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Reductionist versus holistic paradigms in nutrition science

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IUNS 21st ICN International Congress of Nutrition “From Sciences to Nutrition Security”



Sociedad Argentina de Nutrición



IUNS

INTERNATIONAL UNION OF
NUTRITIONAL SCIENCES

Buenos Aires, Argentina, 15-20 October 2017

Sheraton Buenos Aires Hotel & Convention Center

Technical Secretariat:
Fase20
Fase 20 Argentina
Calle. Arenales 843. Piso 2 departamento 7 RETIRO
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SMOKE
FREE
EVENT



144/105 - Nutrition Science at a Cross-Road

“Reductionist versus Holistic paradigms in Nutrition Science”



Anthony FARDET

Research scientist in Preventive & Holistic Nutrition

INRA - Unit of Human Nutrition

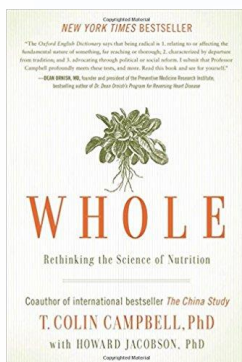
Clermont-Ferrand, France



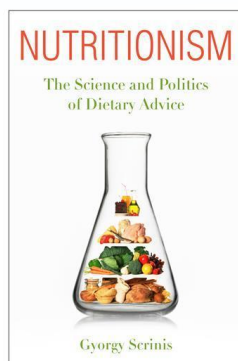
Conflict of Interest Disclosure

I have no conflict of interest to report in relation to this presentation.

A bibliographic basis



T. Colin Campbell



Gyorgy Scrinis

Campbell, C.T., Jacobson, H., **2013**. *Whole: Rethinking the Science of Nutrition*

Scrinis, G., **2013**. *Nutritionism - The Science and Politics of Dietary Advice* Columbia University Press

Toward a New Philosophy of Preventive Nutrition: From a Reductionist to a Holistic Paradigm to Improve Nutritional Recommendations¹

Anthony Fardet* and Edmond Rock

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Fardet, A., Rock, E., **2015**. *From a reductionist to a holistic approach in preventive nutrition to define new and more ethical paradigms. Healthcare* 3, 1054-1063.

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Fardet, A., **2015**. *Complex foods versus functional foods, nutraceuticals and dietary supplements: differential health impact (Part 2). Agro Food Industry Hi-Tech* 26, 20-22.

Fardet, A., Rock, E., **2014**. *The search for a new paradigm to study micronutrient and phytochemical bioavailability: from reductionism to holism. Medical Hypotheses* 82, 181-186.

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Fardet, A., Rock, E., **2014**. *Toward a new philosophy of preventive nutrition: from a reductionist to a holistic paradigm to improve nutritional recommendations. Advances in Nutrition* 5, 430-446.

« Stop ultra-processed foods!
Eat true

Dr Anthony Fardet

HALTE AUX
ALIMENTS ULTRA
TRANSFORMÉS!
MANGEONS
VRAI

3
RÈGLES D'OR
POUR MANGER
SAIN, ÉTHIQUE,
DURABLE

THEBBY
SOLIGNAC
ÉDITIONS

Anthony Fardet

The reductionist paradigm: a more Western approach

“In the sciences, application of methodological reductionism attempts explanation of entire systems in terms of their individual, constituent parts and their interactions”



Linear cause-effect relationship

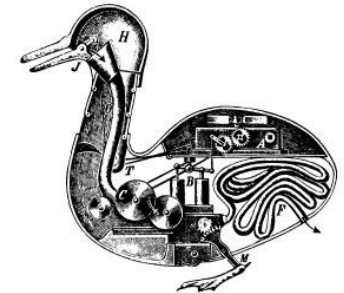
$$2 = 1+1$$

In nutrition : e.g., linear relation:

- 1) between saturated fats, dyslipidemia and coronary heart diseases
 - 2) between calcium, bone density and fracture risk
 - 3) sugars, hyperglycemia, insuline resistance and type 2 diabetes
- Etc.



