Food safety regulations based on science

Huub Lelieveld, ***Cristina L.M. Silva***

Global Harmonization Initiative (GHI)

5TH MONIQA INTERNATIONAL CONFERENCE 2015
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FOOD AND HEALTH – RISKS AND BENEFITS

Illegal additives

Lead oxide

Melamine

French fries

Diethylene Glycol

Chemicals that are not allowed but nevertheless present in food ***are not necessarily additives***. **Most man-made chemicals occur in nature in concentrations that can be detected now, but not previously**. They are produced by

- animals
- microbes (bacteria, fungi, parasites)
- plants
- geochemical processes (e.g. volcanos)

This includes chlorinated organic compounds. **More than 5000 different natural organic halogens have been identified in nature**

G.W. Gribble. Chemosphere 52 (2003) 289–297, and Heterocycles, 84 (1) (2011), pp. 157-207.

30-03-2012 USA:

Carbendazim in orange juice

Carbendazim is approved as pesticide in many countries, but not the United States.

MRLs (maximum residual levels) for carbendazim

EU: 100 ppb - 700 ppb

Canada: 500 - 6000 ppb

USA: **10 ppb**

US Environmental Protection Agency:

"... consumption of orange juice with carbendazim at the low levels that have been reported does not raise public health concerns."

... trade and consumer confidence in the USA disrupted.

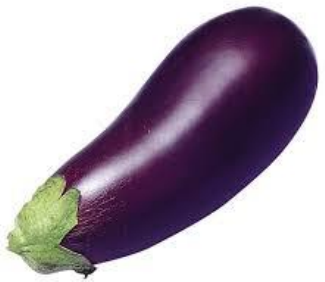
Organic food may contain more pesticides than normal food

Most pesticides are organic

Natural, potentially toxic substances in food 1

- lectins (or hemaglutinins) **(pulses)**
- enzyme inhibitors **(soy, peas, beet, cereals)**
- piperidines **(black pepper)**
- caffein, threobromin, theophilin **(coffee, chocolade, tea)**
- solanine **(potatoes, tomatoes, aubergines)**
- tomatine **(tomatoes)**



Natural, potentially toxic substances in food 2

- oxalates **(rhubarb, spinach, parsley, chives, purslane, cassava, amaranth, chard, taro leaves, radish, kale, monstera fruit)**
- coumarin **(cinnamon, peppermint, green tea, chicory, blueberries)**
- glucosinolates such as sinigrin, progoitrin **(cabbage, broccoli, Brussels sprouts, cauliflower, turnip, radish, horseradish, mustard, rapeseed)**





Natural, potentially toxic substances in food 3

- cyanogenic glycosides, such as amygdalin **(almond, laurel)** and linamarin **(cassave**)
- saponins **(peanut, soy, spinach, broccoli, potato, apple)**
- growth hormones
- antibiotics




Acetaldehyde
Benzaldehyde
Benzene
Benzofuran
Benzo(a)pyrene
Caffeic Acid
Catechol
1,2,5,6-dibenzanthracene
Formaldehyde
Furan
Furfural
Hydroquinone
Isoprene
Limonene
Styrene
Toluene
Xylene
Etc.

Differences in regulations

- result in needless destruction of healthy food in a world where a billion people have very little or no food
- hamper international trade and innovation

The making of food safety regulations

The main problem is the lack of understanding of toxicity by

- politicians
- general public
- activists (antis)
- press

and the strong influence of professional lobbyists

Lobbying
USA

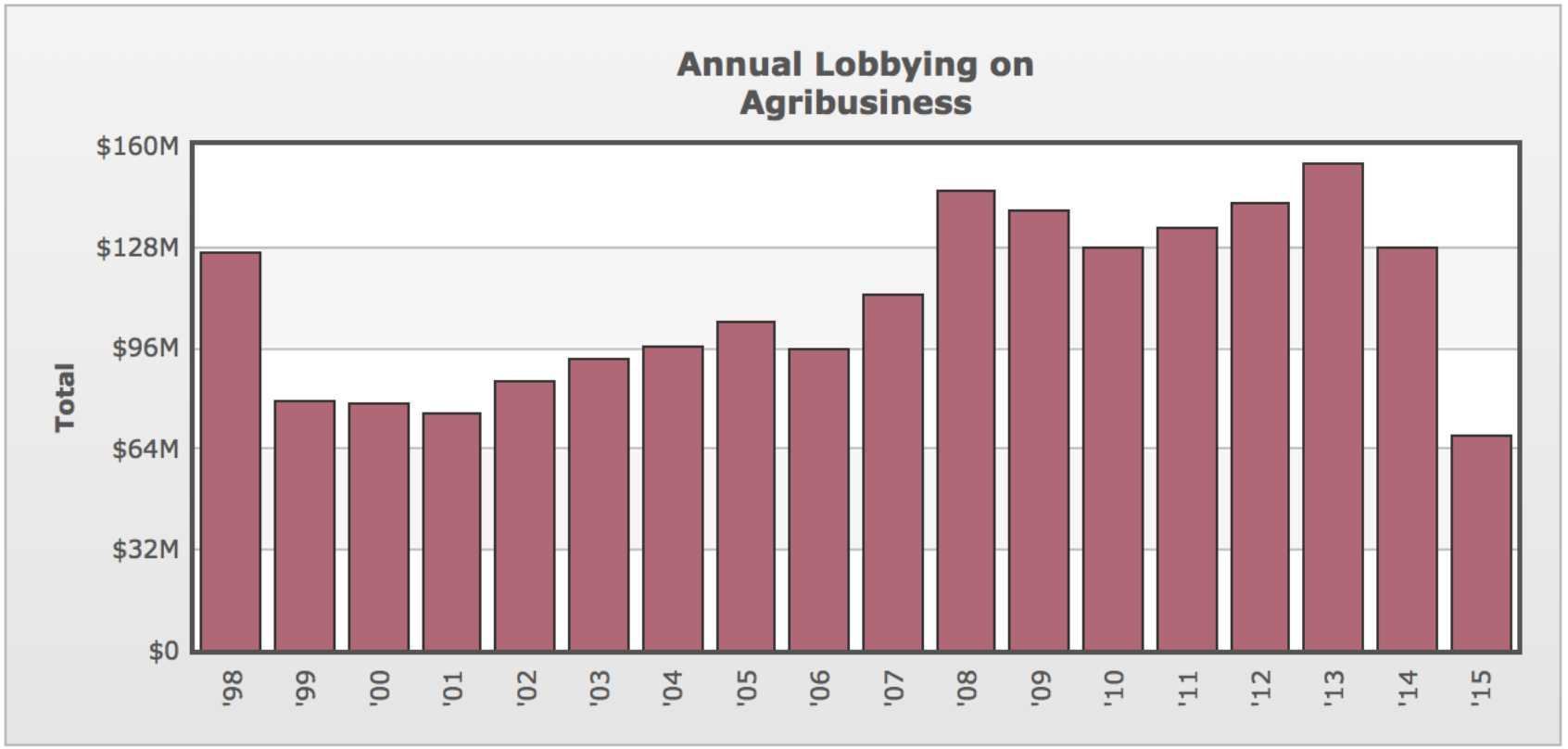
2015

Total for Agribusiness: $67,462,046

Total Number of Clients Reported: 417

Total Number of Lobbyists Reported: 953

https://www.opensecrets.org/lobby/indus.php?id=A



Alert on cancer chemical found in thousands of processed foods

By SOPHIE BORLAND
UPDATED: 01:19 GMT, 22 April 2011

A chemical which causes cancer has been found in a huge range of foods including bread, crisps and baby food.

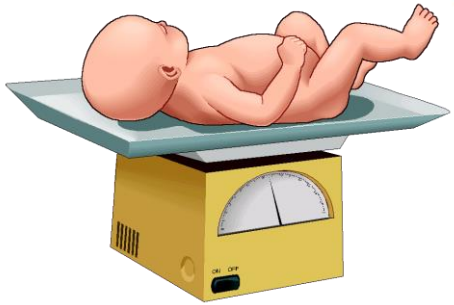
Scientists have identified high levels in thousands of cooked and processed products.

The substance, acrylamide, has been linked to several types of cancer including bowel, bladder and kidney, and is known to cause infertility and loss of muscle control.

