

Raw milk and allergy prevention – a possible feature for organic milk?

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ORGANICS

for tomorrow's food systems

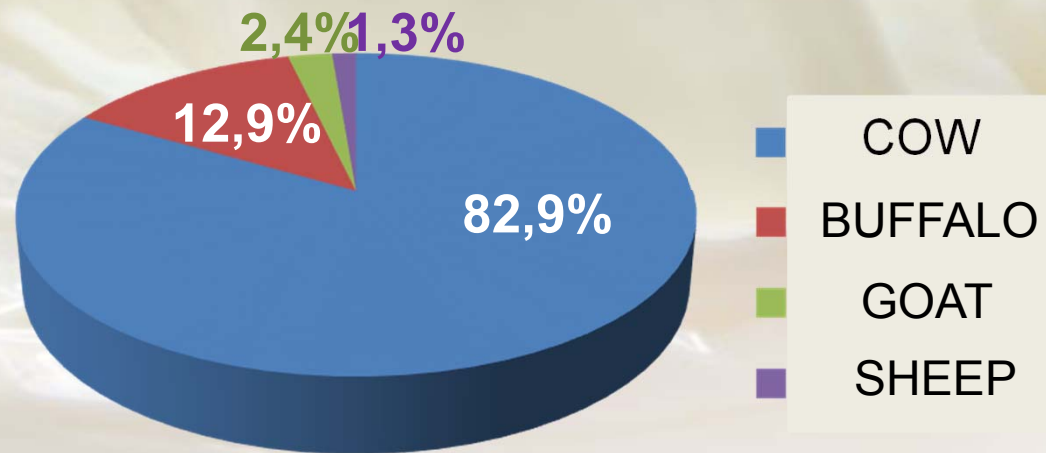


CONTENT



- Milk production, milk characteristics
- Hygiene hypothesis and raw milk
- Raw milk: benefits and hazards
- Raw milk as a carrier for antiallergic properties
- Native milk ingredients: technological challenges and possible solutions
- Assessment of milk categories (suitability to serve as a source for antiallergic compounds)
- Conclusions & outlook

MILK PRODUCTION



Sources: IDF, AMA (2012);
Data Agriculture and Rural Development, EC

MILK

....is an opaque white or bluish-white liquid secreted by the mammary glands of female mammals, serving for the nourishment of their young *)

