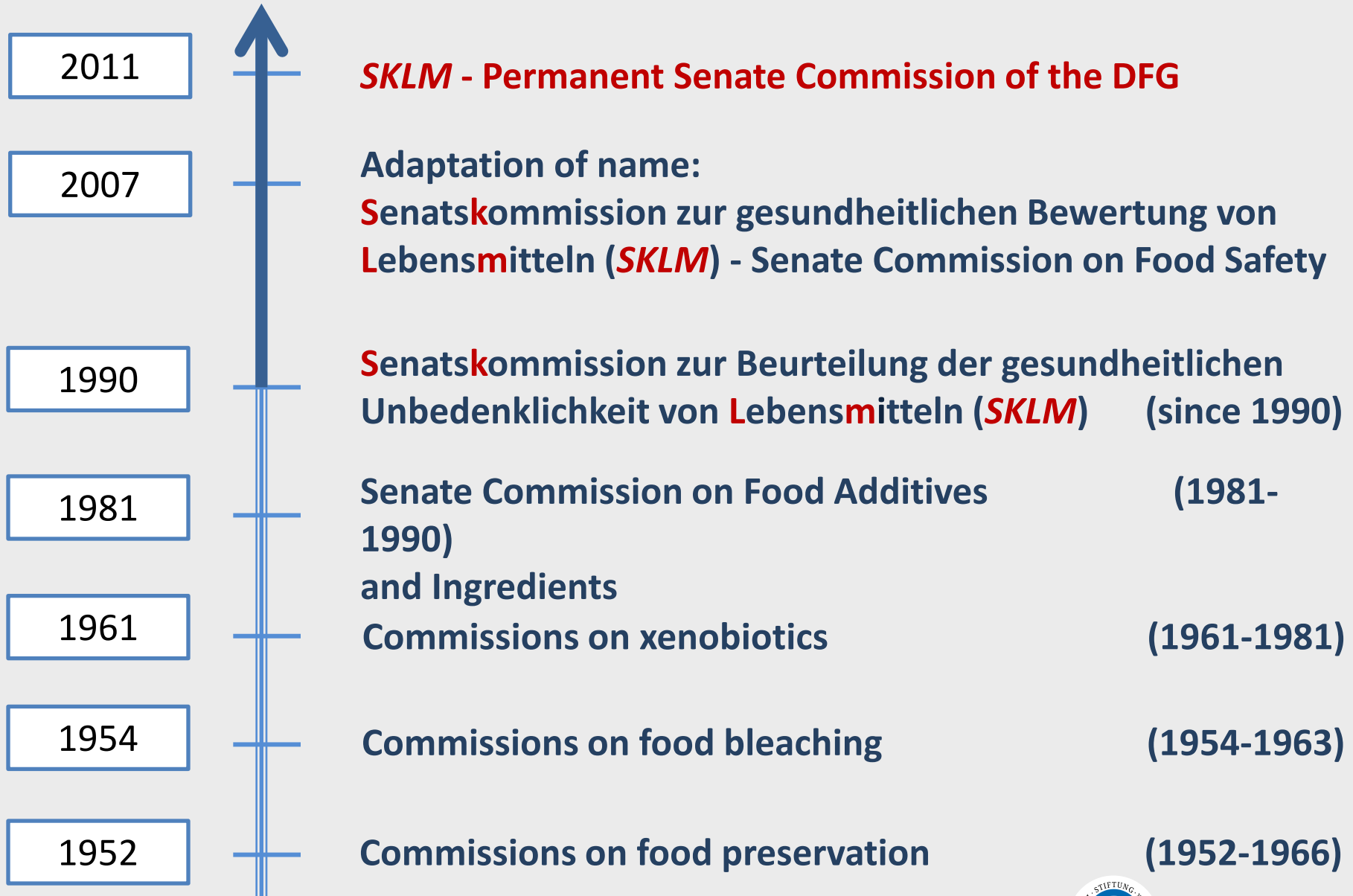




**SKLM Symposium on
New Challenges and Developments in
Food/Consumer Safety**

**The Senate Commission
on Food Safety**

History of food-related commissions of the DFG



Food safety is a societal first-rank good

Challenges

- constant process and product innovations
- changing eating habits
- continuous gaining of new insights