Descartes held that non-human animals could be reductively explained as automata - *De homine*, 1662.



de Vaucanson's Deck

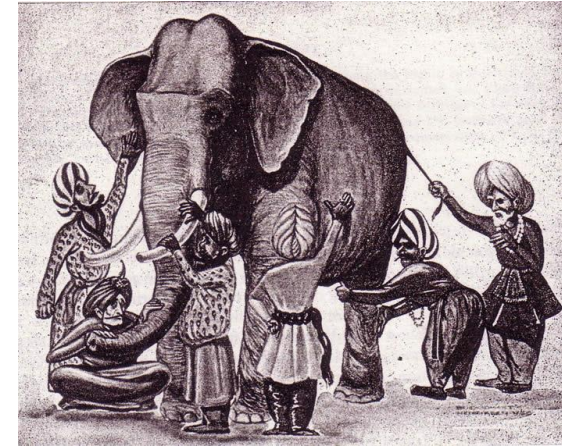
The holistic paradigm: a more oriental approach

Holism (from Greek holos "all, whole, entire") is the idea that natural systems and their properties should be viewed as wholes, not as collections of parts. This often includes the view that systems function as wholes and that their functioning cannot be fully understood solely in terms of their component parts



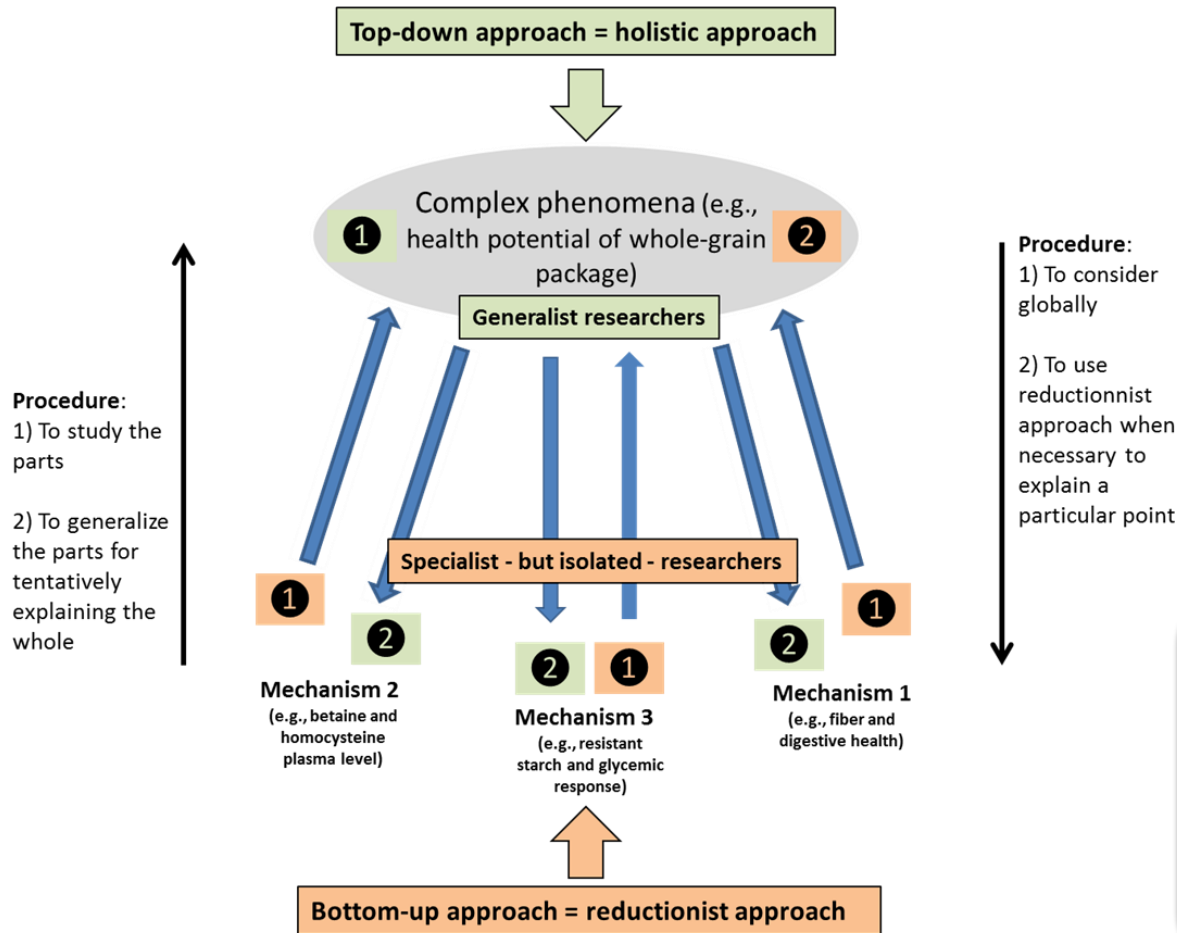
Non linear multicausal cause-effect relationship

$$2 > 1+1$$



Parable of the blind men and elephant

Holism *versus* Reductionism



Fardet, A., Rock, E., 2014. **Toward a new philosophy of preventive nutrition: from a reductionist to a holistic paradigm to improve nutritional recommendations.** *Advances in Nutrition* 5, 430-446.