Fat globules



Casein micelles



Whey proteins

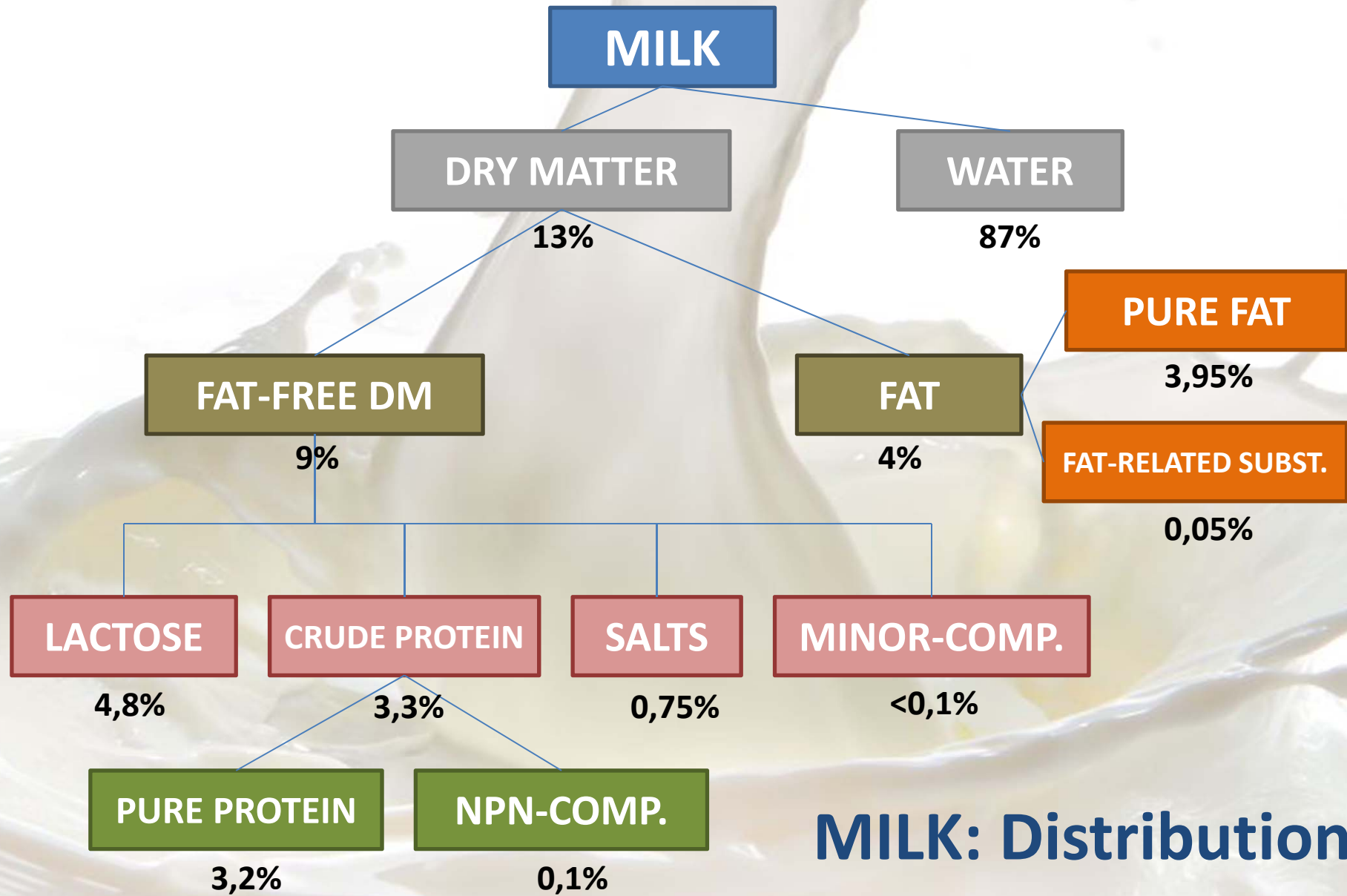


....is an EMULSION, a SUSPENSION, a COLLOIDAL SOLUTION
and a COLLOIDAL DISPERSION



Lipoprotein particles

*) Definition according to Oxford Dictionaries



MILK: Distribution of components

Source: Jenness/Patton (1967)

**Milk is a powerful source
for**



PROTEIN

CALCIUM

VITAMINS

**MINOR COMPOUNDS
WITH ANTIALLERGIC
POTENTIAL?**



WHY

**MINOR COMPOUNDS
WITH ANTIALLERGIC
POTENTIAL?**

Family size, infection and atopy: the first decade of the “hygiene hypothesis”



David P Strachan

Department of Public Health Sciences, St George's Hospital Medical School,
London SW17 0RE, UK

Introductory article

The magnitude of the effect of smaller family sizes on the increase in the prevalence of asthma and hay fever in the United Kingdom and New Zealand

K Wickens, J Crane, N Pearce, R Beasley

Does Living on a Farm during Childhood Protect against Asthma, Allergic Rhinitis, and Atopy in Adulthood?