Absurd regulations

ZERO-TOLERANCE **= ABSENCE OF ...**

- **Antibiotics in food**



20.000 kg/day 800.000 kg/dag

- **Soedan Red**

ppt* in products with ingredients from China

800 l per day life long

* About 1 grain of 2mm in an Olympic swimming pool)

The Netherlands, June 2014
Furazolidon from feed into meat

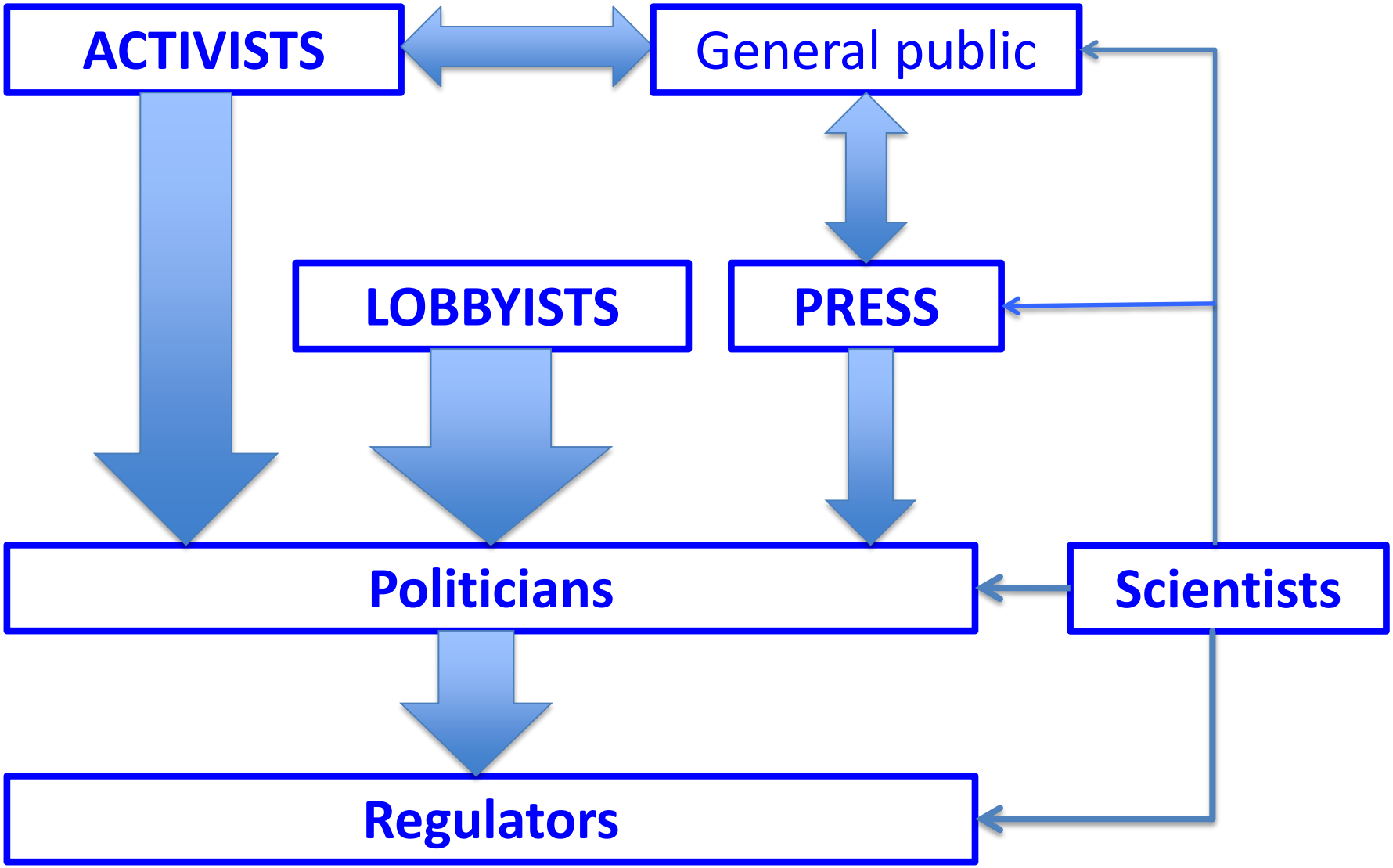
- Average exposure to humans eating meat 1.2 µg per meal (and **worst case 8 µg per meal**)
- Internationally recognised potential harm at 3 µg per day **during a life time** (i.e. 50 or 70 years)
- There are NO reports of harmful effects of therapeutic doses of **200 mg** per day during 21 days (WHO) **- this is 25,000 times more** than the worst case amount
- Conclusion: the meat is safe
- Destruction of 2474 calves and 100 companies closed

Source: Netherlands Food and Consumer Product Safety Authority

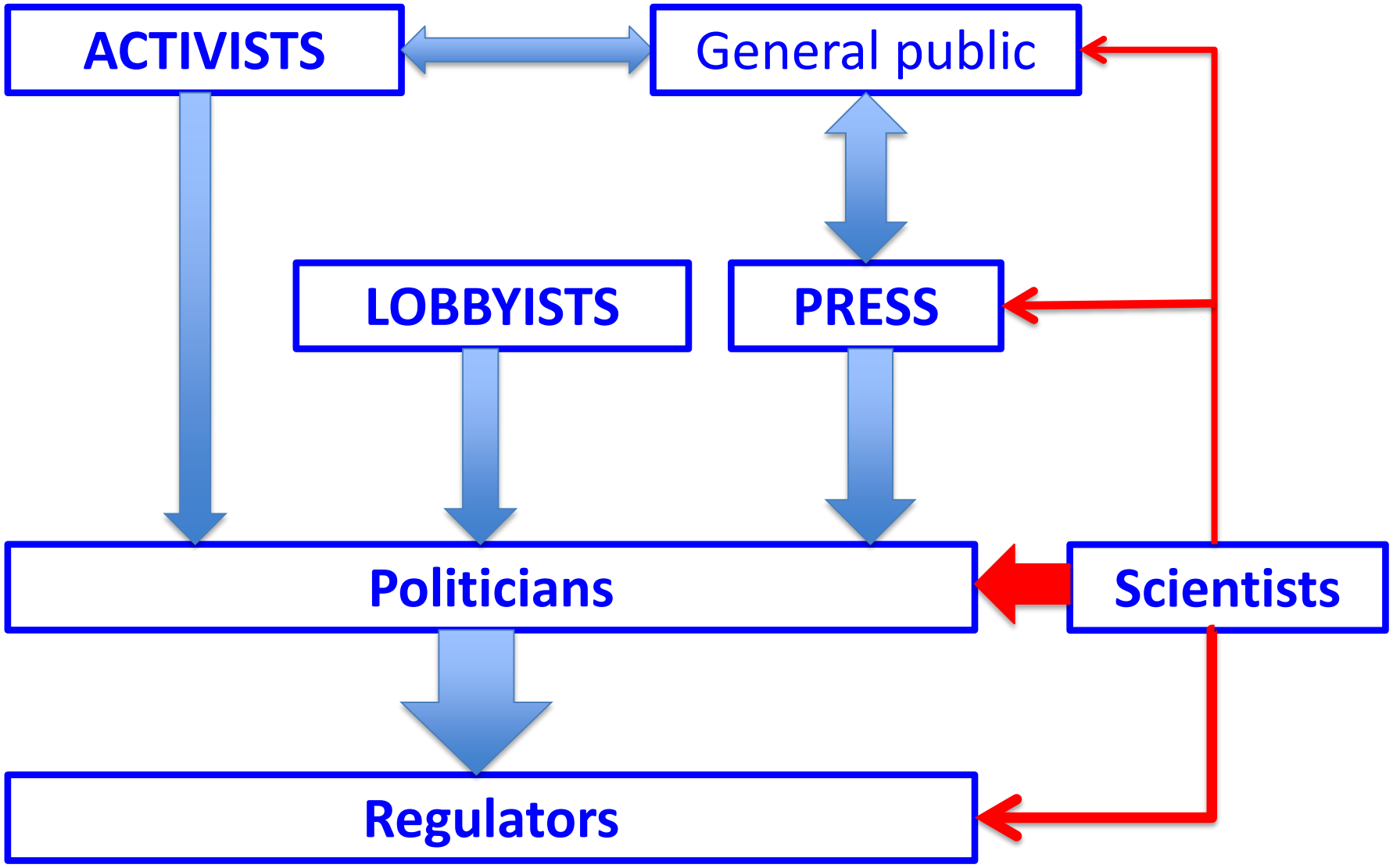
If chemicals have been added illegally:

- those responsible should be prosecuted
- the product should be confiscated
- but **if safe**, the product should not be destroyed