Demand for

- ✓ ongoing analysis and assessment by scientists
- ✓ permanent political advice

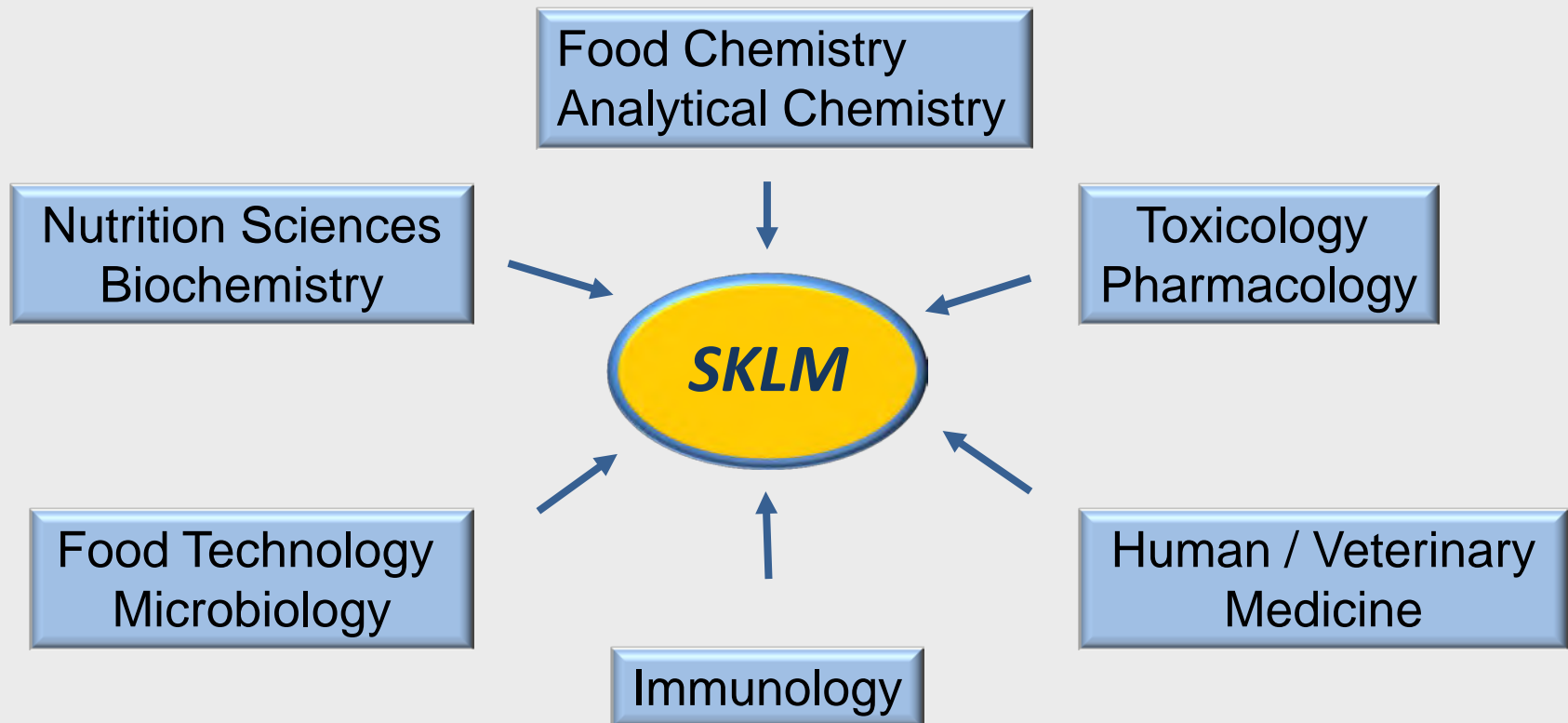
Way of working of the SKLM

- **advises DFG, parliaments, government and public authorities**
- **formulates opinions and recommendations**
- **works as an independent scientific institution**
- **not bound to any sort of directives**
regarding choice and prioritization of subjects in its working field
- **proposes topics of particular importance or resulting from requests**