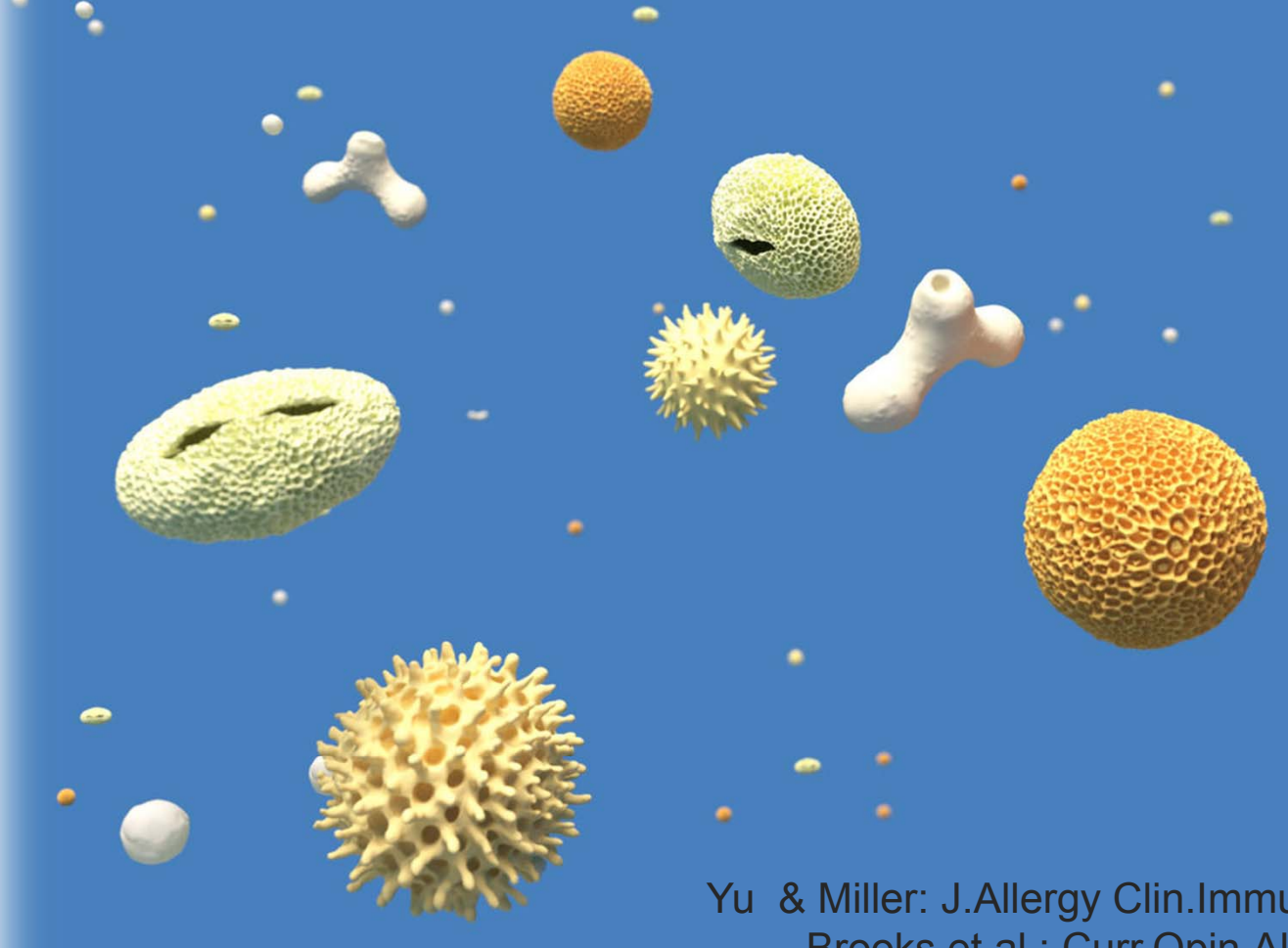
BÉNÉDICTE LEYNAERT, CATHERINE NEUKIRCH, DEBORAH JARVIS, SUSAN CHINN, PETER BURNEY,
FRANÇOISE NEUKIRCH, on behalf of the European Community Respiratory Health Survey

INSERM Unité 408, Paris, France, and Department of Public Health Sciences, King's College, London, United Kingdom



Am. J. Resp. Crit. Care Med. (2001) 164: 1829

**„Hay fever is a post industrial
revolution epidemic“**



Yu & Miller: J.Allergy Clin.Immunol. (2016)
Brooks et al.: Curr.Opin.Allergy (2013)
Schaub et al.: Curr. Rev. Allerg. Clin. Immunol. (2006)

What is asthma?



„Asthma is an immune-mediated inflammatory condition characterized by increased responsiveness to bronchoconstrictive stimuli“

...atopic and non-atopic asthma...

Openshaw et al.: JACI (2004) 114:1275-1277

Children living on a *farm* were at significantly reduced risk of *asthma*

Inverse association of *raw farm milk* consumption with *asthma and allergy* in rural and sub-urban populations across Europe

Waser et al.: Clin. Exp. Allergy (2006) 37: 661-670

von Mutius & D. Vercelli: Nature Rev. Immun. (2010)10: 861-867

Loss et al., JACI (2012) 128: 766-773e4

Illi et al., JACI (2012) 129:1470-1477

van Neerven et al.: JACI (2012) 130:853-858



2006-2010; 150 scientists from 14 countries,
80.000 school-aged children from rural areas,
samples from 8.000 subjects, 800 milk samples,
numerous environmental samples

„.....the dramatic increase in the incidence and severity of allergy and asthma has been proposed to be linked with an altered exposure to, and colonization by, micro-organisms, particularly in early life.....however, it is likely that multiple environmental factors with currently unrecognized interactions contribute to the atopic state...“



Frey et al.: Allergy 67:451-461 (2012)