Now


ACTIVISTS
General public
LOBBYISTS
PRESS
Politicians
Scientists
Regulators

Future


ACTIVISTS
General public
LOBBYISTS
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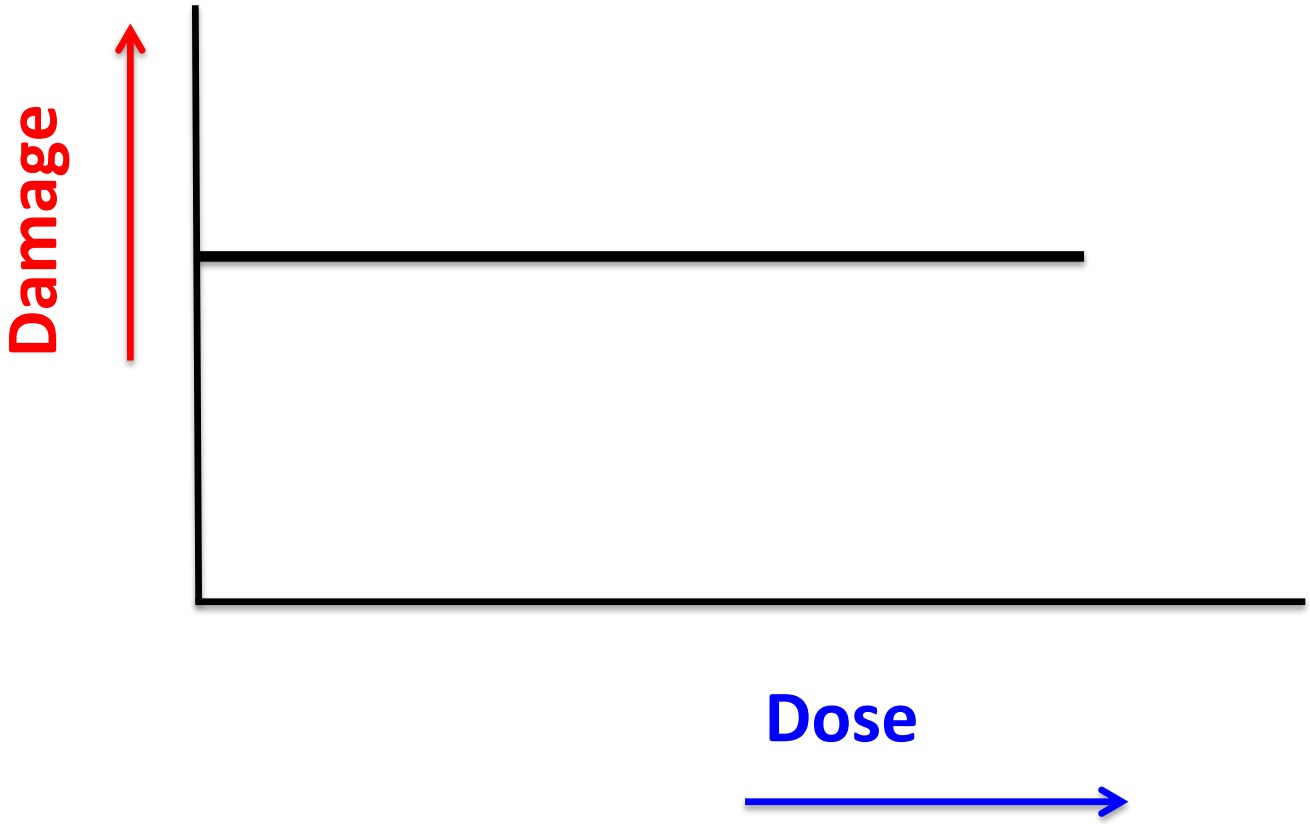
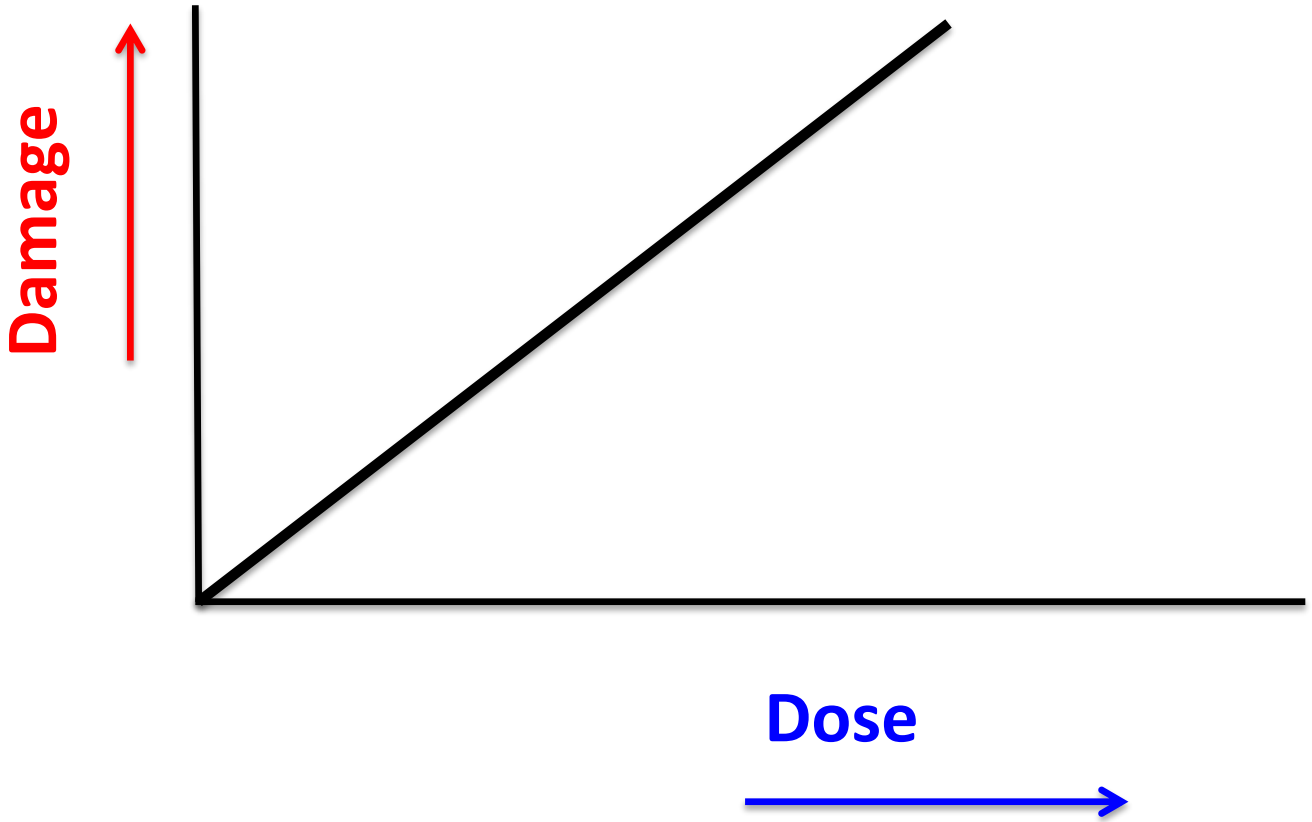
Regulators

