	0.06
3	0.22	0.40	0.06
Average	**0.22**	**0.41**	**0.06**

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(poultry) meat authentication 2.0

Measuring trough packages for routine retail or warehouse check

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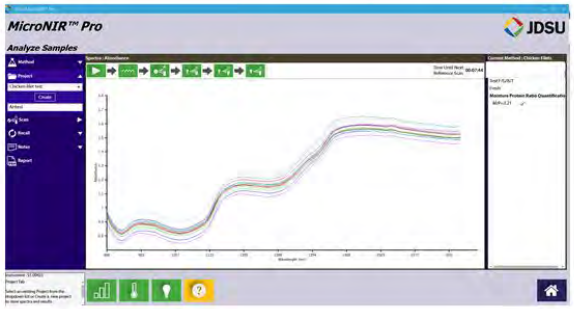
Program the models in a user friendly interface for inspectors



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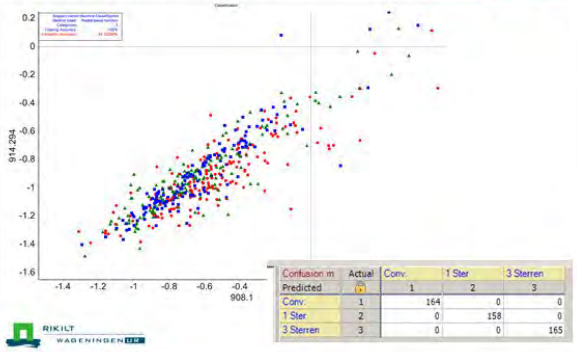
Endless possibilities with SVM... (1)
Chicken star system

Beter Leven ★★★



Confusion m	Actual	Conv.	1 Ster	3 Sterren
Predicted		1	2	3
Conv.	1	164	0	0
1 Ster	2	0	158	0
3 Sterren	3	0	0	165

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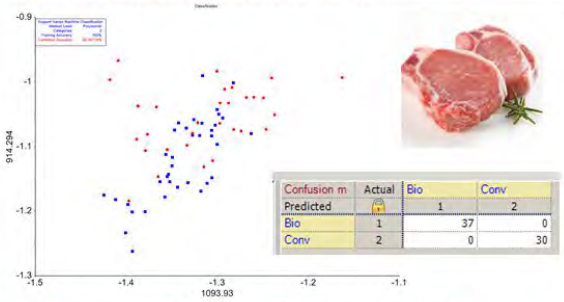
Endless possibilities with SVM... (2)
Pork steaks: Bio or not to bio?



Confusion m	Actual	Bio	Conv
Predicted		1	2
Bio	1	37	0
Conv	2	0	30

Reference method by FFA/triacylglycerideprofiling by GC-MS

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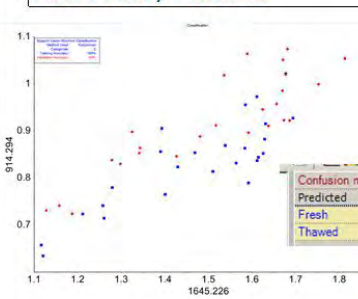
Endless possibilities with SVM... (3)
Fish Fresh/Thawed



Confusion m	Actual	Fresh	Thawed
Predicted		1	2
Fresh	1	25	0
Thawed	2	0	25

Develop and confirm results with HADH enzymatic essay

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Baselining of edible oils for fast authentication

Reference method by FFA and triacylglyceride profiling by GC-MS

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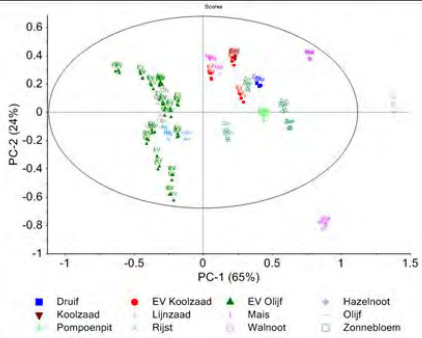
PCA analysis can group by oil type ruffly



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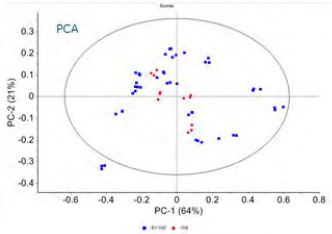
Extra vierge vs refined olive oils



Support vector machines

Confusion m	Actual	EV Olijf	Olijf
Predicted		1	2
EV Olijf	1	45	0
Olijf	2	0	12

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Measuring through bottles?

Promising MicroNIRs pilots @ RIKILT

Fish:	Freshness, freeze history
Peanut butter:	Peanut content (%)
Oils	Identity: olive (extra vierge, refined, rape seed, sunflower, etc.)
Milkpowder:	(Low value) additives (maltodextrin, starch, proteir tes, whey proteins). Nitrogen enhancers: Melamin
Honey:	Monofloral variety
Bananas:	Determination of ripening age
General:	Macrocomponents (light-status, indication nutritional value, alcohol levels etc.)






*...**many** many many applications not tried so far...*

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Other handheld, portable spectroscopic techniques (1)

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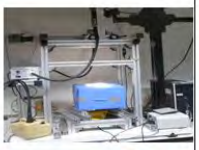
Other handheld, portable spectroscopic techniques (2)

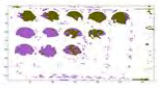
Handheld-hyperspectral camera – expected@ RIKILT in 2015

- Visual of NIR
- hot-spots, additions, mixtures

Examples @ RIKILT:

- Milk powder (find additives)
- Saffron (fake/genuine/mixtures)
- Beef steak (biological/conventional)





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Thank you for your attention!

Questions?