DISINFECTION
DECONTAMINATION



DISINFECTION
CLEANLINESS

TODAY'S TRENDS

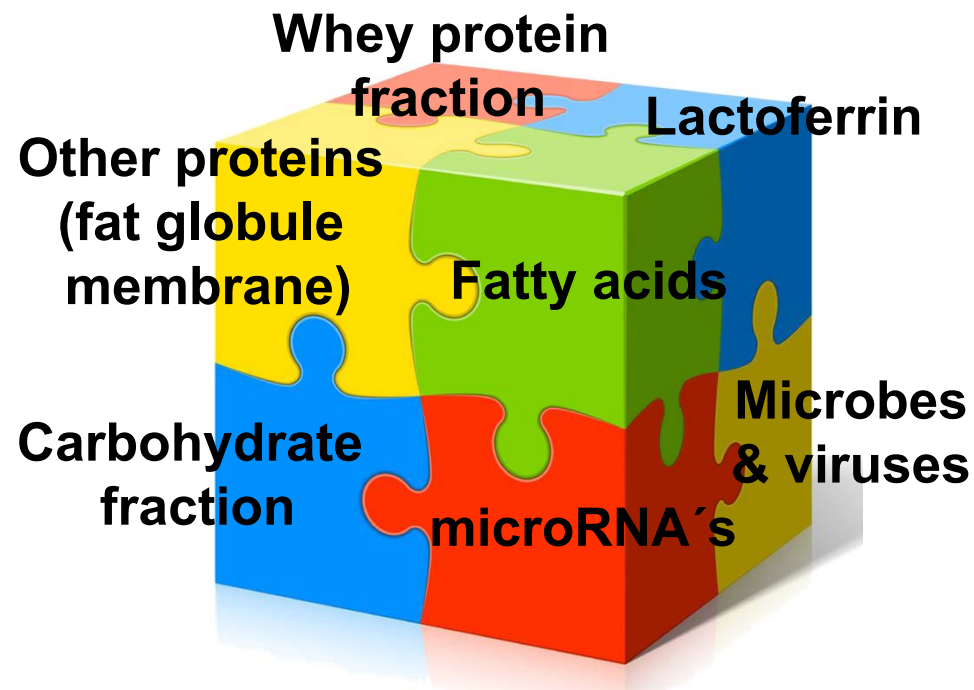
...the opposite



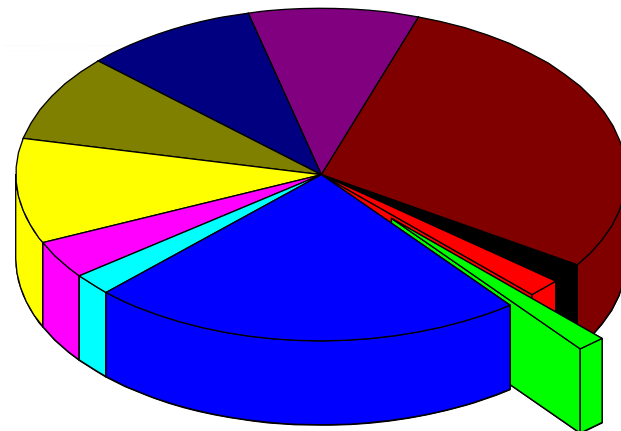
Why raw farm milk?



Raw milk? (with native and/or? heat-sensitive ingredients? and/or? contaminants?) possesses beneficial? function? in allergy/asthma prevention?



BUT: Raw milk may bear the hazard of being a vector for pathogens






1,5%

- Vegetables
- Cheese
- Dairy products other than cheese
- Eggs
- Bovine meat
- Broiler meat
- Pig meat
- Fish and sea food
- Buffet meals
- Bakery products
- Other



EFSA statements regarding outbreaks related to raw milk consumption in the E.U.

- Consumers' **interest in drinking raw milk** has been growing, as many people believe it has health benefits.
- Sales of raw drinking milk through vending machines is permitted  in some member states, but consumers are usually instructed to **boil the milk before consumption**.
-  The EFSA BIOHAZ Panel concludes that **raw milk** can be **a source of harmful bacteria** like *Campylobacter*, *Salmonella* and Shiga-toxin producing *E. coli*, but also of tick-borne viruses etc.
-  **Between 2007 and 2013, 27** outbreaks due to raw milk consumption were registered.