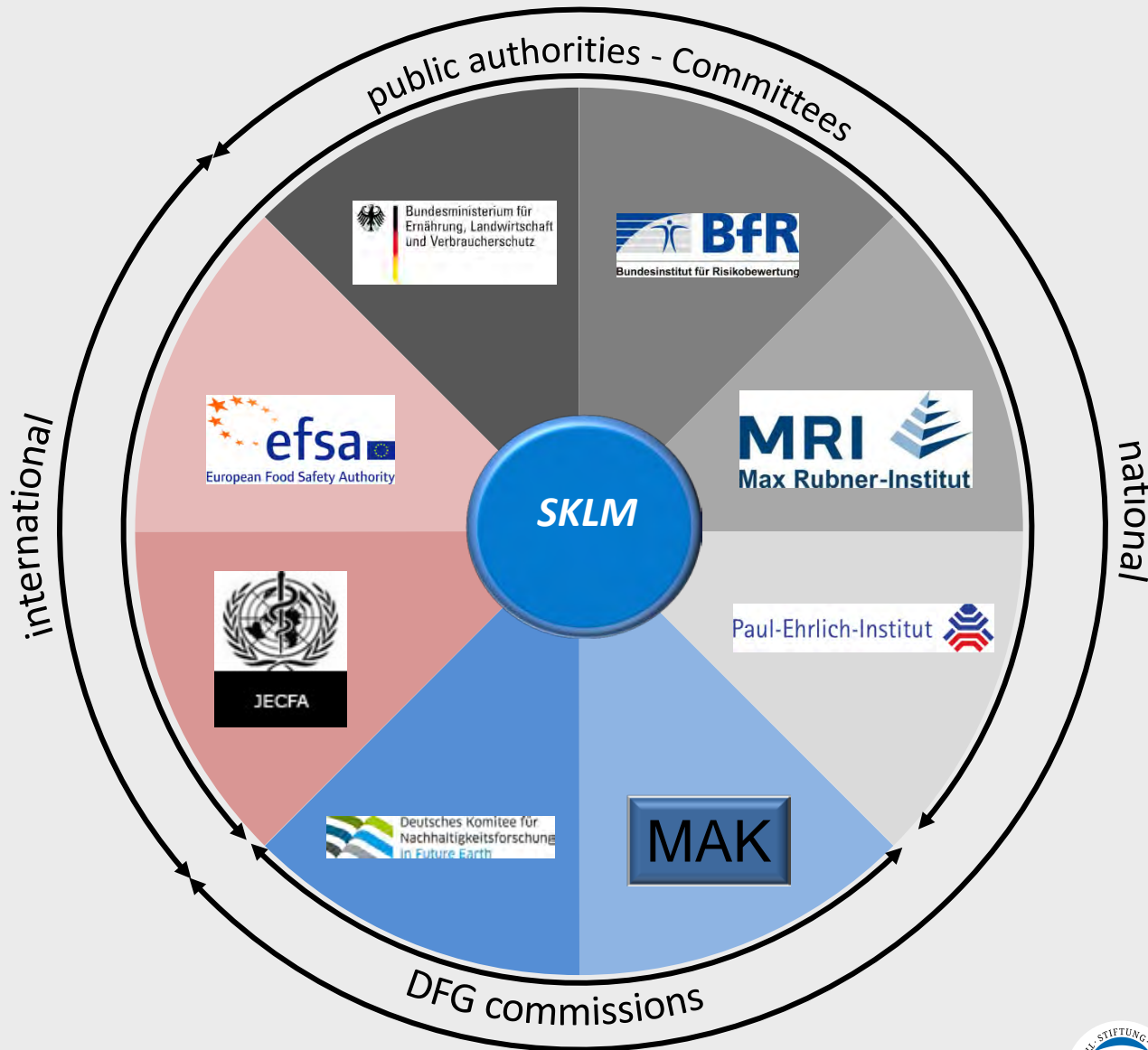
SKLM: professional disciplines involved

Plenary: 18 members and permanent guests (D / A / NL)

3 Working groups: members and invited experts



SKLM in exchange with





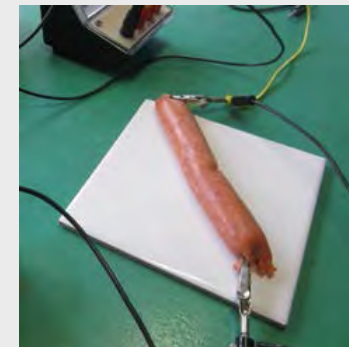
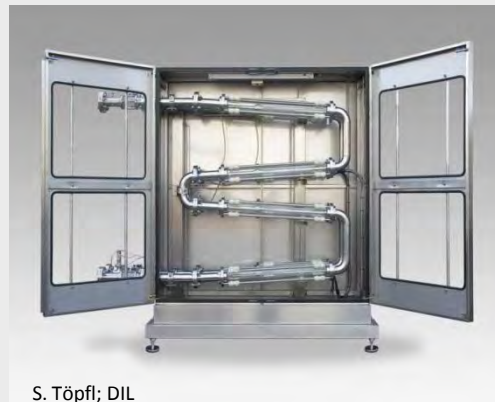
SKLM Working Group on Food Constituents

- Thermally induced compounds (e.g. acrylamide, acrolein)
- Natural food ingredients (e.g. furanocoumarins)
- Functional food (e.g. phytosterol oxidation products)
- Food supplements (e.g. isoflavones, red rice)
- Contaminants (e.g. mycotoxins, pyrrolizidine alkaloids)



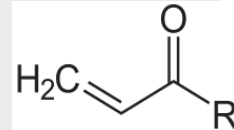
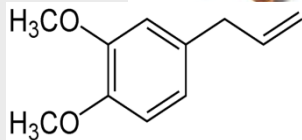
SKLM Working Group on Food Technology and Safety