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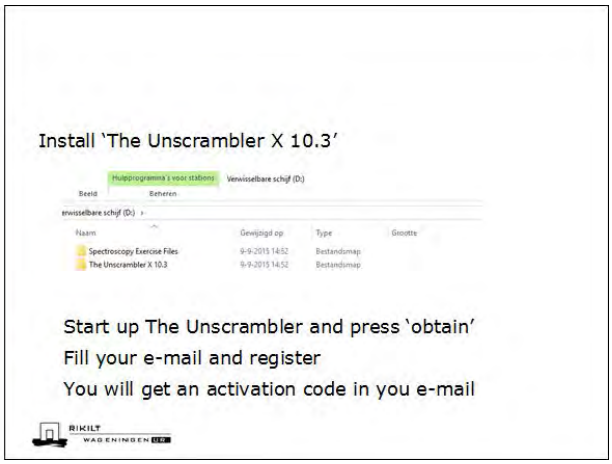
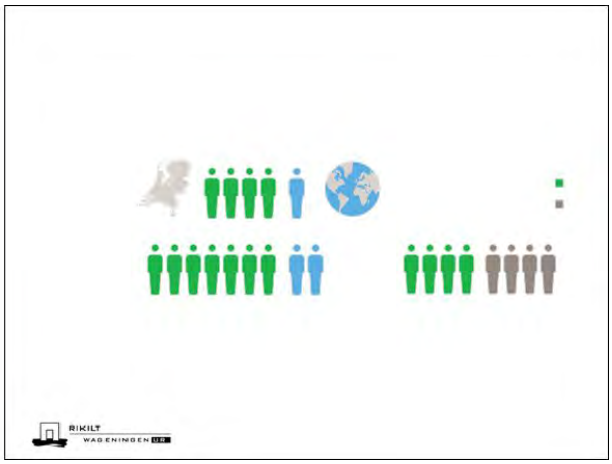
2015 International Lectures on Food Authenticity and Nutrients

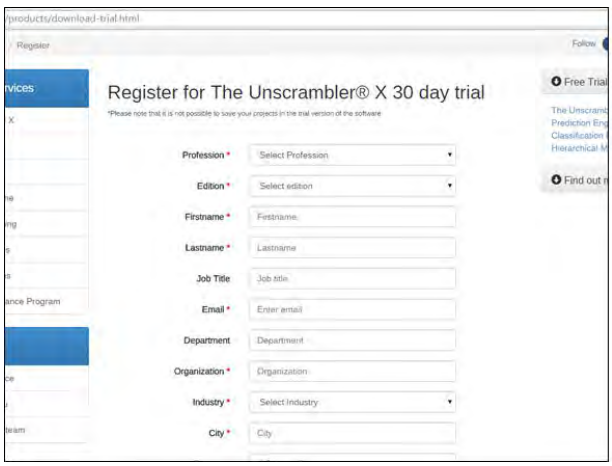
营养与食品安全国际讲坛:食物真实性与营养素安全

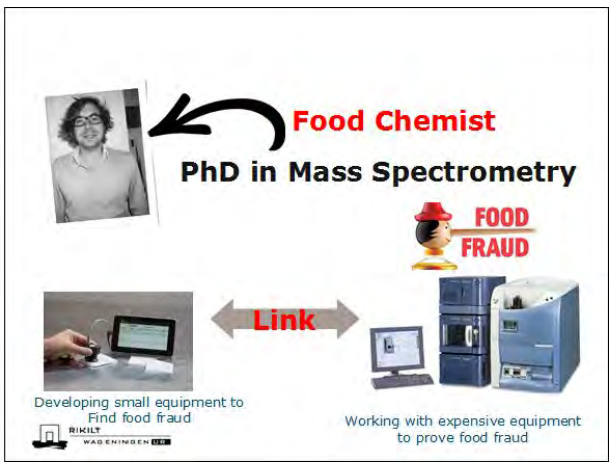
9 月 9 日晚至 10 日，Yannick 博士为同学们展示了 Unscrambler 软件，并进行了试用版的互动学习。以橄榄油、玉米油、红花油光谱扫描数据为例，详细地演示了数据的建立、前处理和 PCA、 PLS-DA 等分析方法的操作；有趣地利用游戏“Duck Hunt”引出近红外光谱技术(NIR)，他表示 NIR 不仅能开发游戏或遥控电视机……，还可以分析食物成分、鉴别食物真假！

9 月 11 日上午，集中介绍了对光谱数据处理的一种化学计量学方法-支持向量机（Support Vector Machine，SVM）。当光谱数据出现基线漂移或峰位移动时，用 PCA 等方法无法完成食品鉴别模型的建立，此时应使用 SVM 对数据进行处理分析，并建立判别模型。Yannick 博士通过实例演示了 SVM 对数据的处理过程、软件操作步骤及注意事项。









Food fraud: EU conference confronts the growing problem of food crime

Cri
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By Ro

Organ
traffic
are so

Food-related crime: EU Commissioner John Dalli described it as «one of the most important challenges»

A lack of reliable global data means it is difficult to estimate the true extent of food crime, but the figures that do exist point to a significant increase in the number of confirmed cases each year. In the EU alone, they went up by 26% between 2007 and 2008.

The conference also followed «Operation Opson», an investigation into food crime led by *Europol* at the end of 2011 which

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NIEUWS
NEDERLAND

Mogelijk Spaans hondenvlees verwerkt in gehaktballen

door Shari Deira 4 apr 2013

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McDonalds

LIFEHUNTERS

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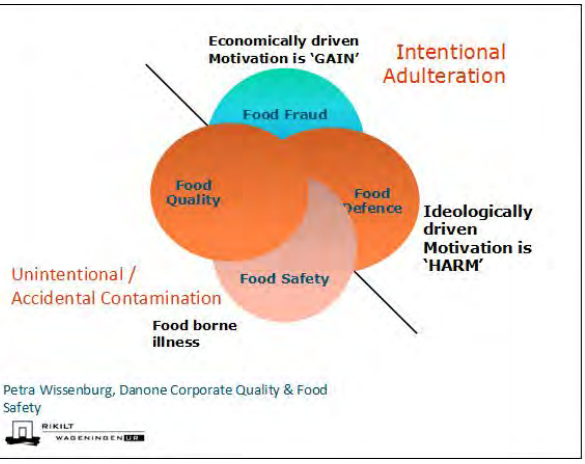