Outbreaks related to raw milk consumption in the U.S. - examples



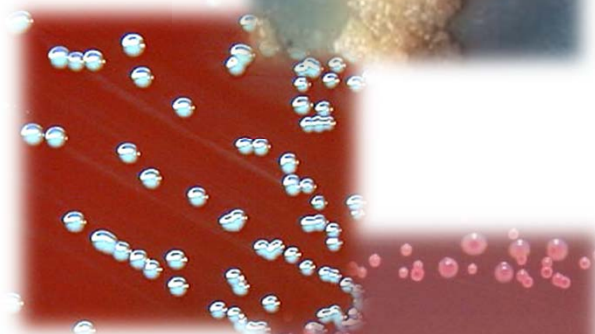
Outbreak	Source	Location, Time
Cryptosporidiosis	Raw cow's milk	Tennessee, 2015
Campylobacteriosis	Raw goat's milk	California, 2015
Campylobacteriosis	Raw cow's milk	California, 2015
Listeriosis	Raw cow's milk	California, 2014
EHEC 0157:H7	Raw cow's milk	Kentucky, 2013
Campylobacteriosis	Raw cow's milk	Pennsylvania, 2013

Microbiological raw milk hazards: what else?

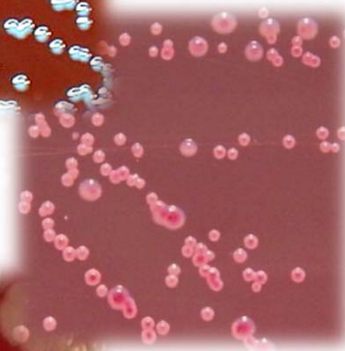
Mycobacterium tuberculosis



Brucella melitensis



Yersinia enterocolitica



Cronobacter sakazakii





Is a relatively low incidence of raw milk-related outbreak cases acceptable

NO - JUST ONE SINGLE CASE IS ONE CASE TOO MUCH !

The 'evolution' of raw milk microbiota



Yeasts & Molds
Endospore formers
Pseudomonades

airborne



faeces-borne

E.coli
Enterococcus
Campylobacter
Listeria monocyt.
Salmonella
Mycobacterium
Viruses



udder-borne

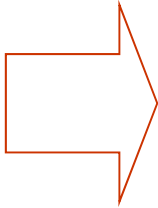
Micrococcus
Staphylococcus
Streptococcus
Lactococcus
Enterococcus



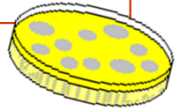
Pseudomonas
Corynebacterium
Enterobacteria
Endospore formers
Staphylococcus



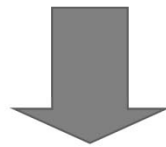
surface-borne



**1.000 – 5.000
CFU/ml**



**Milk may be utilized
as a nutritious substrate
by many (micro)organisms and
by almost
every pathogen**



- 1. Is there a way to produce raw milk, which is fully safe?**
- 2. Is it possible to produce (and to process?) milk still containing all relevant (?) ingredients and that is totally safe to the consumer?**

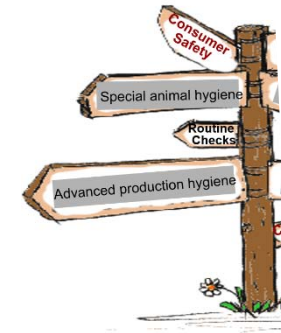


LEFT HAND SIDE RIGHT HAND SIDE

Where to go?



Hurdles for Large-Scale Production of High Quality Raw Drinking Milk *(left hand side branch)*



- Infrastructure problems (large herd, control, filling/packaging on site)
- Expenditure for veterinary surveillance programmes
- Gaps in the surveillance net and no 100% safety (?)
- Inadequate microbial testing procedures (standards, detection limits, time...)
- Distribution logistics (cold chain, timing, shelf-life)
- Consumer preferences, convenience