Reductionism: a brief history of Western nutrition

The period of « **quantifying nutritionism** » :

- ≈1850-1950: controlled by research scientists
- Discovering and quantifying nutrients, and the needs of the body
- Preventing nutritional deficiencies
- The caloric approach



The period of « **good-and-bad nutritionism** » :

- ≈1960-1990: controlled by governmental organisms
- Good and bad nutrients to be limited or encouraged
- Negative messages dominate ("low-fat campaign" in the USA)
- Reducing the risk of chronic diseases

The period of « **functional nutritionism** » :

- ≈1995 up today: controlled by agro-food industry
- More positive messages for body health
- Focus on functional nutrients

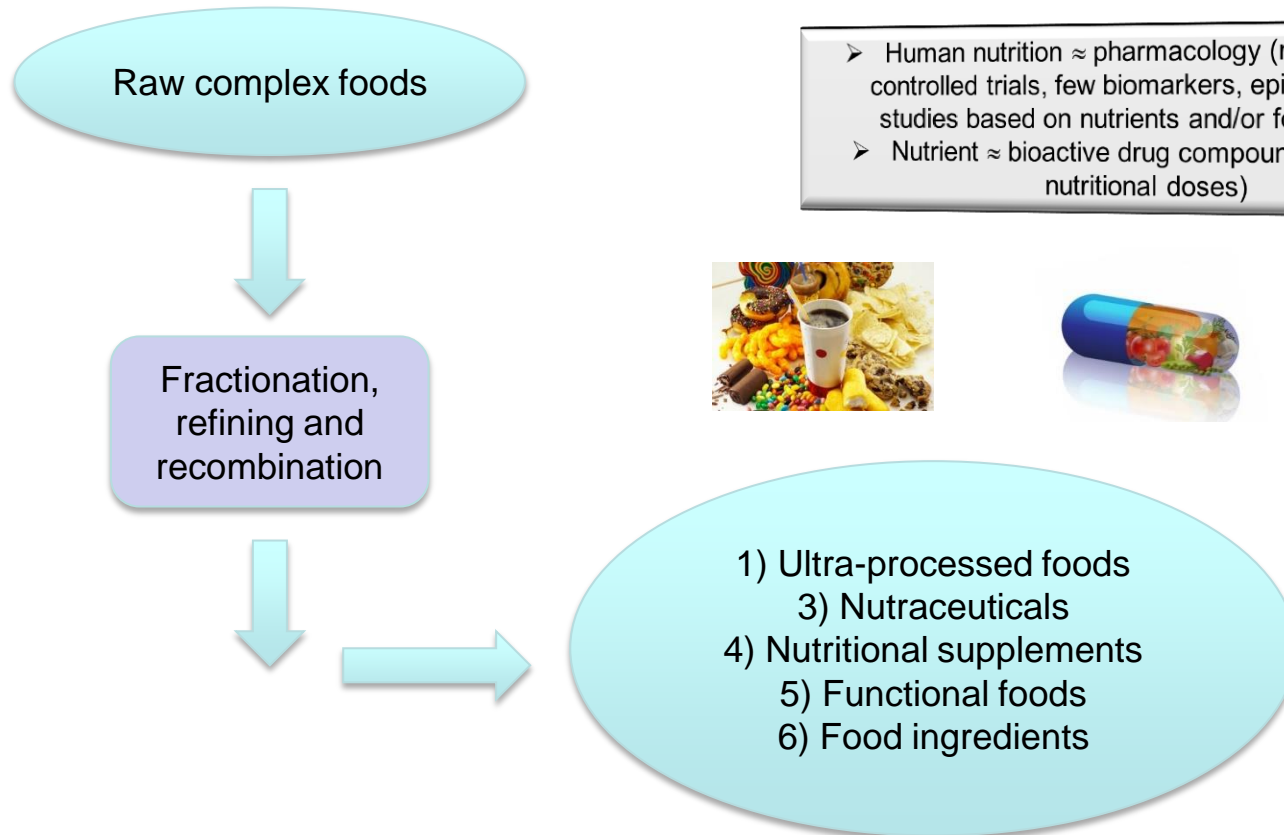
NUTRITIONISM

The Science and Politics
of Dietary Advice

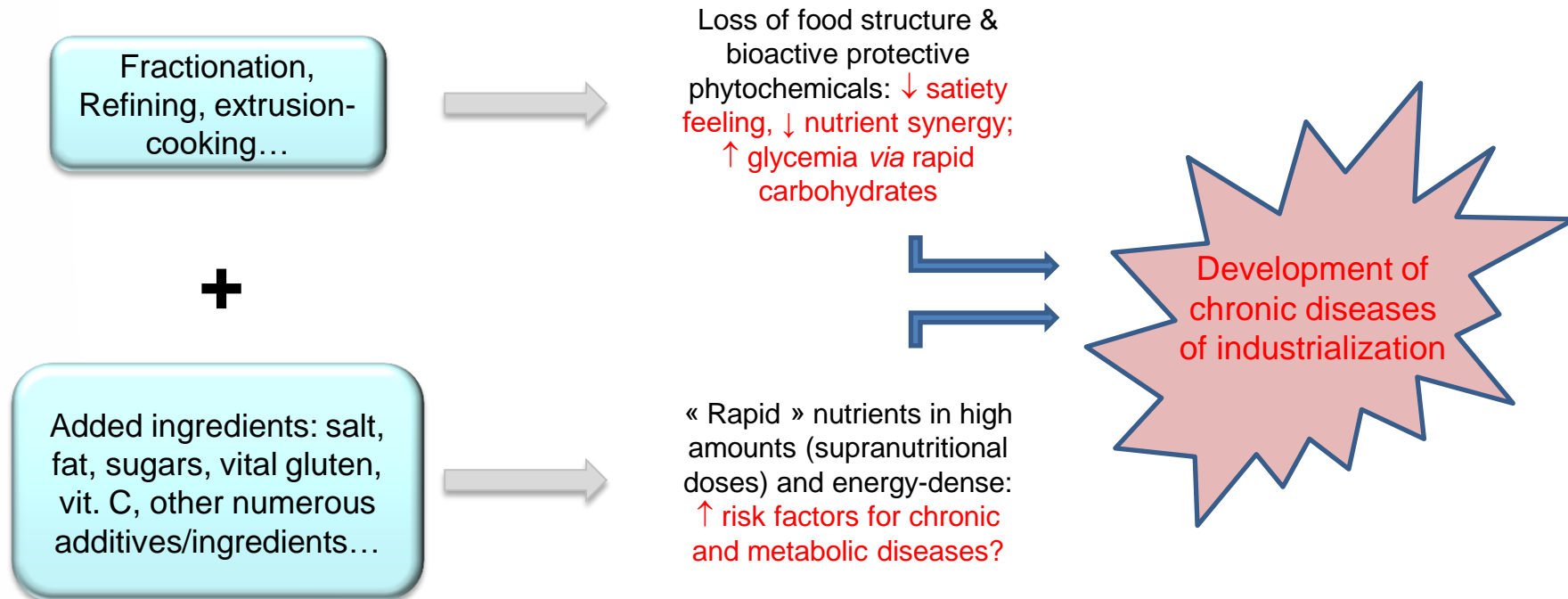


Gyorgy Scrinis