Petra Wissenburg, Danone Corporate Quality & Food Safety

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Characteristics food fraud

- Substitution/addition of food, food ingredients or feed constituents
- Deliberate, on purpose
- For economic gain
- May result in serious economic losses, image damage, stakeholders confidence, and food safety issues

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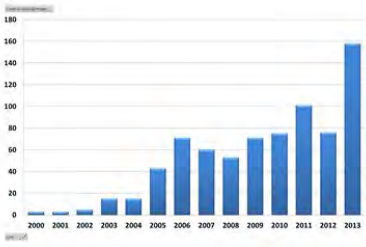
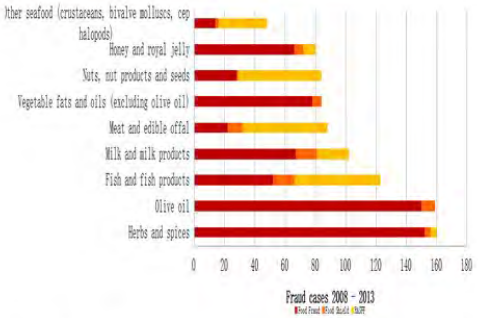
Food fraud databases

Food Fraud: RASFF



Food fraud notifications of RASFF system (2000 to 2013).

Fraud reports in three databases



Food Security: enough on our plates?

Food security is not just a problem for the poor. It will become, increasingly, a problem for everybody

Editorial
The Guardian, Sunday 7 April 2013 21.30

July 16, 2013 at 11:00 AM

America's Organic Food Shortage

With Jane Clayson in for Tom Ashbrook.

Farmers across the country are struggling to keep up with the high demand for organic food. Will we have to go abroad to feed our appetite ?

Retail demands shape global food market

Price is the main governing feature

Food and ingredients are sourced world-wide

Extensive, fragile, vulnerable food supply chain

Control systems are nowadays primarily aiming at food safety

Food authenticity and integrity has received less attention in the last decade

However, recently there is much more concern nowadays.

Reg 882/2004 revised and includes fraud nowadays

Official Controls along the food chain:
Regulation (EC) No 882/2004

Entered into force in 2006.

Provides for a set of ru
to:

- **prevent, eliminat humans, animals the food chain, e environment**
- guarantee fair prac **feed and the prol**

Food Fraud
Article 111
Coordinated control plans and information and data collection

Food Fraud
Article 8(2)
General rules on official controls

Competent authorities shall perform official controls on a regular basis and with appropriate frequency to identify possible intentional violations of the rules referred to in Article 1(2), taking into account, in addition to the criteria referred to in paragraph 1, information regarding such possible intentional violations shared through the mechanisms of administrative assistance provided for in Title IV and any other information pointing to the possibility of such violations.

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RECORD SEIZURES OF FAKE FOOD AND DRINK IN INTERPOL-EUROPOL OPERATION

16 February 2015

Thousands of tonnes of fake and sub-standard food and drink have been seized in 47 countries around the world as part of an INTERPOL-Europol coordinated operation.

Operation Opson IV, conducted during December 2014 and January 2015, resulted in the seizure of more than 2,500 tonnes of counterfeit and illicit food, including mozzarella, strawberries, eggs, cooking oil and dried fruit.

Involving police, customs, national food regulatory bodies and partners from the private sector, checks were carried out at shops, markets, airports, seaports and industrial estates.

"This year again, the results from Opson clearly reflect the threat that food fraud represents, as it affects all types of products and all regions of the world. Cooperation at national and international level is indispensable to disrupt the criminal gangs involved in this business," said Chris Vansteenkiste, head of Europol's Focal Point Copy who coordinated the activities in Europe.

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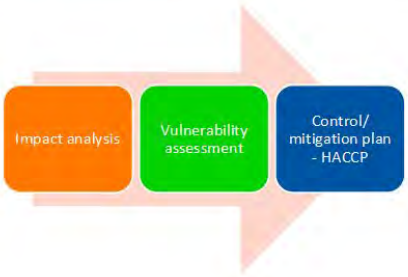
Control of fraud risks



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Vulnerability to fraud?

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Global Food Safety Initiative

- 2014 Position paper on mitigating the risk of food fraud
  - Food fraud vulnerability assessment
  - Food fraud vulnerability control plan
- SSAFE: Development of a standard for self-assessment of food fraud vulnerability

Cargill, Coca-Cola, Danone, Kellogg's, zoetis

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31

The concept

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Indicators for opportunities examples

- Complexity of adulteration products
- Availability technology and knowledge to adulterate
- Detectability fraud
- Interference/access processing lines
- Transparency chain network
- Historical evidence

Indicators for motivations examples

- Valuable ingredients/products
- Supply/demand and pricing ingredients/products
- Economic conditions
- Level of competition
- Financial strains
- Organizational structure
- Ethical business culture (incl. neutralizations)
- Victimization
- Personality traits
- Criminal offences

Indicators for controls examples

- Fraud monitoring system and verification of the system
- Information system (mass balance, track and trace)
- Ethical code of conduct
- Integrity screening of employees
- Whistle blowing
- Contractual requirements suppliers
- Social control chain network
- Legal framework and enforcement

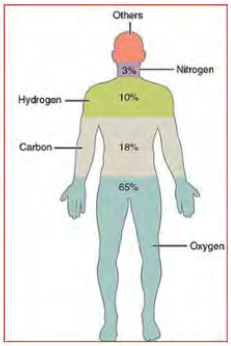
Concept tool

Control measures

Fraud control measures

Hard controls among others

- Advanced confirmatory analysis in the laboratory
- Rapid red/green light methods for on-site



Analytical techniques

- Chromatography
- Mass spectrometry
- DNA-based techniques
- Immunology
- Physical tests, e.g. DSC
- Wet chemistry
- Microscopy
- Sensor-based technologies
- Sensory analysis

Ingredients:

Fat: Milk fat replaced in butter; high value oils

Watered wine, juices, and milk

Honey with sugar

Coffee

Tea

Spices

Etc.