Right hand side branch

**Pasteurized milk is safe,^{*)}
but those compounds that may exert
beneficial effects **are reduced or inactivated****

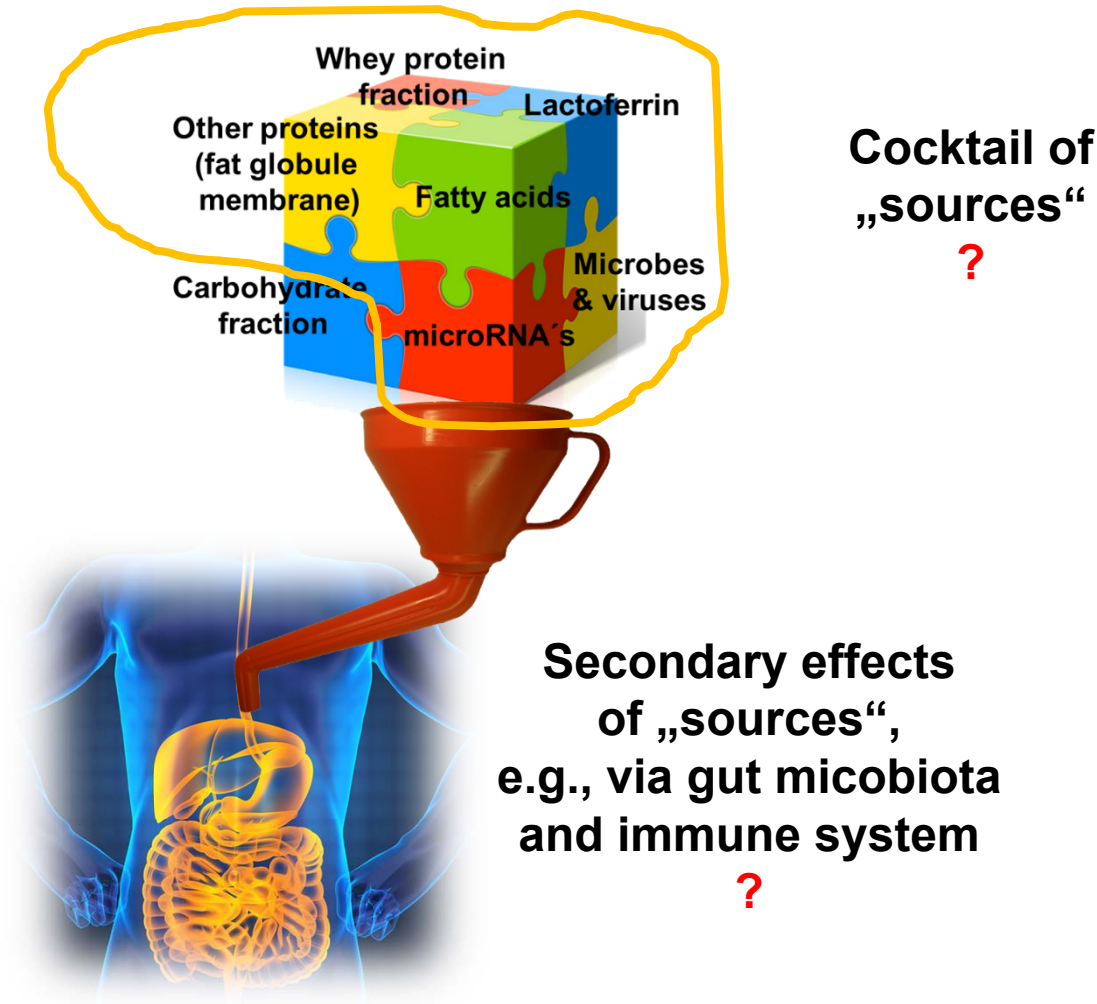


**Procedures like pasteurisation and
homogenisation induce **changes^{**)}** in milk
composition**

***) with the exception of milk protein allergies**

****) e.g., ESL milk and past. milk: changes largely depend on the various technologies applied**

Native milk compounds under observation/speculation for exerting special effects



3 Milk categories as „points of interest“

PREREQUISITES



MONITORING

- Animal health (veterinary)
- Primary production
- Collection system
- Product manufacturing

Colostrum

or

Conventional *raw* milk

or


Organic *raw* milk

as it is

a fraction thereof

Assessment of „substrate“:

Colostrum

PRO	CON
<ul style="list-style-type: none">• Distinctly higher levels of Lactoferrin• Elevated levels of IgG, IgA, IgM and BSA• Higher levels of minor proteins (enzymes & enzyme inhibitors) and growth factors• Higher cytokine levels• Higher fat levels• Lower SCFA levels• Higher LCFA levels• High in Ca• Partly higher in vitamins• Higher somatic cell counts	<ul style="list-style-type: none">• Highly transient and variable composition• Variable microbiological quality• Collection systems not well-advanced yet• Different legal situation (1662/2006)• Novel Food (?) discussion 

Assessment of „substrate“:


Conventional raw milk

PRO	CON
<ul style="list-style-type: none">• Well-established production and collection systems• Continuous availability• Microbiological quality usually constantly high• Composition partly controllable (e.g., feed)	<ul style="list-style-type: none">• Lower levels of relevant (?) substances• Protective ingredients need to be augmented• Limited sustainability