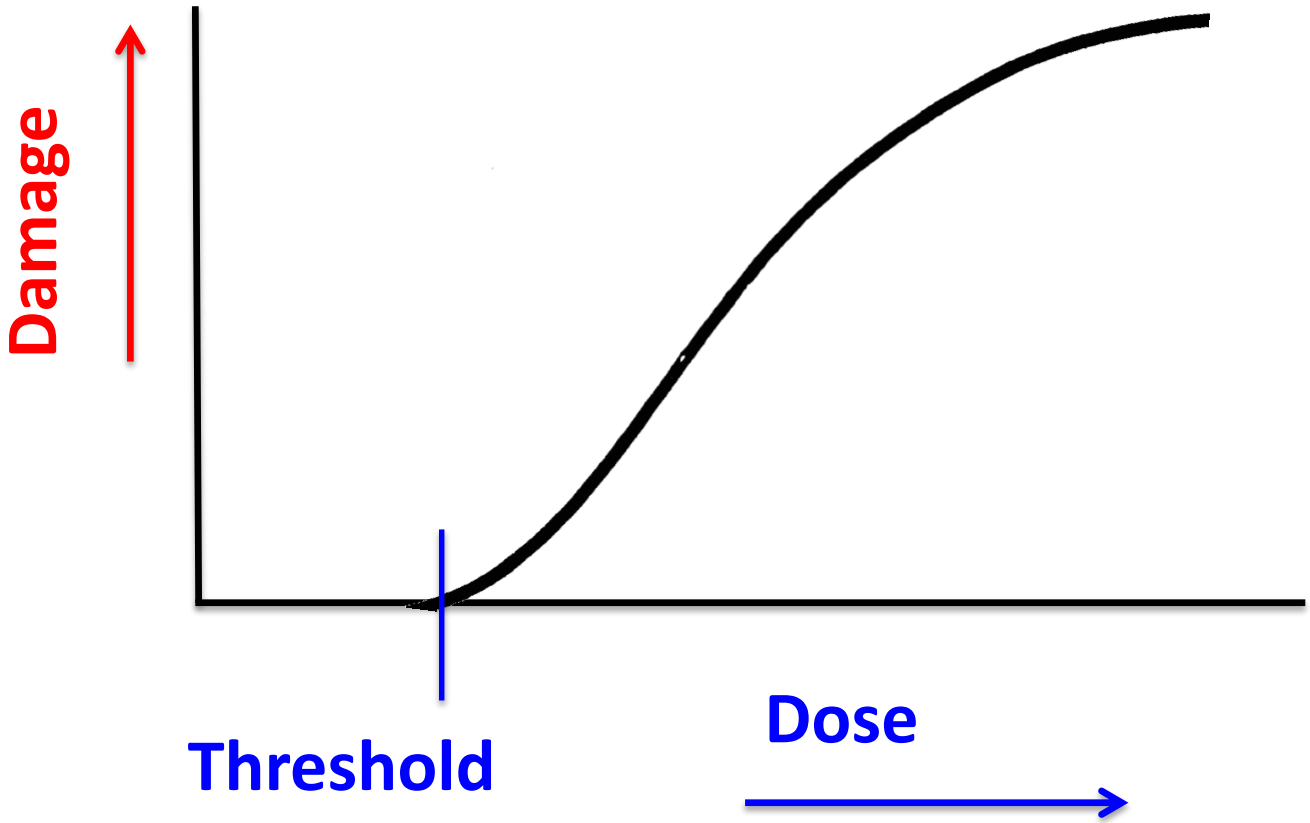
The Global Harmonization Initiative wants to improve food regulations and remove absurd regulations by obtaining global scientific consensus
and convincing those who need to know



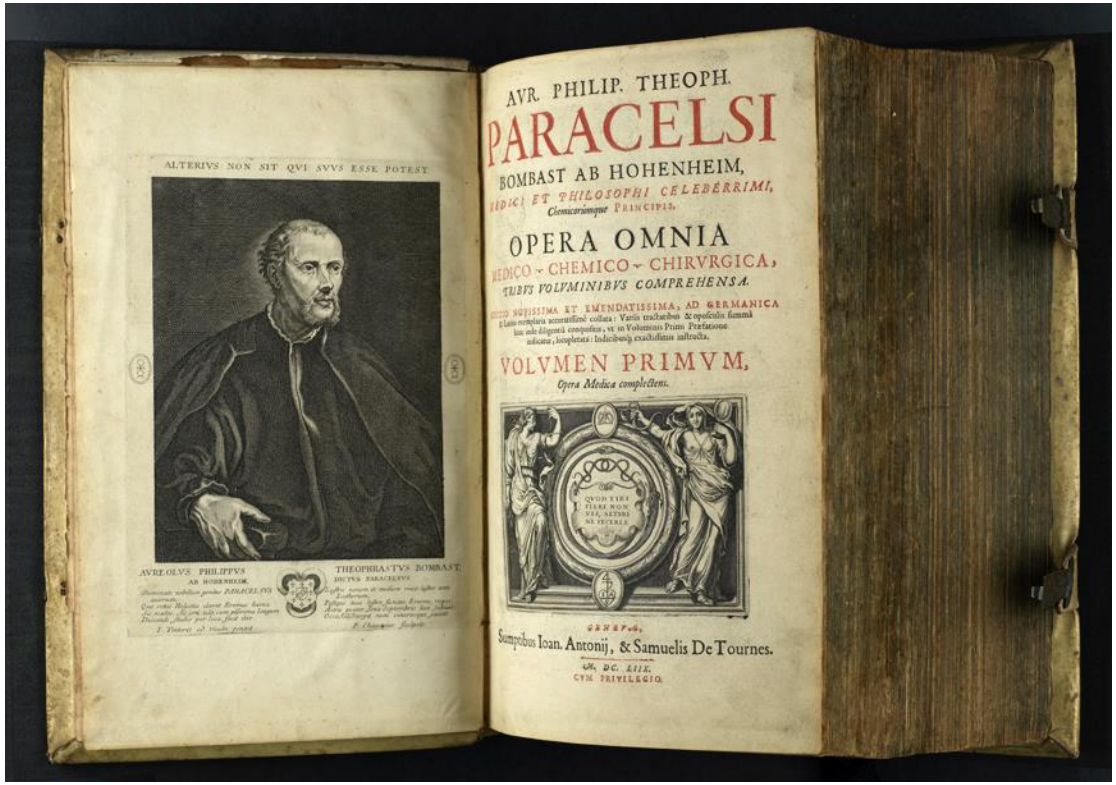
The perception of the general public

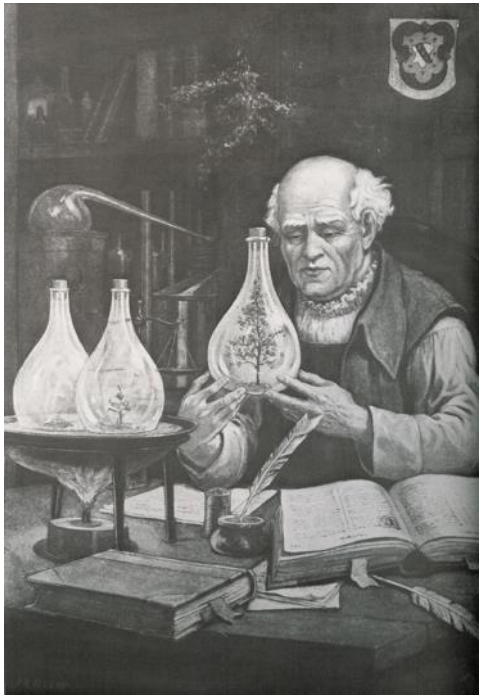


Understanding of most politicians and policy makers



Toxicologists: there is a threshold of no concern makes (NOAEL, no adverse effect level). All food contains toxins.