Used tea leaves boiled with ferrous sulphate and sheep's dung, coloured with ferric ferrocyanide, tannin or carbon black, before being resold (Accum, 1820).

Coffee adulterations: Sawdust, iron, tan, Venetian red, chicory, roast wheat, peas and beans (Atcherley, 1874).

Composition: one, some or all constituents (water, protein, fats, carbohydrates, micro-constituents)

Product history

Geographical origin (linking geology, climate to products composition)

Farming management system: organic, animal welfare considering, sustainable, halal

Processing (fresh, frozen, stored)

Melamine — China Tainted Baby Formula Scandal

Death penalty for Melamine milk scandal collaborators

Posted January 22, 2009 20:27:00

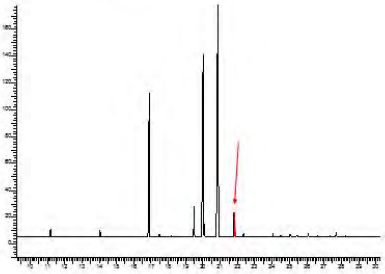
Milk

- Dilution?
- Payment: fat and protein content
- Protein and fat analysis methodology based on ancient analytical techniques
- Increase of fat content?
- Increase of protein content?
- Protein analysis based on N

N-replacer

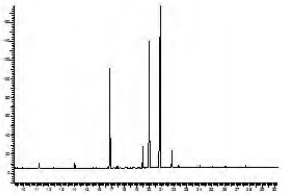
- Soy proteins: cheaper source of protein
- How to detect this type of adulteration?

Single marker approach

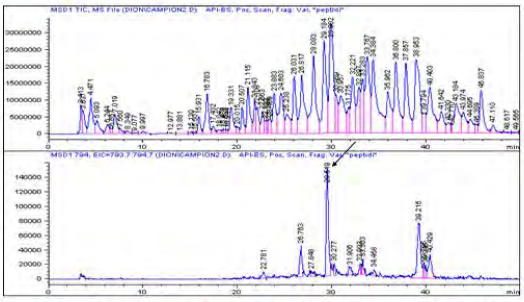


Targeted analysis examples:

- GC analysis
- LC analysis
- DNA: PCR methods
- Immuno assays
- Etc.



LC-MS Targeted: LC-MS peptide pattern of skimmed milk powder + 5% soya protein isolate



Soya peptides detected at specific retention times (Mw 794 Da at 29.5 min).
Soya peptides not present in SMP standard.

Other N-based chemicals?

- Preferably high N-content
- Soluble in water
- Fine white or colorless powder in suspension
- Odorless
- Tasteless
- Difficult to detect
- Cheap:
  waste/by-products from other industries?

Melamine and related chemicals

melamine

ammelide

ammeline

Cyanuric acid

Nylon production

- Precursors: some possess odours, not suitable
- Some are candidates

Adulterants selection

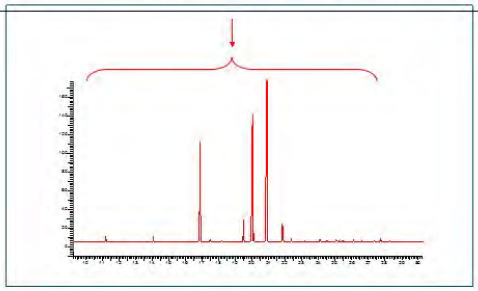
Potential adulterants

NH_4Cl,
CAPROLACTAM,
$(NH_4)_2HPO_4$,
Polyvynilpirrolidone (PVP)

Known adulterants

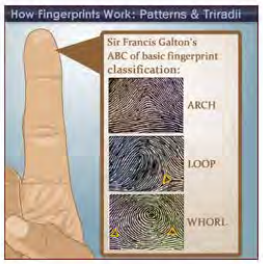
Melamine
Ammelide
Urea

Multiple markers: looking for patterns

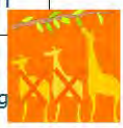


Multi marker fingerprints?

Fingerprints of target product group versus counterparts (e.g. genuine and adulterated products).



General approach



Selection of interesting marker groups

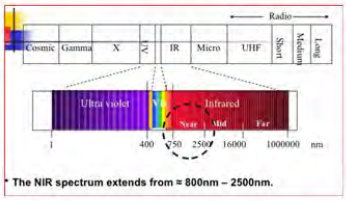
Selection of analytical techniques

Selection/optimation of statistical models

Broad anomaly testing

Near Infrared reflectance spectroscopy (NIRS)

- Is a non-destructive and rapid technique applied for food quality and authenticity evaluation
- Most widely spread use of NIRS is for the determination of certain constituents such as protein, moisture, starch, lipids, ash, oil



* The NIR spectrum extends from ≈ 800nm – 2500nm.

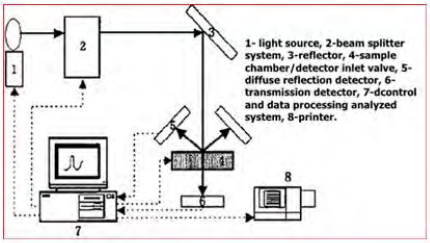
Still remember 1989? ☺

NIRS

- NIRS utilizes the spectral range 800-2500 nm, resulting in complex structural information related to the vibration behaviour of combinations of bonds.
- It concerns response of the molecular bonds O=H, C=H, C=O and N=H.
- These bonds are subject to vibrational energy changes when irradiated by NIR frequencies
- Vibration patterns include stretch vibration and bent vibration

NIRS

- When molecules vibrate, energy in the NIR region is absorbed and translated into an absorption spectrum