- **Evaluation of novel food processing technologies**
(high pressure, pulsed electric field, plasma or ohmic heating)
 - **regarding e.g. microbial contamination, process contaminants, allergenicity**
- **Issues of basic relevance (e.g. the concept of history of safe use, microbial food cultures)**
- **Evaluation of combined processes (e.g. high pressure with high temperature)**



Joint SKLM/ MAK Working Group on Genotoxic Carcinogens

- „Joint venture“ with the DFG Permanent Senate Commission MAK*
- Risk assessment of genotoxic carcinogens
- Development of new strategies to evaluate the toxic effects of low doses of genotoxic carcinogens being present in foods and at the working place



*Senate Commission for the Investigation of Health Hazards of Chemical Compounds in the Work Area

SKLM basic statements/opinions

Development of new strategies or evaluation criteria

➤ Functional Food and Food Supplements

- Criteria for the evaluation (Symposium, Wiley-VCH 2004; www.dfg.de/sklm 2006)

➤ Risk Assessment of Phytochemicals in Food: Novel Approaches

- Transdisciplinary aspects and novel methodologies (PBBK, QSAR, OMICS) (Symposium, Wiley-VCH 2010)

➤ Risk-Benefit Analyses

- Thermal processing of food: Potential health benefits and risks (Symposium, Wiley-VCH 2007)
- Nitrate and nitrite in the diet: An approach to assess benefit and risk for human health (Molecular Nutrition and Food Research, 2015)

Nitrate and nitrite in the diet: An approach to assess benefit and risk for human health

- Ongoing controversy - potential detrimental versus beneficial health effects related to dietary nitrate and nitrite intake.
- Round table meeting - Experts from The Netherlands, Sweden, United Kingdom and USA were invited by the SKLM in November 2012 to discuss the benefit/risk aspects of dietary nitrate and nitrite.
- Review of the SKLM - with conclusions, identified gaps in knowledge and highlighted areas deserving further research

Nitrate and nitrite in the diet: How to assess their benefit and risk for human health

Michael Habermeyer¹, Angelika Roth¹, Sabine Guth¹, Patrick Die², Karl-Heinz Engel³, Bernd Epe⁴, Peter Fürst⁵, Volker Heinz⁶, Hans-Ulrich Humpf⁷, Hans-Georg Joost⁸, Dietrich Knorr⁹, Theo de Kok¹⁰, Sabine Kulling¹¹, Alfonso Lampen¹², Doris Marko¹³, Gerhard Rechkemmer¹¹, Ivonne Rietjens¹⁴, Richard H. Stadler¹⁵, Stefan Vieths¹⁶, Rudi Vogel¹⁷, Pablo Steinberg^{18} and Gerhard Eisenbrand¹*

Mol. Nutr. Food Res. 59: 106-128 (2015)

Effect of White Versus Red Meat on Endogenous N-Nitrosation

Risk???

in Human Colon and further Evidence of a Dose Response

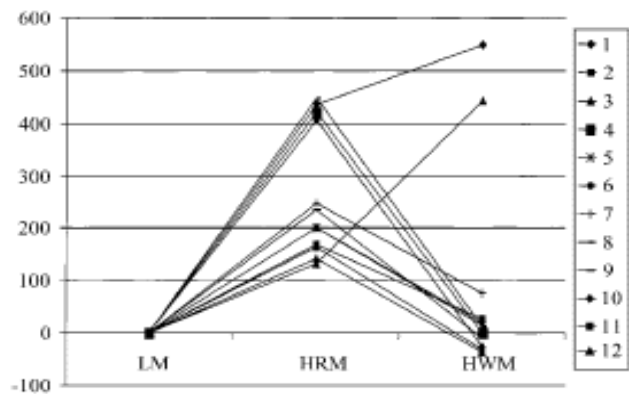


FIGURE 1 Individual changes in fecal ATNC concentration in 12 individuals fed a low-meat (60 g) diet, a high-red meat (420–600 g) diet and a high-white meat (420–600 g) diet. Subjects 1–7 were in group 1 (600 g meat), and subjects 8–12 were in group 2 (420 g meat).