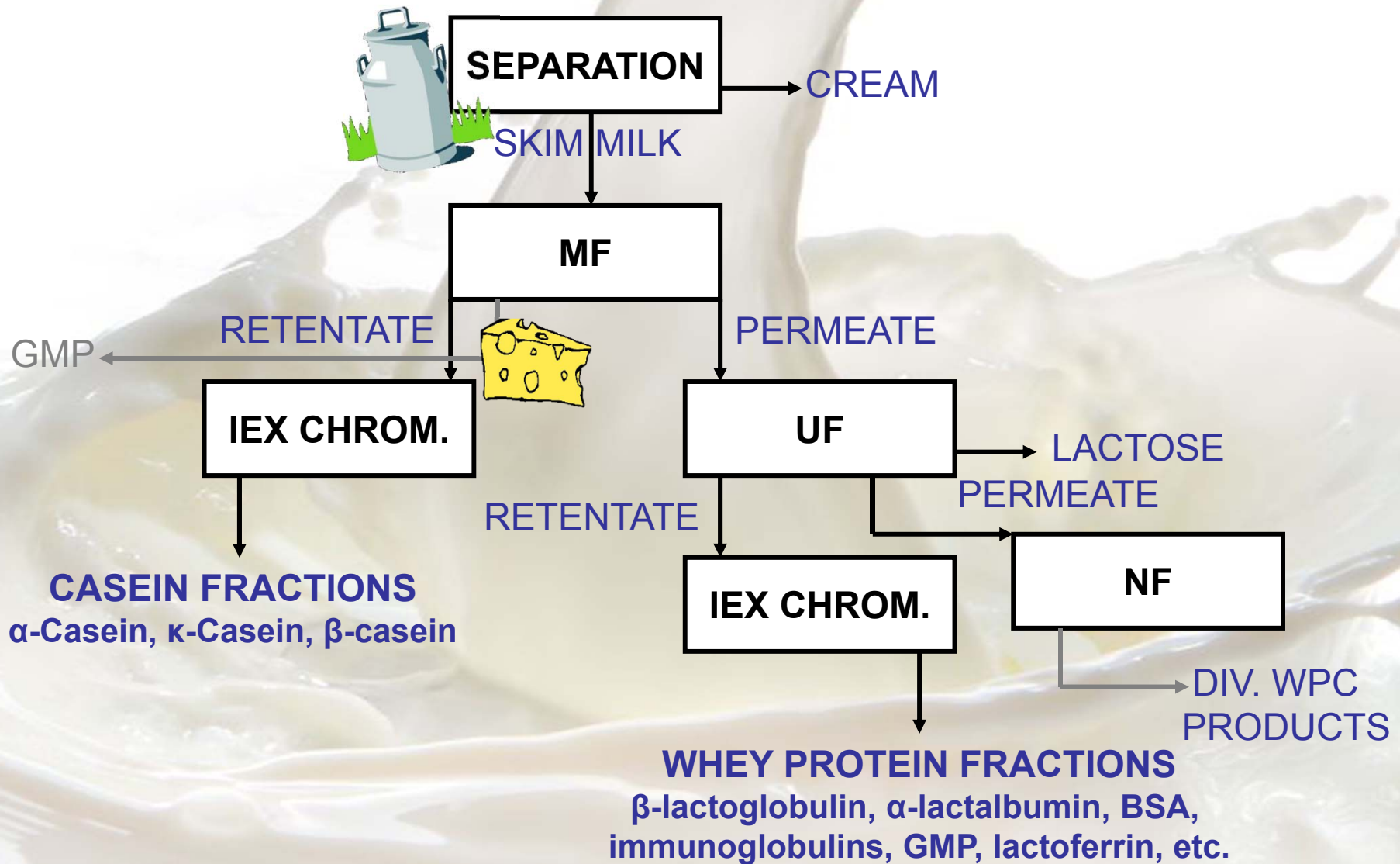


Assessment of „substrate“:

Organic raw milk

PRO	CON
<ul style="list-style-type: none">• Follows sustainability concepts• Animal welfare prioritized• Regionality• Special feeding regimes• Fatty acid profile of higher nutritive value• Microbiological quality mostly high• Restricted exposure to antibiotics in livestock production• Collection systems are established• Higher consumer perception	<ul style="list-style-type: none">• Lower levels of relevant (?) substances (excl. Ω3-FA)• Protective (?) ingredients need to be augmented 