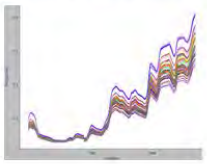


Sampling plan

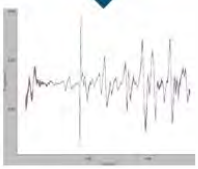
- Approx. 30 milk powder samples
- Genuine and with the various adulterants: NH_4Cl, CAPROLACTAM, $(NH_4)_2HPO_4$, Polyvynilpirrolidone (PVP), melamine, ammelide, urea
- Adulteration at 0.1, 0.5, 1.0, 2.0% levels
- 80% of samples kept for training set of the chemometric models
- 20% of samples kept for external validation of the estimated models

NIR-VIS spectroscopy

Spectra were acquired from 400 to 2500 nm in reflectance mode

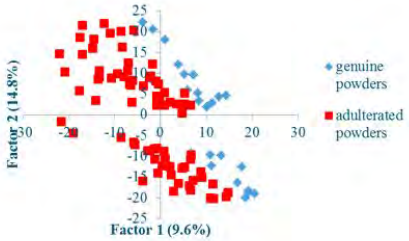


Pre-processing:
1) multiplicative scatter correction (MSC)
2) standard normal variate (SNV)
3) second derivative



RIKILT WAGENINGEN UR

PLS-DA model for genuine versus adulterated milk powders



RIKILT WAGENINGEN UR

PLS-DA model for genuine versus adulterated milk powders: correct prediction

- Cross validation (training set)
  - Genuine = genuine => 92%
  - Adulterated = not genuine => 100%
- External validation
  - Genuine = genuine => 86%
  - Adulterated = not genuine => 96%

RIKILT WAGENINGEN UR

Composition: Manuka honey

RIKILT WAGENINGEN UR

The main honey suppliers' organisation in New Zealand believes 1,700 tons of manuka honey are produced there every year, but 1,800 tons are being sold in the UK alone.

RIKILT WAGENINGEN UR

What is Manuka honey?

- Made from the nectar of *Leptospermum spp* or Manuka bush, a shrub native to New Zealand and southern Australia.
- It has been reported to have potent biocidal activity.
- Activity is rated by the Unique Manuka Factor (UMF).
- Price up to 60 euro/jar
- Aim: To characterize and differentiate this type of honey from other honeys

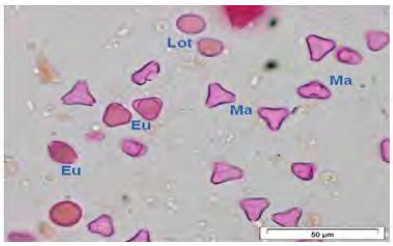
RIKILT WAGENINGEN UR

Honey study

- Samples: ca. 230 samples, ~25% Manuka honey
- Commercial certified honey
- Honey obtained directly from beekeepers, confirmed by pollen analysis
- Analytical approach: fingerprint techniques
- NMR for active components
- Near Infrared Spectroscopy
- Proton Transfer Reaction Mass Spectrometry
- HPLC

RIKILT WAGENINGEN UR

Microscopy: pollen analysis



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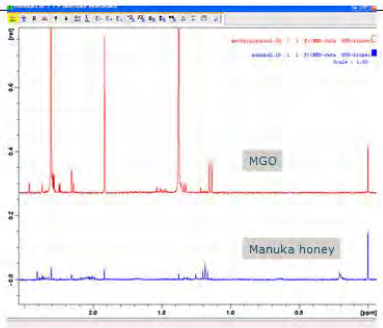
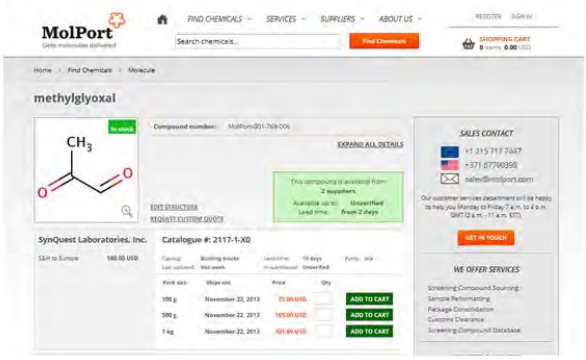
Pollen for sale

RIKILT WAGENINGEN UR

Methylglyoxal: the functional component

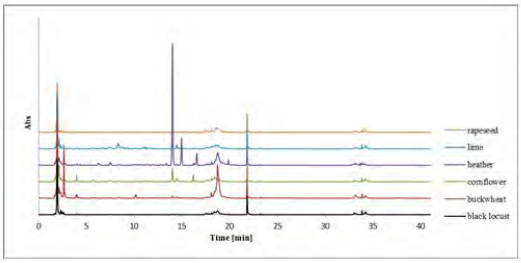


RIKILT WAGENINGEN UR



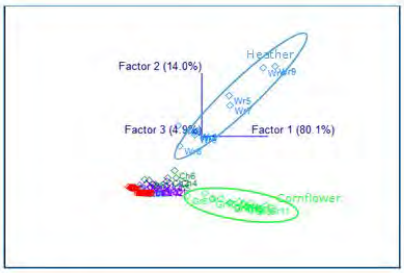
RIKILT WAGENINGEN UR

LC fingerprinting of honey of various floral origin



RIKILT WAGENINGEN UR

PCA scores plot



Rapid on-site measurements of compositional issues

- Micro NIRS (950-1650 nm)
- Chicken fillets

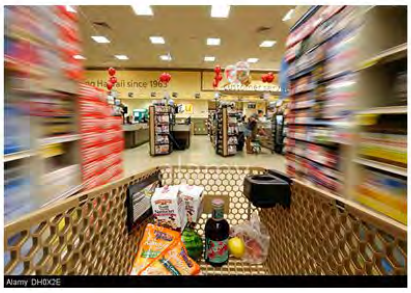
- Moisture- and protein content, fresh or defrosted, preparation or untreated

Micro NIRS

- Instant measurements

79

On our way to reality



80

Compositional fraud

- Food fraud vulnerability assessments in progress
- Simple compositional issues: single marker analysis
- More complex compositional issues and broad anomaly testing: fingerprinting approach
- Rapid on-site measurements of compositional issues: usually fingerprinting approach