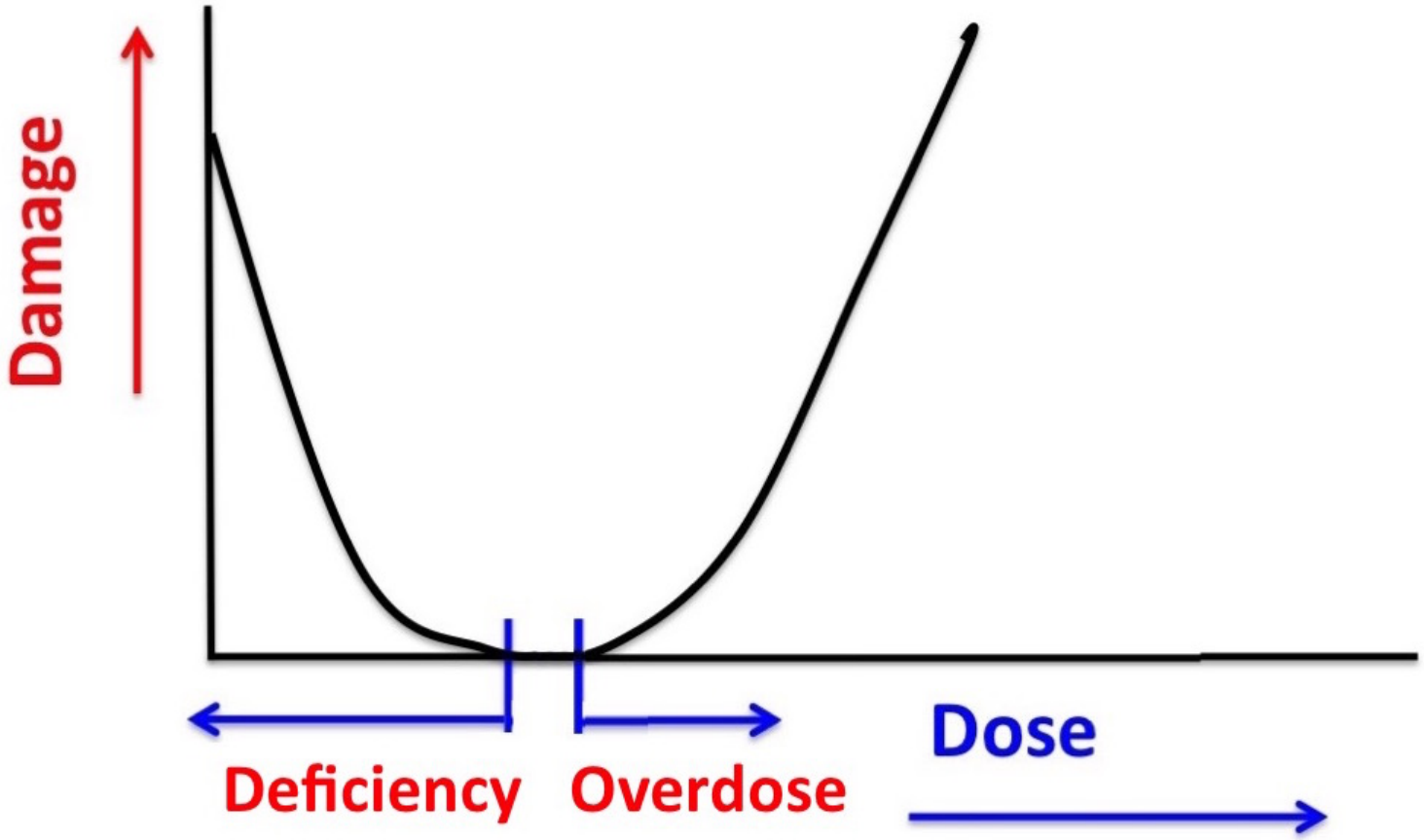




Everything is poisonous if the amount is high enough

or

There are no toxic substances, only toxic concentrations



Many substances are harmless in the right amounts but harmful if **too much** or **not enough**

Vitamin A

Adults: needed 1 mg per day
harmful at 3 mg per day

Seleen

Adults: needed 50-150 µg per day
harmful at 300 µg per dag

(Netherlands Health Council)

Evolution

Humans and their predecessors have been exposed to all those most scary chemicals for millions of years and developed a **biological system** (with liver, kidneys, etc.) to cope with them or even use them beneficially.

The system, however, can be overloaded and then the chemical becomes toxic.

WG Genetic toxicology

Dr. Firouz Darroudi, the lead expert in this field gives GHI endorsed courses to make governments and industry aware of the test tube methodology.

- Until recently: Head of the department Genetic Toxicology, University Medical Centre, Leiden (still leading projects)
- Still: Senior Advisor of Unesco, WHO, IAEA and the National Institute for Occupational Safety and Health (USA)

More recently:

- Director of Biomedical Research and Head of Radiation Genetics and Chemical Mutagenesis in Doha (Qatar)
- Director of the Center of Human Safety & Health and Diagnostic Genome Analysis in Dubai (UAE)
- Supervisor of research programs of a recently opened cancer research center in Tehran

WG Genetic toxicology

Chair: Firouz Darroudi

Currently evidence of safety of new food products, new ingredients and new technologies is typically obtained by animal testing.

Testing using animals is not popular and therefore the industry is reluctant to introduce improved products and processes. Moreover it is slow and expensive.

The alternative, developed in the past three decades is in vitro testing, using intact human liver cells. It is:

- more accurate
- relevant to humans (not test animals)
- cheap
- fast

But it is NOT IN CURRENT REGULATIONS

GHI Working Group Mycotoxins

- Globally, approximately **25 %** of the staple food is lost because of the presence of unacceptable concentrations of mycotoxins
- In some countries this figures is higher than **50 %**.

Development of methods to reduced the formation of mycotoxins in food

- using **available results** of scientific research
- applying **existing good practices**
- proposing regulations to make practices compulsory, **globally the same**

<u>To be included</u>

agricultural practice

transportation

storage

manufacturing

packaging

Subgroups	Chairs
Fruits and vegetables	Prof. Mona Popa
Feed products	Prof. Hamid Ezzatpanah
Grains	Prof. Hamid Ezzatpanah
Food additives	Dr. Iulia Iatco
Nuts and dried foods	Prof. Karina Grigoryan and Dr. Liviu Gaceu
Spices	Dr. Naresh Megan

To join, send email to:

Prof. Mark Shamtsyan

mark.shamtsyan@yandex.ru

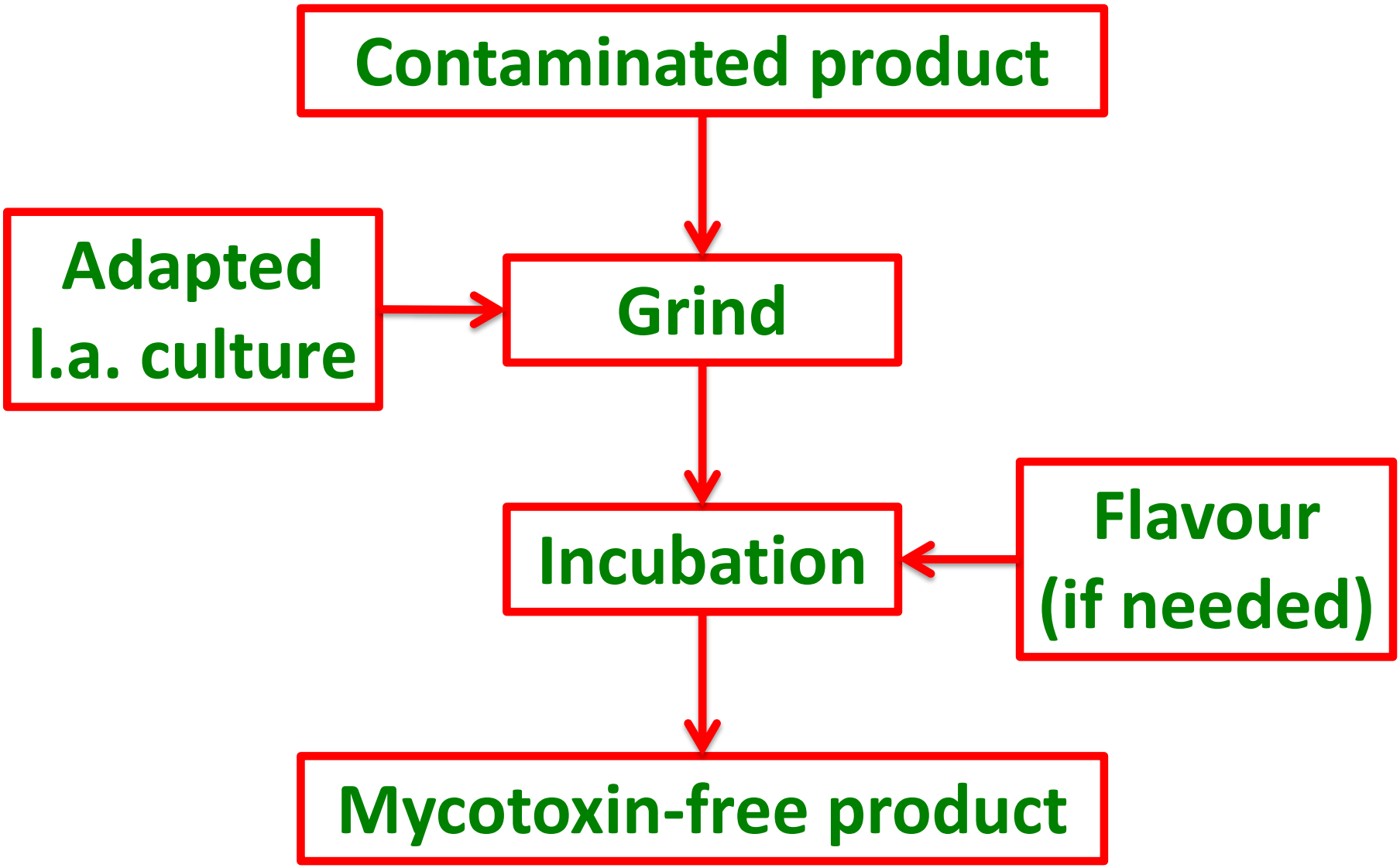
From Farm to Fork

- How to prevent contamination (Felicia Wu, Nature, 2014)
- Where do moulds grow and when do they produce toxins
- Prevent or reduce growth by
  - Control of humidity (insulation of silos)
  - Modified atmosphere
  - Drying (using solar energy and mirrors)
  - etc.