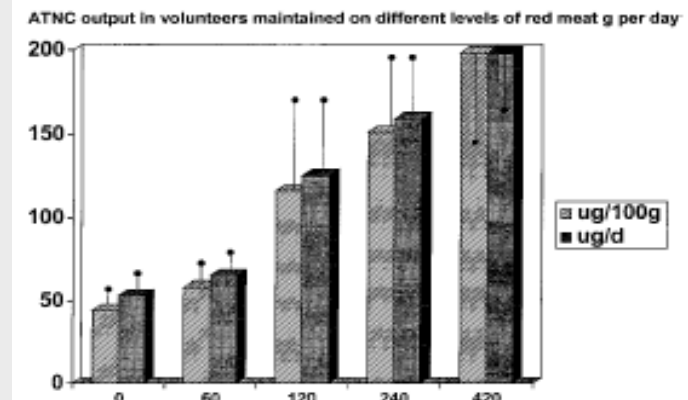
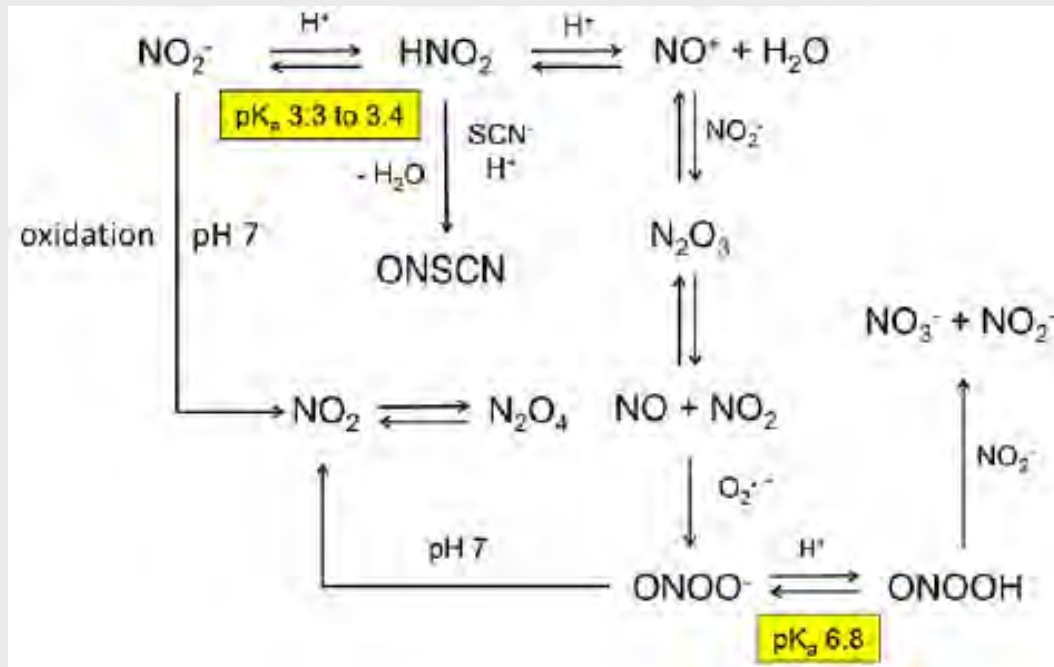


FIGURE 2 Dose response to 0, 60, 240 and 420 g of meat/d and to 120 g of meat/d (from reference 19 and this study). Eight subjects were studied at the 0-, 240- and 420-g level, 9 at the 120-g level and 17 at the 60-g level. Mean and SEM bars are shown.

Bingham, S.A. et al.; J. Nutr. 132: 3522S-3525S (2002)

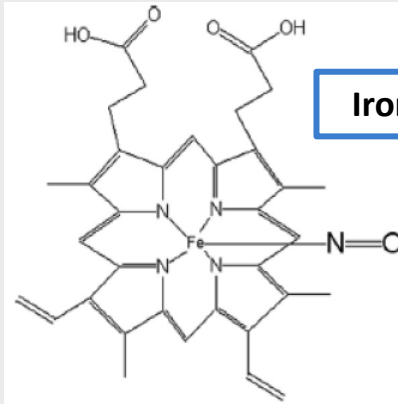
Metabolism of nitrite

Risk???

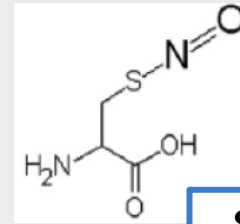


Secondary Targets of Nitrite-Derived Reactive Nitrogen Species
 d'Ischia et al., Chem. Res. Toxicol. 24: 2071-2092 (2011)

Risk???