PART 2

- After the break: part 2, adulteration with the history of foods

Tonights Class: The Unscrambler - licences

During break / after class send me:

1. 'Machine ID' → When you start up the program
    1. Example: C17561FB
2. Your E-mail adress

To: yannick.weesepoel@wur.nl

Food fraud, authenticity and analytical techniques Part 2

Yannick Weesepoel – RIKILT Wageningen UR
(yannick.weesepoel@wur.nl)

Production history

- Geographical origin of sustainable palm oil
  - Fingerprint techniques, Fatty acids

Geographical provenancing of palm oil

Palm oil sampling:

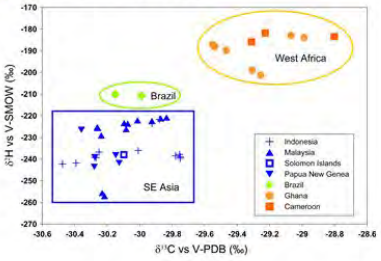
- 44 crude samples from 8 countries

Palm oil analysis:

- δ2H, δ18O and δ13C by "classical" EA-IRMS

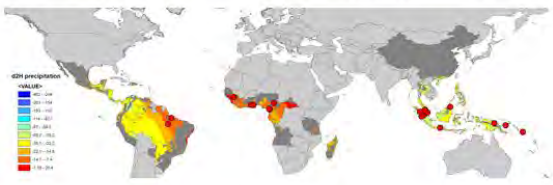
Geographical provenancing of palm oil

- Results δ2H and δ13C

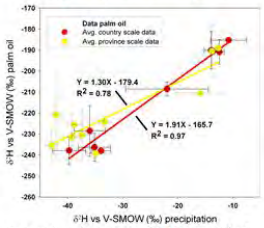


Geographical provenancing of palm oil

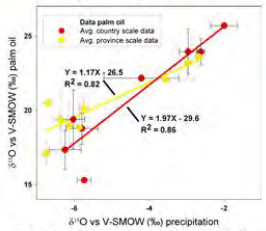
Question: is there are relation between δ2H and δ 18O in palm oil and in global precipitation?



Geographical provenancing of palm oil

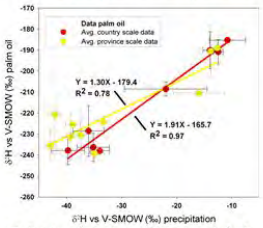


Relation between δ2H in global precipitation and δ2H in palm oil

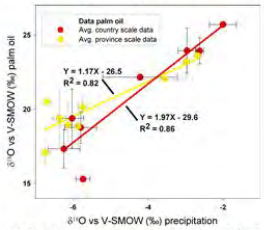


Relation between δ18O in global precipitation and δ18O in palm oil

Geographical provenancing of palm oil



Relation between δ2H in global precipitation and δ2H in palm oil



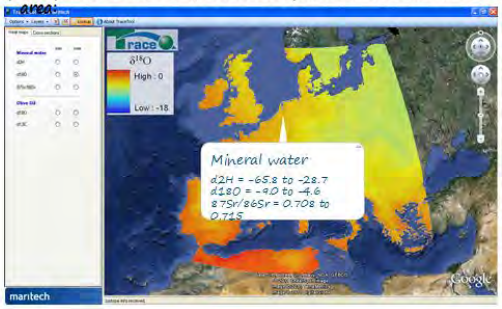
Relation between δ18O in global precipitation and δ18O in palm oil

→ Relation with isotopes in precipitation can be used to provide spatial prediction models for d2H and d18O in palm oil

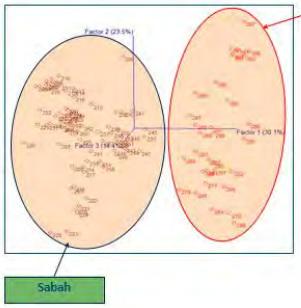
TraceTool v2.0

http://www.maritech.com.my/tracetool/

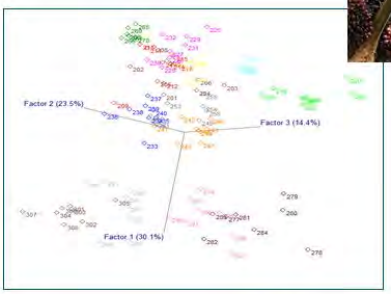
Retrieve predicted range of isotope values for a certain production area.



Fatty acids



Fatty acids



Coloured: Different mills Sabah

Fatty Acid vs. Climatic Factors

- In order to determine the relationship between individuals fatty acids and the climate, climatic information was obtained for each mill;

Code	LAT	LON	MILL	ALTITUDE	ANTEMP	ANPREC	PRECDQ	PRECWQ
1	3.30000000	103.1400000	Bukit LeeLau	39.0000	265.0000	2653.0000	387.0000	483.0000
2	2.61232800	102.6791440	Gomali	38.0000	270.0000	2012.0000	359.0000	520.0000
3	2.11000000	103.3900000	Pamol Kluang	56.0000	259.0000	2514.0000	469.0000	646.0000
4	2.71888100	102.9079720	Pukin	75.0000	266.0000	2207.0000	367.0000	480.0000
5	4.69304500	118.0127740	Saturong	119.0000	284.0000	2089.0000	464.0000	490.0000
6	5.61616400	117.8502380	LS POM (Leepan)	27.0000	269.0000	3087.0000	549.0000	556.0000
7	5.74081700	117.8103830	LS POM (Ladang Sabah)	45.0000	268.0000	3252.0000	562.0000	567.0000
8	5.70985300	117.4386850	Malsa	23.0000	270.0000	3256.0000	577.0000	588.0000
9	5.57751600	117.2358480	Mayvin	96.0000	266.0000	2917.0000	584.0000	611.0000
10	5.05375000	118.2967280	Morisem	65.0000	267.0000	2144.0000	440.0000	446.0000
11	5.99670000	117.5912000	Palmol Sabah	10.0000	270.0000	3282.0000	562.0000	566.0000
12	5.70212200	117.8216600	Prolific	34.0000	269.0000	3085.0000	517.0000	521.0000
13	5.83928000	117.8437000	Sakilan	24.0000	270.0000	3171.0000	497.0000	503.0000
14	5.33408500	117.7814820	Syarimo	17.0000	270.0000	2745.0000	522.0000	526.0000

Food fraud risk assessment is a developing area.