Reductionism, Processing, Food Science & Nutrition



Reductionism, Processing, Food Science & Nutrition



Reductionism & Nutritional recommendations

- **Recommendations based on nutrients:** a failure
 - « low-fat » & « low-GI » campaigns
 - Cholesterol and SFA: Dogmas today challenged
- **Recommendations based on food groups:** a partial failure
 - PNNS : 5 fruits & vegetable/day...
 - Food pyramids
- **Major problem of these recommendations:** they consider the food only on the basis of its nutritional composition
- **While the basic paradigm is partial and does not reflect reality, it can only produce disappointing results**

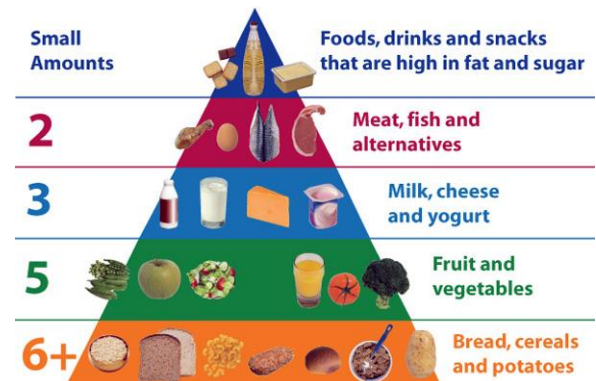
Reductionist
French
recommendations



Holistic Brazilian
recommendations



Reductionist food pyramid



Holism vs Reductionism in the cereal sector

Cereal products & **Reductionism** :