Processes that reduce mycotoxin concentrations, e.g., using

- microbes
- enzymes (Petr Karlovsky, 2014)
- insects (Hornung (1991) using *Tenebrio molitor*
- ozonolysis (Haizhou Dong, 2013)

Removal of mycotoxins by microbes or enzymes



By Larry Keener & Huub Lelieveld

Global harmonisation of food legislation: the way forward

There have been many food scares during the past 10 years. Examples are BSE, Salmonella in eggs, acrylamide, *Escherichia coli* O157:H7, avian influenza and foot-and-mouth disease. These scares have urged governments to tighten legislation. In the EU it led to Regulation (EC) 178/2002 (amended by (EC) 1642/2003) of which implementation started in 2002 and must be completed before 2007.

Although governments work together in organisations such as Codex Alimentarius and the World Trade Organisation (WTO), regrettably there are often differences in regulation between countries. The WTO recommends using international standards where they exist but also allows tougher standards if there is scientific justification. Serious concerns apply to the phrases 'where they exist' and 'scientific justification'. In such cases decisions may easily err on the extreme side and may lead to undue destruction of large amounts of food or provide serious barriers to trade.

In an attempt to eliminate these problems, the Food Science and Technology organisations in the USA and Europe, viz. the International Division of IFT, EFFoST and the Food Chemistry Division of FECS, intend to make an inventory of significant differences in legislation between countries on all continents and to produce recommendations to remove these differences, based on sound science and technology.

During IFT's Annual Meeting in July 2004 in Las Vegas, a symposium was devoted to the subject, covering food legislation in Asia, Europe, North America, South America, and Australia. Speakers explained the good intentions of governments and international organisations and the consensus among all of them on issues identified. The second task therefore is to identify issues that need to be prioritised. Subsequently, working parties will be formed to deal

in Vienna, Austria. The group is supporte by nearly two dozen international scientif organisations, academic research institu and publishers, including IUFoST, the India Central Food Technological Resear Institute, the International Association for Cereal Science & Technology, and the Korean Food Safety Institute.

GHI furthers the opportunity for collabor work among members and provides educational outreach to key stakeholder organising member meetings, workshop and symposia throughout the world. GH activities at the Cape Town conference

12 Food & Beverage International June 2010

Trends in Food Science & Technology 20 (2009) 582–584

Review

Progress with the global harmonization initiative☆

Huub Lelieveld*

Essahlaan 11, 3723 HT Bilthoven, Netherlands (Tel.: +31 30 225 3897; e-mail: huub.lelieveld@etor.nl.net)

The need for global harmonization of food safety regulations is growing with every new food safety incident. To be able to control food safety adequately, there must be a sound legal basis. Regrettably, often that basis has not been well developed or is not in existence. With regulation based on sound science, it is unlikely that incidents will be eliminated, but it will help to reduce the number and severity of food safety incidents. Regulations, however, will never stop incidents that have been created with criminal intent, although some legal measures may help. An example may be a global regulation for tamper-evident packaged food. Currently, as a direct result of the threat of bio terrorism, countries have been developing regulations on tamper-evidence for example for baby food and products sold at airports.

GHI association

To give GHI a legal existence, in October 2007, the GHI Association was registered in Vienna, Austria. The goal of GHI remains "Achieving consensus on the science of food regulations and legislation to ensure the global availability of safe and wholesome food products for all consumers". This has been carefully incorporated in the constitution, which is entirely based on the Charter of GHI. To comply with the Austrian law, however, the Charter had to be translated into German and the text had to be adapted to meet legal requirements. The Executive Committee of GHI has painstakingly ensured that the translation and necessary changes did in no way alter the goal and objectives as described in the Charter. The German "Vereinssatzung" (constitution)" can be found on the GHI website (http://www.globalharmonization.org/constitution-german-2008.pdf). An English translation will be posted on the website shortly. The Austrian law also required to have instead of "Co-Chairs" a President and a vice-president. The Founders of the Association are Huub Lelieveld (Netherlands), Larry Keener (USA), Gerhard Schleining (Austria), Sangsuk Oh (Korea), Vishwesh-waraiah Prakash (India), Christine Boisrobert (USA) and Roland Poms (Austria). The Executive Committee consists of the same persons, with the exception of Roland Poms, who is the Chair of the Supervisory Board. Currently, Huub Lelieveld acts as President and Larry Keener as Vice-President.

Supervisory board

From the start, the founders of GHI stated that impartiality of the scientific consensus process would be an essential requirement to be able to cooperate with scientists from all over the world and therefore, this impartiality should be carefully main
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* Although in English the spelling is with an "s", as a result on its inception during a meeting in the USA, in the official name the spelling is "Harmonization", with a "z".
*Corresponding author.

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GHI

The pressing need for global harmonisation of food regulations


By Huub Lelieveld (President of the Global Harmonization Initiative) and Professor Lucia Anelich (Director at Anelich Consulting, South Africa)

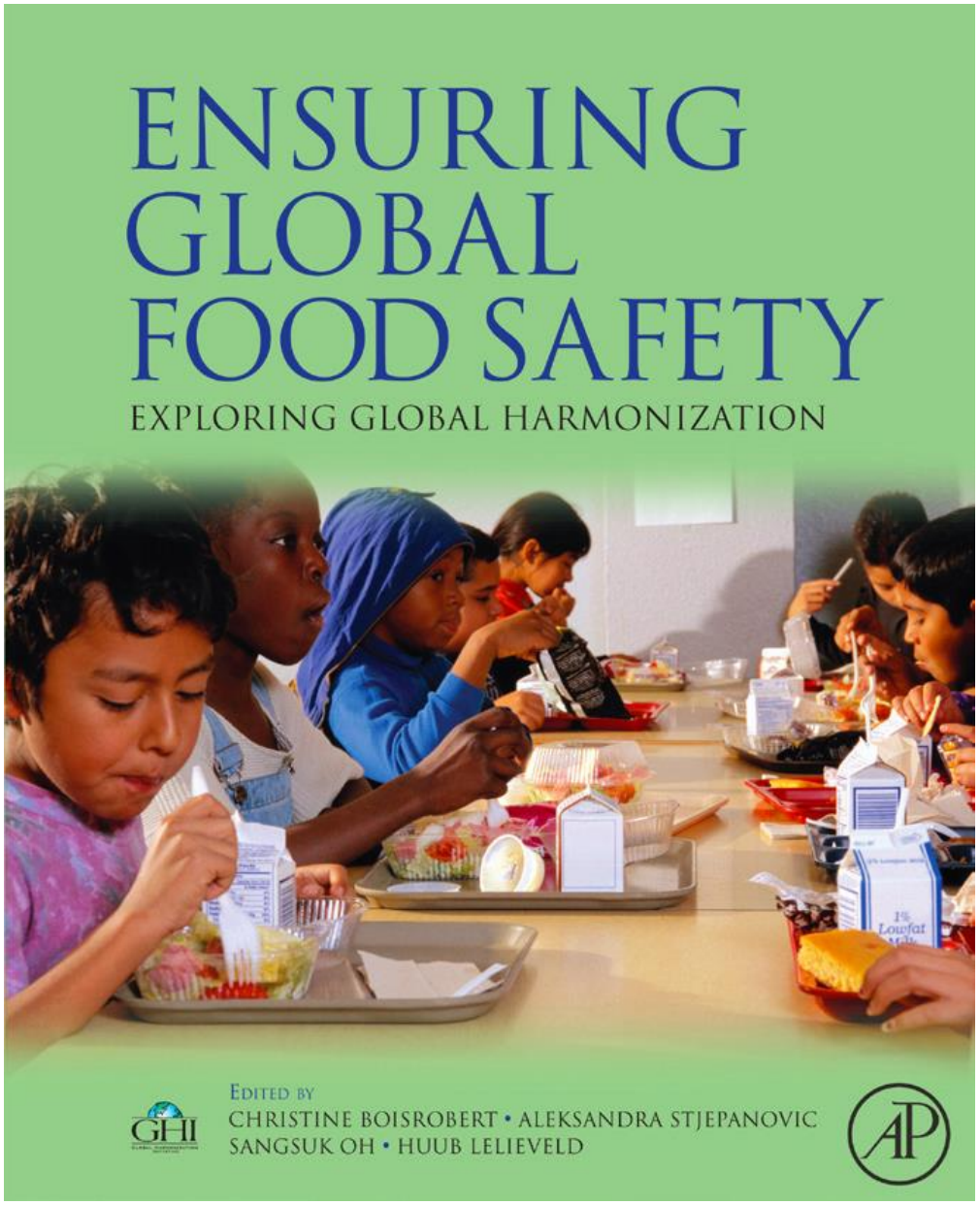
While the globalisation of world trade has created new pathways to economic growth for many nations, the trend toward a "one-world economy" has also exposed critical differences in international laws and regulations that are designed to protect the world's citizens. Nowhere is this more evident than in the global food supply chain, where gaps in the science used to justify international regulations not only create confusion for food producers trying to achieve compliance, but also create a world of barriers to achieving food security and effective food safety – and the technological advances that could ensure both. The need to harmonise global food regulations and laws has never been greater, considering the following challenges:

- **Food security and nutrition**

  Despite the fact that the world as a whole produces enough food for everyone, about half of the food produced does not reach those who need it. As a consequence, today about one *billion people* suffer from hunger. One of the major reasons is that a significant percentage of the food is destroyed during harvesting, transport and storage. Much is spoiled before consumption due to inadequate preservation, but food may also be deemed unfit for consumption – and consequently destroyed unnecessarily – without scientific justification due to inadequate or uninformed laws. In addition, food preserved to prevent microbial spoilage often has a significantly reduced concentration of essential nutrients. This leads to entire populations suffering from a dangerously reduced resistance to disease, especially affecting children during their growth phase. One way to address this is to promote the development of new technologies that preserve foods from spoilage and simultaneously retain vital nutrients; however, conflicting, non-science-based regulations act as barriers to the creation and adoption of these much-needed technological solutions.

- **Food safety**

  Nations enact food safety regulations to protect consumers from food poisoning. This is needed because some unscrupulous producers and tradesmen are more concerned about making a profit than safeguarding consumer health. Regrettably, significant differences in food safety regulations between nations can, and do, result in situations in which a food that is considered safe in one country is considered unfit for consumption in another country. This, in turn, leads to the destruction of imported foods that are safe but that do not meet regulatory requirements, or prevents countries from exporting food to areas where it is needed. Without globally harmonised, science-based regulations, rules intended to protect consumers from foodborne illness or death merely serve to erect trade barriers that inhibit technological advances that ensure public health.



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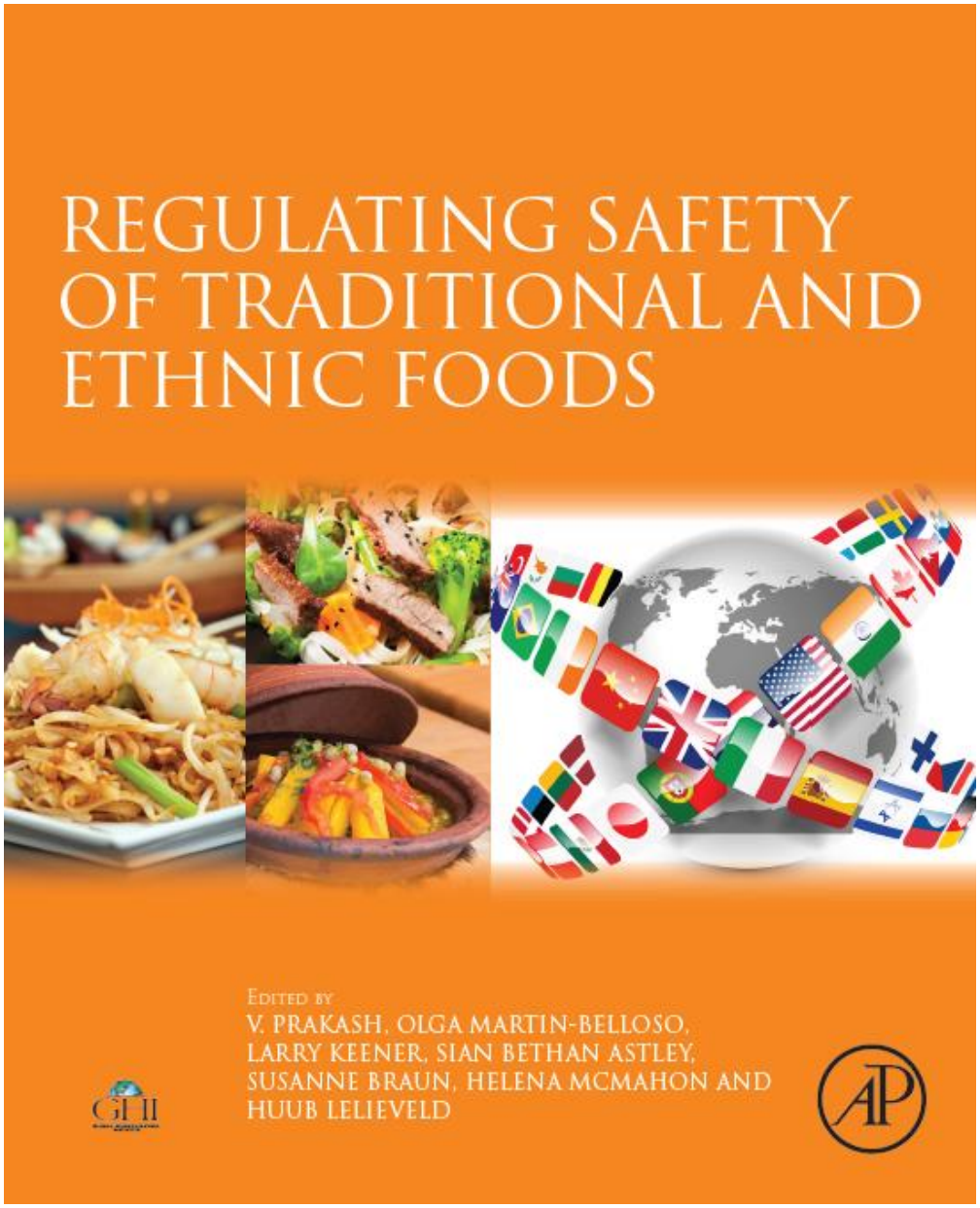

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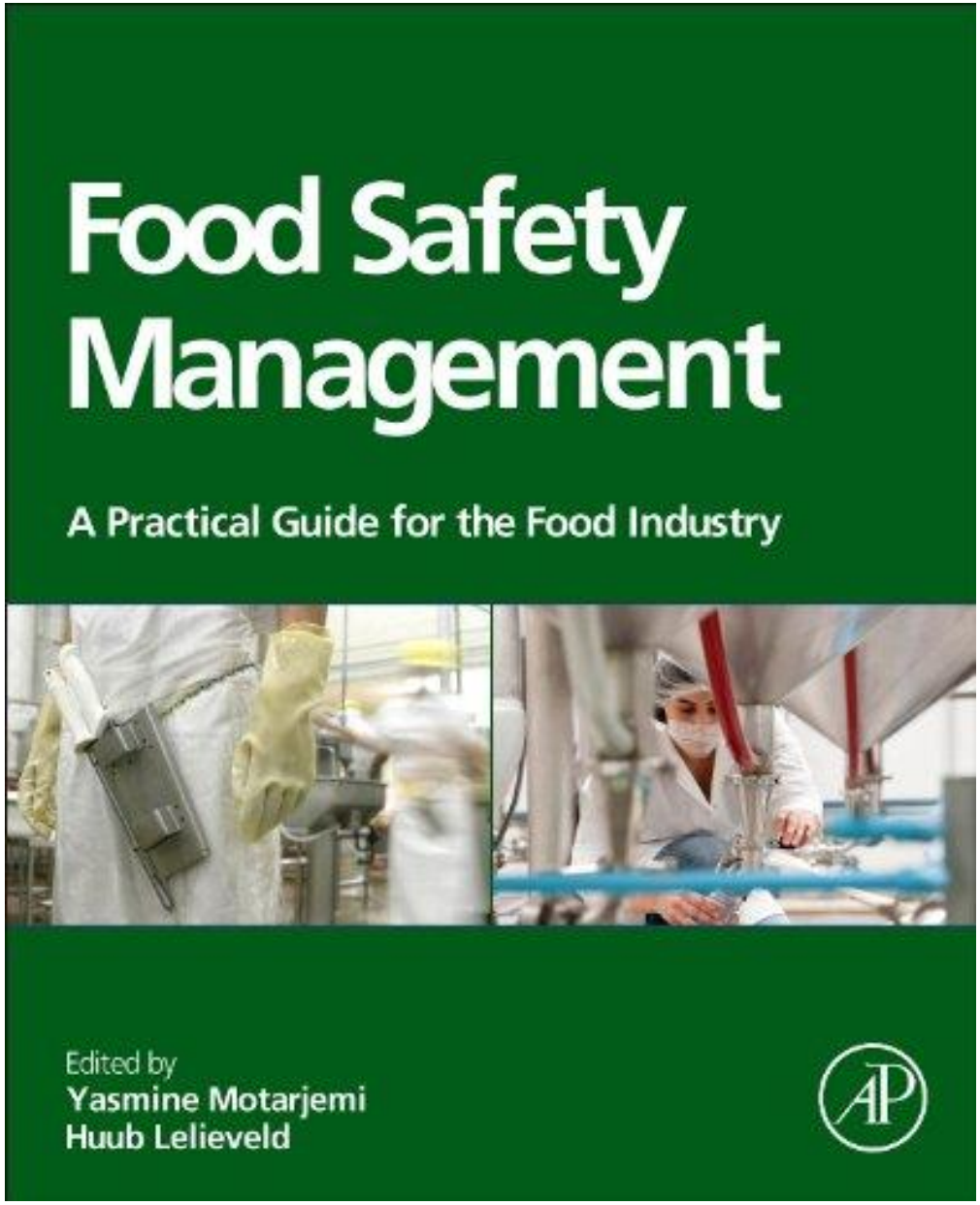