Food adulteration can sometimes be detected with simple methods

More often it requires more sophisticated methods, i.e. fingerprint-type methods in combination with chemometrics

New developments in testing and ICT will allow rapid continuous checks in-line in an industrial environment

1 王倩. 内蒙古牛羊肉脂肪酸测定及其特征研究[D]. 内蒙古：内蒙古农业大学, 2014.

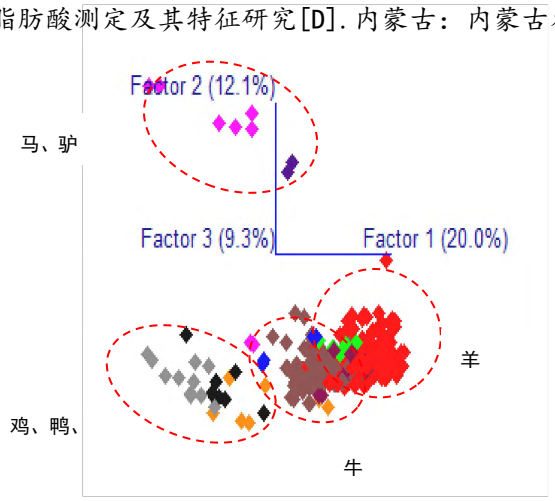
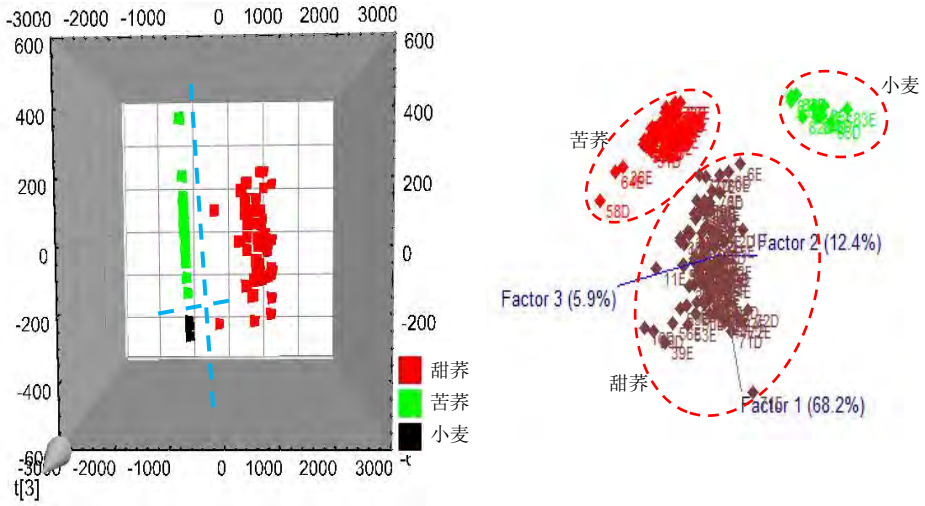


图　不同动物脂肪酸指纹 PCA 分析图

2 闫超. 内蒙古荞麦黄酮类化合物测定及特征研究[D]. 内蒙古：内蒙古农业大学, 2015.



A.　MS　　B.　HPLC

图　甜荞、苦荞和小麦 PCA 得分向量图

3 刘莉敏，郭军等. 蜂胶乙醇提取物 UPLC-Q-TOF-MS 指纹特征初探[J]. 食品科学，2014, 35(18):96-99

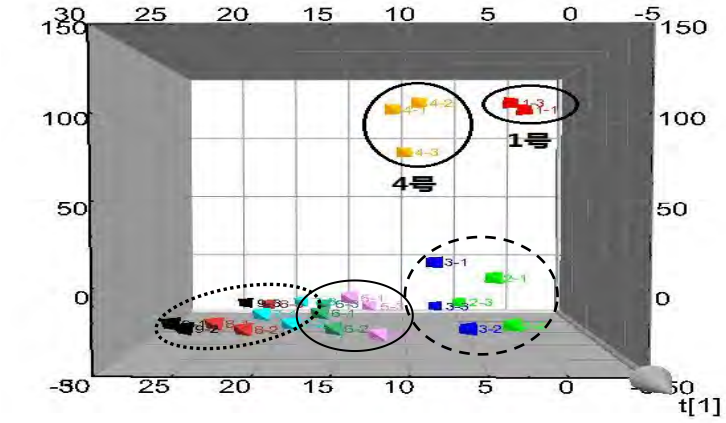


图 3 蜂胶总质谱数据 PCA 分析得分向量图

Fig.3 PCA Score plot of total mass spectrum of 9 propolis

注：(1) 一种颜色代表一种蜂胶，每种蜂胶做了三个平行测定；(2) 1 和 4 脱离了其他 7 种蜂胶高悬上方，说明这两种蜂胶的总质谱特征与其他有很大差异。2、3 为国产市售蜂胶；5、6

内蒙古农业大学食品学院张星杰书记致欢迎辞和祝词

内蒙古营养学会理事长、内蒙古食品药品监督管理局
食品安全专家 王齐田 主任医师致开幕词

中国营养学会副秘书长中国疾病预防控制中心营养与健康所食物营养评价室主任王竹研究员，国家食品安全风险评估中心食物营养素风险和化学残留风险评估专家李建文副研究员进行专题讲座；双全教授/副院长对农大博硕士双语本科生作专家和课程介绍