...the technology (simplified)

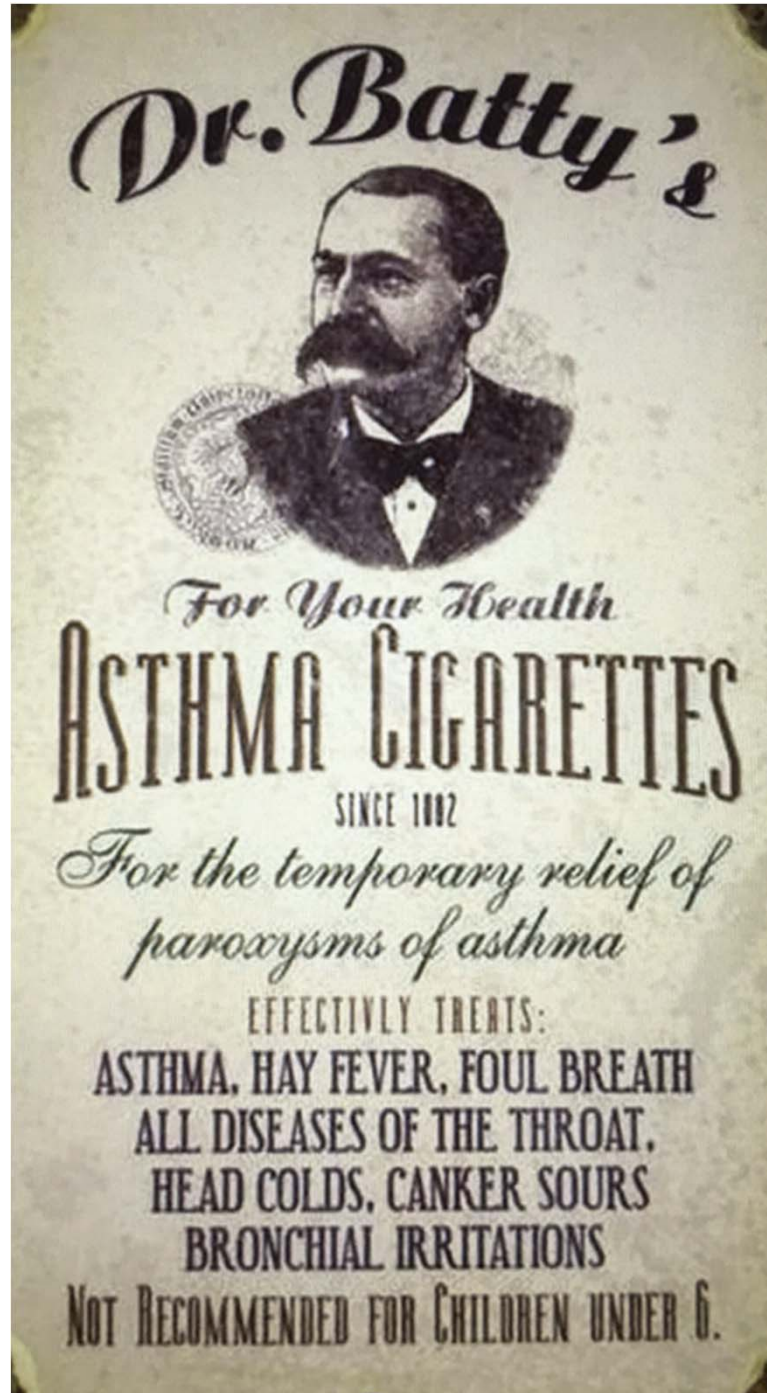





Conclusions and outlook

- **(Raw) milk obviously plays an important role as a carrier of (some) protective factors**
- **Asthma protection effects are most probably not only correlated with single compounds and/or elements**
- **There seem to be multiple effects involving human genetic, environmental as well as nutrition-related factors**
- **Studies are needed to prioritize within such a 'cocktail' of factors/compounds in an epidemiological context**
- **It should be clarified which kind of milk treatment is possible in order to maintain the native status of the compounds considered but also to ensure milk safety**
- **Clinical (cohort) studies are needed to verify if (raw) milk possesses some higher protection potential than conventional milk**
- **Raw organic milk and colostrum may be envisaged as interesting and contemporary vectors for compounds modulating the immune system**

Any alternatives?



Dr. Batty's



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Great Britain, 1890



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