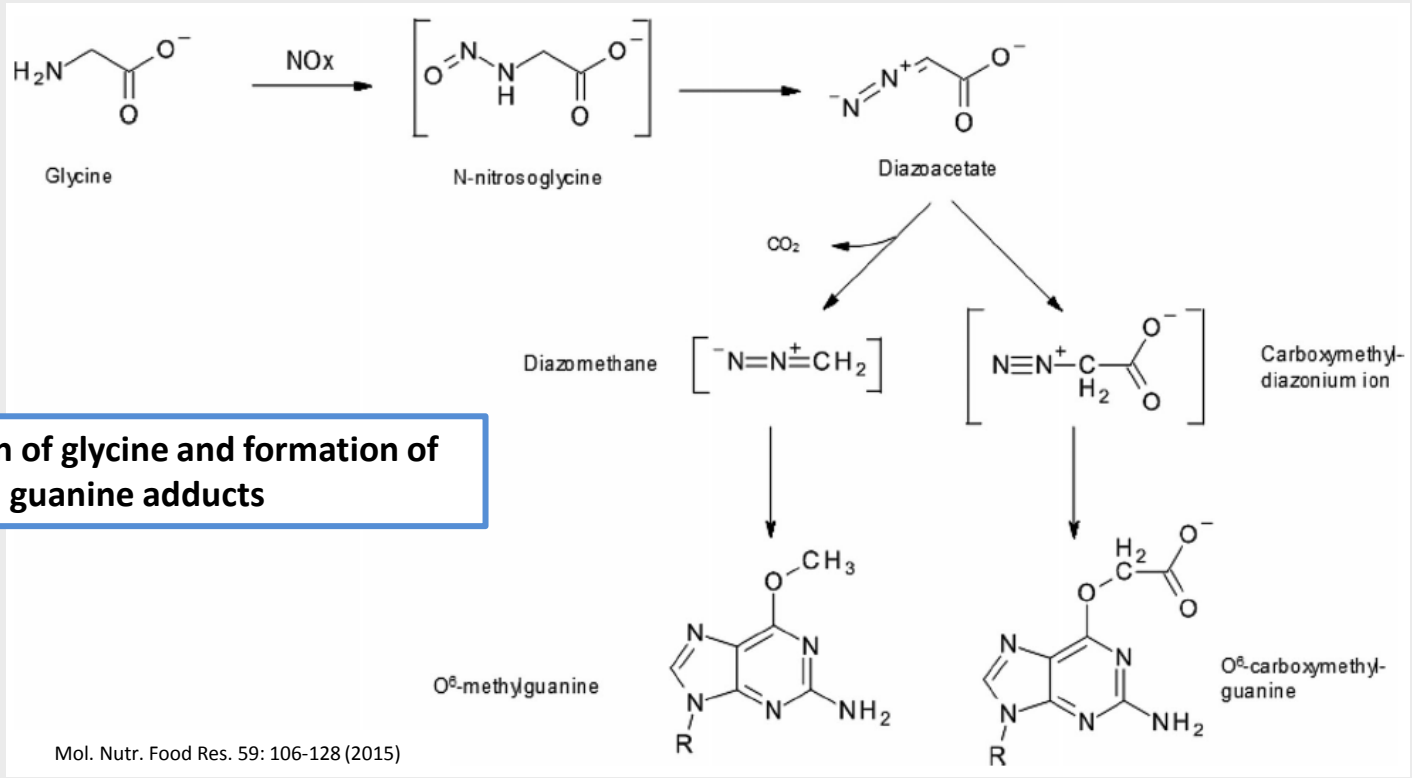


Iron nitrosyl heme



S-nitrosocystein

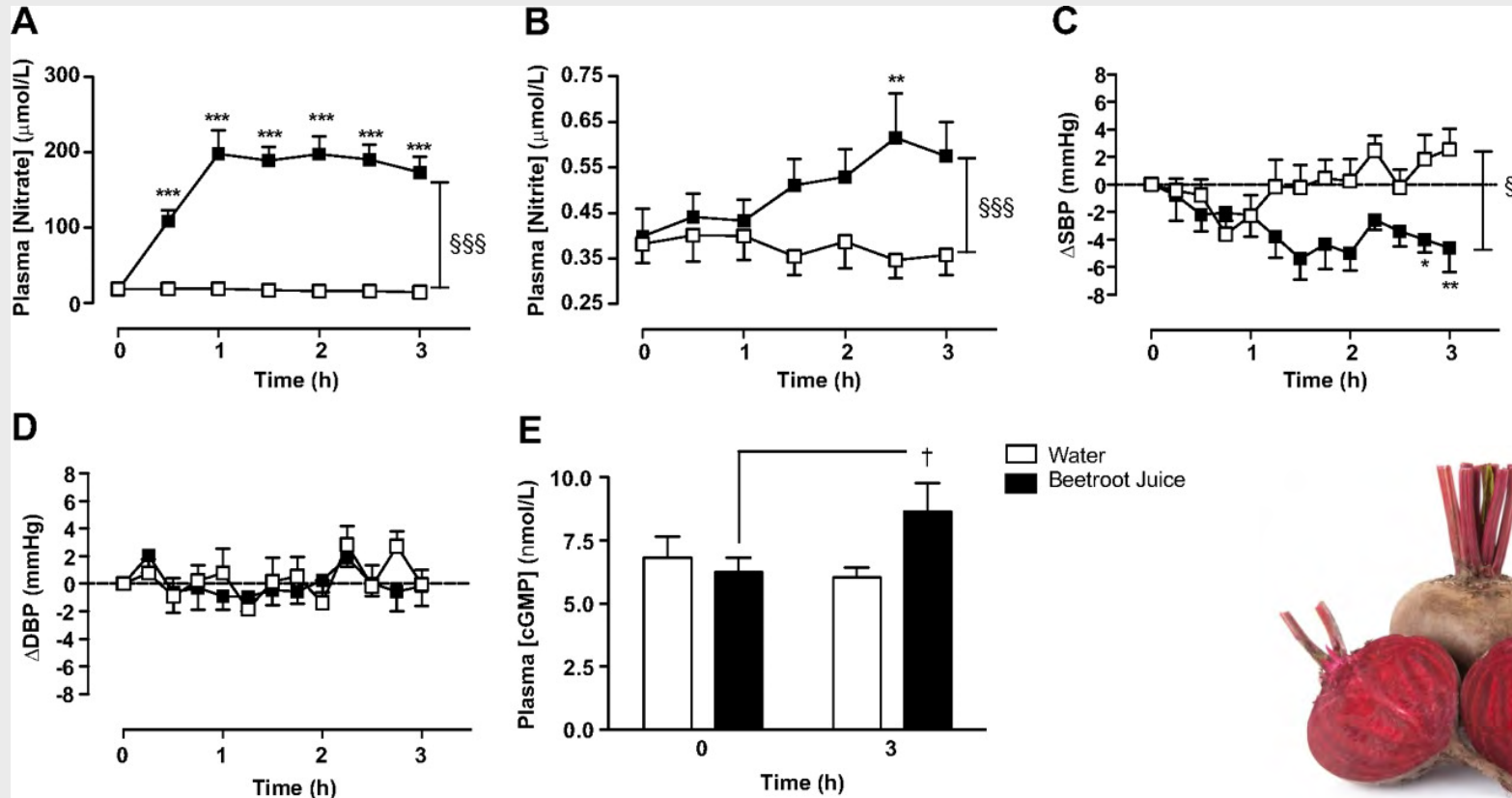
Nitrosation of glycine and formation of guanine adducts