Weesepoel 博士介绍食品安全研究所的工作

Yannick Weesepoel 博士与伊利集团创新中心（云战友博士）和集团质量管理部（李翠枝、王云霞）专家进行技术交流。

校内外师生在博学楼与图书馆会议室及乳品楼会议室听 Yannick Weesepoel 博士的专题课程

Weesepoel 博士在食品学院食品质量与安全系指导师生

郭军和乌云达来教授以蒙古礼仪为 Yannick Weesepoel 博士接风洗尘

交流探讨

Weesepoel 博士晚上的课程，内蒙古农业大学食品学院食品质量与安全系主任 郭军教授 担任翻译和讲解

高级讲座 — 支持向量机讲解（Support Vector Machine，SVM），郭军老师担任翻译。Yannick:“PCA、SIMCA 和 PLS-DA 不能判别的光谱指纹，有了 SVM 就得到了解决！这在欧洲 6 年前是不可想象的!”郭军教授:“对我们来说，在你到来之前就是不能想象的!”

Yannick Weesepoel 在教师节参加郭军教授研究生组织的活动！

实验室的青春会务组成员：
从左起依次为：张晶、张晓儒、木其尔、刘美玲、
刘莉敏、顾翔宇、张鑫

内蒙古农业大学 食品科学与工程学院

简　介

食品学院始建于 1988 年，该院在时代潮流的涌动下迅猛发展。目前该院**在校本科生 1794 人**，60 个班，平均每年级 15 个班；全日制**博士研究生 40 人，硕士生研究生 183 人**，另有**在职研究生 160 余人**。为自治区内外食品和其他行业输送了大量的人才！本院设有**食品科学与工程、食品质量与安全、包装工程和酿酒工程**等四个本科专业；拥有**食品科学与工程一级博（硕）士学位授权点**，食品科学、农产品加工及贮藏工程、粮食油脂及植物蛋白工程、水产品加工和畜产品安全生产等 5 个二级博（硕）士学位授权点。食品科学与工程专业是**自治区品牌专业，农产品加工及贮藏工程学科是自治区重点建设学科**。

该院科研和开发实力紧跟国内同类院校发展水平，特别是乳肉科学与工程、食品生物技术和包装工程领域的部分研究已达国际水平。

该院国家级和自治区级科研和实践教学平台有，**“乳品生物技术与工程”教育部重点实验室**、“乳品生物技术”教育部工程研究中心、**“畜产品加工”国家级特色优势学科专项资助实验室**；“乳制品研究”自治区重点开放实验室、“畜产品加工”内蒙古工程技术研究中心以及中日政府合作项目“益得”乳品实验厂。另还有“食品质量与安全实验室”、“果蔬加工实验室”、“粮油加工实验室”等常规教学和一般科研开发实验室。

近年博士研究生专业和研究方向（注：以当年招生信息为准）

专　业	研究方向	指导教师
食品科学	肉制品科学与技术	靳烨、格日勒图、贺银凤
农产品加工及贮藏工程	乳制品生物技术与工程	张和平、孙天松、吉日木图、孟和毕力格
	植物食品资源利用	张美莉
	食品包装与储运	董同力嘎

近年硕士研究生专业和研究方向（注：以当年招生信息为准）

专　业	研究方向	指导教师
食品科学	食品质量与安全	靳烨、郭军
	食品微生物	孟和毕力格、殷文政、王俊国、乌云达来
	食品生物技术	格日勒图、孙天松、双全、高爱武
农产品加工及贮藏工程	乳、肉生物技术与加工工程	张和平、吉日木图、白英
	肉制品科学与技术	贺银凤、莎丽娜、赵丽华
	植物资源加工与保鲜技术	韩育梅、李正英
	食品包装与储运	董同力嘎、范贵生、杨晓清、孙文秀
发酵工程	微生物与发酵工程	孙天松、陈忠军
粮食、油脂及植物蛋白工程	粮油及植物蛋白工程	张美莉、包小兰

内蒙古自治区科学技术协会

Inner Mongolia Association for Science and Technology

内蒙古自治区科学技术协会(简称内蒙古科协)成立于 1958 年。是党领导下的民团体，是党和政府联系科技工作者的桥梁和纽带，是发展我区科技事业的重要社会力量。内蒙古科协经过 40 年的发展，拥有理、工、农、医以及自然科学与社会科学交叉性学术团体 2000 多个，会员达 11 万人。近年来，内蒙古科协充分发挥科普工作的主力军、学术交流的主渠道、对外民间科技交流的主要代表的作用。

内蒙古营养学会

学会邮箱：nmg_ns@126.com　**学会交流：**QQ 174077227

内蒙古生理科学学会 1983 年恢复学会活动后成立了营养学分会，内蒙古医学院林士英教授任营养分会理事长，呼市防疫站柴崇山老师任副理事长兼秘书长，杜生福老师任副秘书长，负责学会日常工作，学会挂靠在内蒙古医学院。2000 年 12 月换届呼市防疫站狄妙香教授任理事长，内蒙古医学院杜生福教授任常务副理事长兼秘书长，包头医学院许秀举教授任副理事长。经过五年的积极筹备，2006 年营养学分会晋升为一级学会—内蒙古营养学会。

多年来本学会积极致力于公共营养、临床营养和妇幼营养领域的宣教工作和学术交流，2008 年获得中国营养学会宣传贯彻《中国居民膳食指南》先进地方学会；2006 年 12 月中国营养学会授权内蒙古营养学会为内蒙古地区公共营养师培训基地；2008 年内蒙古劳动厅职业技能鉴定中心批准本学会为“公共营养师培训点”。先后举办公共营养师培训班 12 期，培训学员 360 多人。

执行主编：张晶　刘莉敏

编辑校对：顾翔宇　木其尔　高玎玲　张鑫　张晓儒　刘美玲

（内蒙古农业大学食品科学与工程学院研究生“实验室里的青春”工作组）

责任编辑：郭军　乌云达来

地址：内蒙古农业大学西区乳品楼侧楼 202 室

电话：0471-4317891

Email:guojunge@imau.edu.cn