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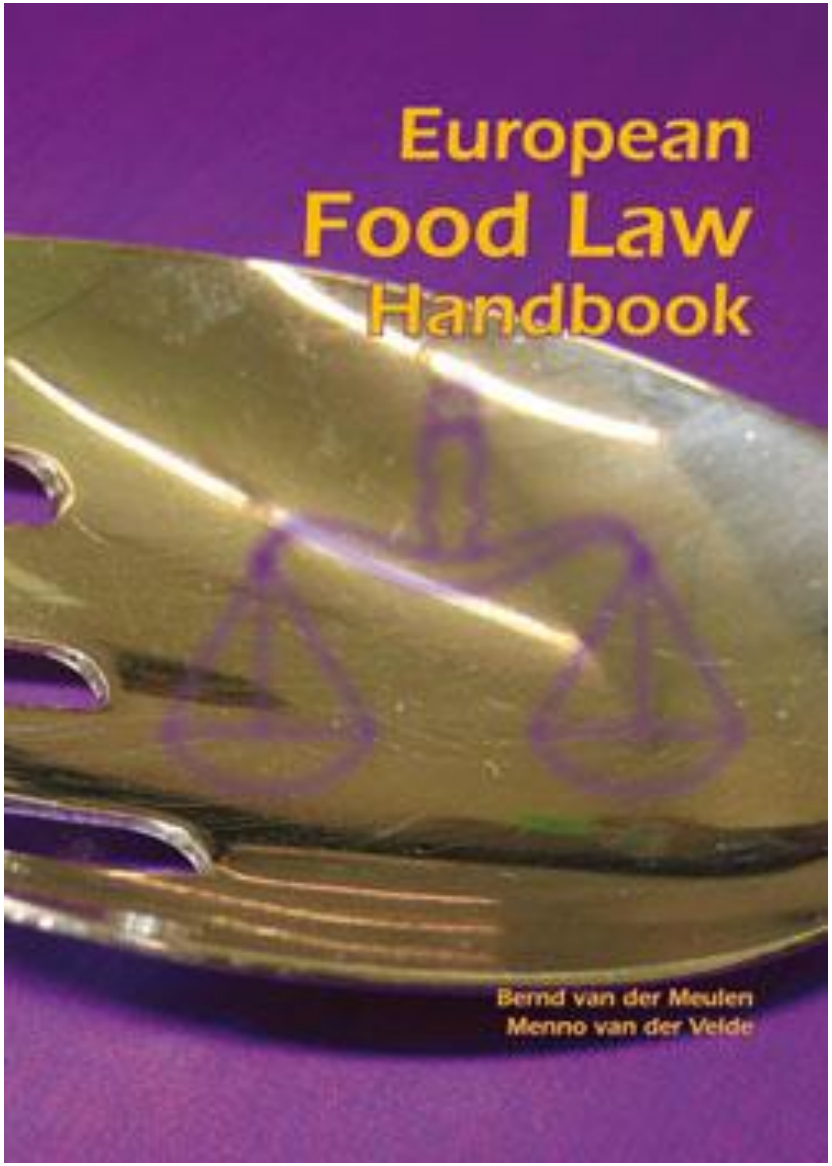


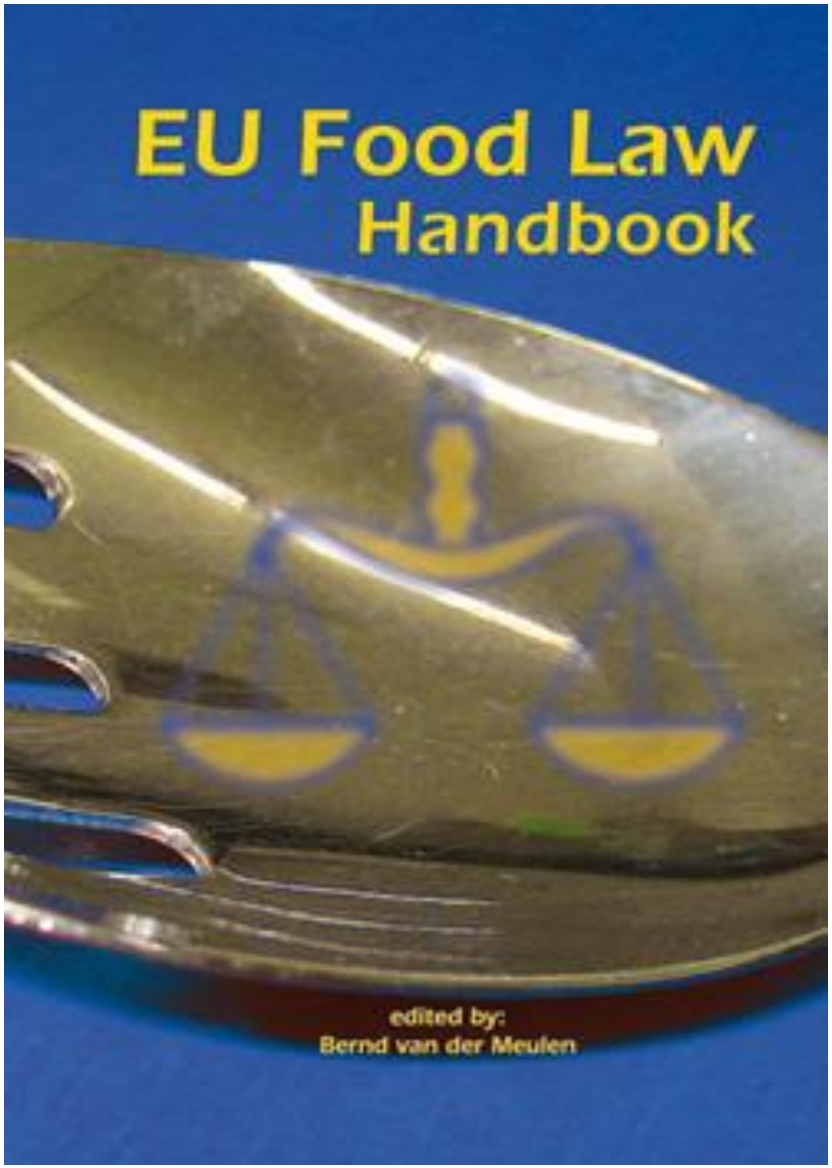
European Food Law Handbook

B. v.d. Meulen and M. v.d. Velde
Wageningen University
Eur. Inst. for Food Law

2008 632 pages
ISBN: 978-90-8686-082-1

Bernd van der Meulen is Legal Advisor (Foods) in GHI

Price (€): 66.00 (excluding VAT)



EU Food Law Handbook

B. v.d. Meulen
Wageningen University
Eur. Inst. for Food Law

2014 692 pages
ISBN: 978-90-8686-246-7

Bernd van der Meulen is Legal Advisor (Foods) in GHI

Price (€): 75.00 (excluding VAT)

If you are not a member, you are invited to join GHI, just go to

www.globalharmonization.net/user/register

and if you forgot, email

Info@globalharmonization.net

There is no fee, you only need to qualify as a food scientist

You will influence the future

Thank you for your interest