Mol. Nutr. Food Res. 59: 106-128 (2015)

Inorganic Nitrate Supplementation Lowers Blood Pressure in Humans

Benefit???



Dietary nitrate supplementation with beetroot juice raises plasma nitrite and lowers BP.

The effects of 250 ml beetroot juice with 5.5 mmol of nitrate or water control on circulating plasma nitrate (A), nitrite (B), cGMP (E), SBP (C) and DBP (D)

Kapil, V. et al.,
Hypertension 56: 274-281 (2010)

Nitrate and nitrite in the diet: An approach to assess benefit and risk for human health

The SKLM Opinion: Research Needs and Knowledge Gaps

- minimal doses of nitrate that reduce blood pressure?
- nitrosation kinetics of amino compounds (precursors for carcinogenic NOC)
- relationship between NOC exposure \leftrightarrow cancer?
- biomarkers
- methods for reliable risk/benefit assessment
- updated database on human dietary intake of nitrate/ nitrite and NOC

Nitrate and nitrite in the diet:

An approach to assess benefit and risk for human health

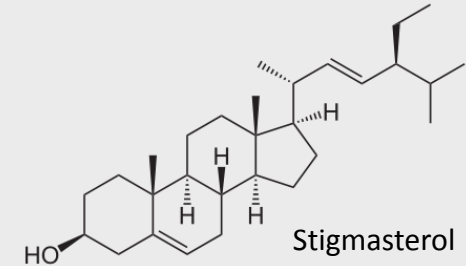
The SKLM suggests as an essential step:

- **Dietary intervention studies using appropriate biomarkers for detrimental or beneficial health effects**
 - in subpopulations with e.g. slight hypertension
 - **Proposed biomarker for beneficial effects: mean diastolic blood pressure**
 - a reduction of 5 mmHg is supposed to reduce the long-term risk of developing CVD
 - **Proposed biomarker for detrimental effects: urinary excretion of non-carcinogenic N-nitroso-amino acids**
 - to be considered: endogenous vs. exogenous N-nitrosation
- **Additional information needed:**
 - specific DNA adducts (in human blood leukocytes biopsy samples) or
 - specific transcriptomic responses as indicators of genotoxic damage

CVD: Cardiovascular diseases

Functional Food: Phytosterols/Phytosterolesters in Food

- **plant sterols: soy bean, wheat, corn, potatoes**
(e.g. stigmasterol, sitosterol, sitostanol, campesterol)
- **Advertising message: “cholesterol lowering properties”**
- **mimick cholesterol and compete with it for absorption**
- **scientific evidence from human studies:**
 - 1,6-3 g plant sterols can reduce LDL-cholesterol (by ~10%)
 - no additional benefit in taking more than 3g/day



Opinions of the SKLM in 2001 and 2007



2001: Use of Phytosterols and Phytosterolesters in Foodstuffs

- Only for persons increased serum cholesterol levels → appropriate declaration!
- Concerns:
 - specification of the phytosterol preparation (composition, purity, source, impurities)
 - influence on absorption of lipophilic nutrients (vitamins/carotinoids)
 - strong increase in the number of supplemented products



Approval of a large variety of plant sterol enriched foods in the EU

2007: 2nd Opinion on the Use of Phytosterols in Foodstuffs



SKLM affirmed its concerns:

- extended product range → exceeding of the recommended daily intake of 3g/d?
- Exposure of non-target populations (children, pregnant women)



Opinion on phytosterol oxidation products in foods: Analysis, occurrence, exposure and biological effects (2014)

- Undesirable reaction to be expected in products enriched with plant sterols
- Upon thermo-oxidative treatment: formation of phytosterol oxidation products (POPs)

Claim for risk-benefit analysis :

Influence on benefit? → Reduced cholesterol lowering properties of phytosterols upon oxidation

Additional risk? → Potential adverse effects of the POPs inherently present in enriched foods (proatherogenic properties ?)



Particularly in light of the potentially increasing dietary exposure to such compounds via consumption of foods enriched with plant sterols!

Phytosterol oxidation products in enriched foods:
Occurrence, exposure, and biological effects
Scholz B, Guth S, Engel KH, Steinberg P.
Mol Nutr Food Res. 2015 Jul;59(7):1339-52

SKLM Opinions on Isoflavones

- Isoflavones:
 - secondary plant constituents, e.g. soy and red clover
 - exhibit an **estrogenic activity**
- Advertising message:
 - **“for the relief of menopausal symptoms”**
- **Freely available** in pharmacies, health food shops, supermarkets and internet
 - Self-medication without medical supervision



SKLM Opinions on Isoflavones

- 2006 and 2009: Risk assesment by SKLM

Isoflavones as phytoestrogens in food supplements and dietary foods for special medical purposes

- Since 2009: New studies on humans have been published

→ in preparation by SKLM:

Evaluation of the impact of isoflavones on breast tissue and the thyroid system in humans

Focus on:

- clinical intervention studies: **pre.** vs **postmenopausal** women
- observational studies: **Asian** (high lifelong exposition)
vs. **Western** (often low exposition later in life)

Safety aspects concerning the production of food and food ingredients with insects as source

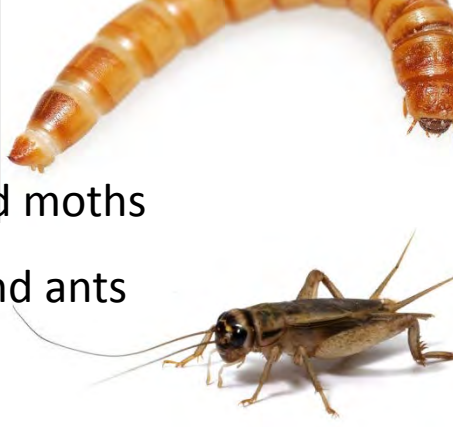
Rearing of mealworms in China



Mealworm for cookies



Insects as food:

- Eaten world-wide
 - Larvae of beetles and flies
 - Caterpillar of butterflies and moths
 - Imago of crickets, locusts and ants
- 
- The image shows two insects against a white background. At the top is a large, segmented, orange-brown mealworm, curved into a gentle arc. Below it is a brown cricket, shown from a side profile, facing left. The cricket has long antennae and six legs.
- Potential for sustainable food production
 - Alternative protein source
 - Alternative source of lipids and other components
 - High nutritional value

Safety aspects concerning the production of food and food ingredients with insects as source

Topics of discussion:

- Choice of insect species
- Microbial risk
- Risk of allergy
- Isolation of compounds
 - Are established technologies sufficient?
 - Demand for new technologies?
 - Enrichment of toxins?
 - Purity of fractions (e.g. separation of proteins from chitin)
 - Contamination with antinutritive compounds

Further activities: Organization of Symposia

- ❖ Functional Food: Safety Aspects (2002)
- ❖ Thermal Processing of Food: Potential Health Benefits and Risks (2005)
- ❖ Risk assessment of phytochemicals in food – novel approaches (2009)
- ❖ 1. Sino-German Symposium on “Challenges in food safety” (Nanchang, 2009)
- ❖ 2. Sino-German Symposium on “Challenges and perspectives in food safety”



(Beijing, 2013)

- ❖ New Challenges and Developments in Food/Consumer Safety (2015)

Publications in:

Web pages of the DFG
www.dfg.de/sklm



DFG SKLM Symposia
 Volumes (Wiley-VCH)



Peer-reviewed international journal
Molecular Nutrition and Food Research