- Selection/breeding of wheat species for a single character
- Reduction of the number of species
- Grain fractionation & flour refining
- Ingredients & bioactive isolation : fibre + gluten + starch + bran + germ + polyphenols + aleurone +... then recombination
- Added salt, sugar & fat

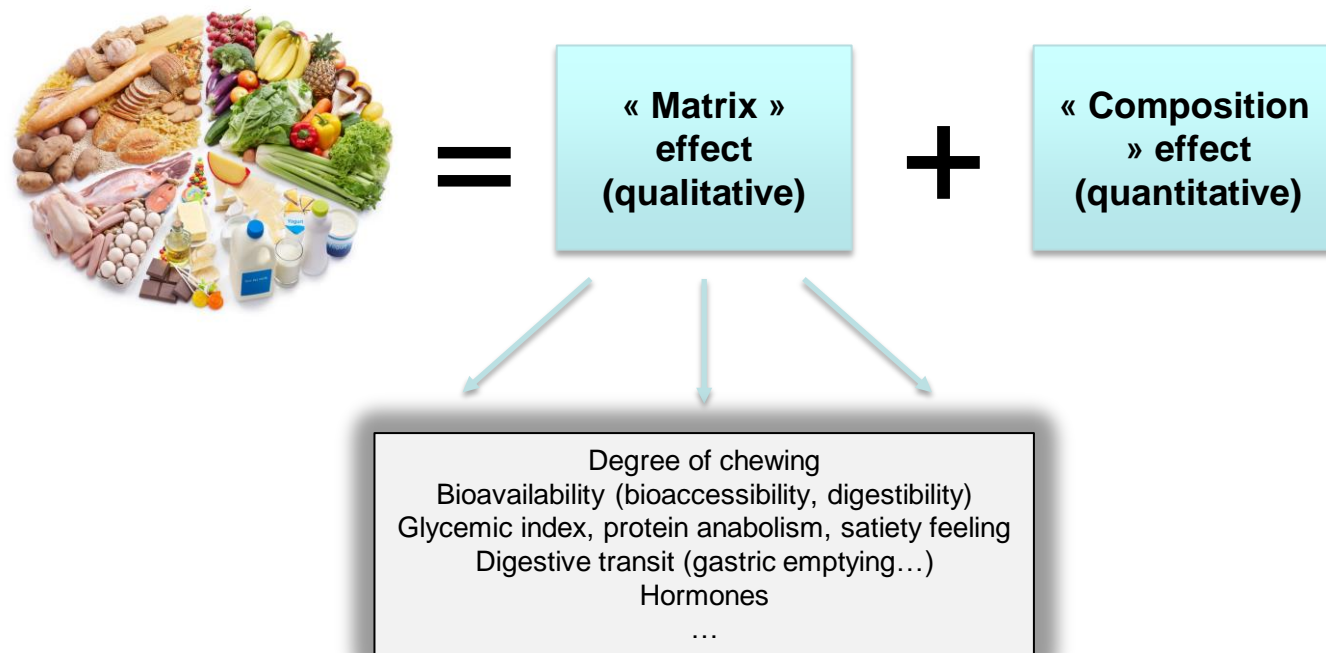
Cereal products & **Holism** :

- Considering matrix effect or physical structure
- Less drastic refining
- Not reducing cereal health potential only to fibre fraction
- Fibre « co-passengers »
- The « food package », multi-functionality & synergism

- Wholemeal *versus* white bread
- Wholemeal *versus* white pasta
- Brown *versus* white rice
- Muesli *versus* puffed cereal grains
- ...



Holism & Food Health Potential



At identical composition in nutrients and therefore in calories, two foods with different physical structures (thus different degree of processing) will not have the same health potential

1 calorie food A ≠ 1 calorie food B

The concept of grain package and multi-functionality: a multicausal non linear relationship

Several compounds can fulfill a same physiological function:



More than
34
antioxidant
compounds

Synergy

↓ Oxidative stress
(involved in more
than 100
pathologies!)

A single compound can fulfill several physiological functions:

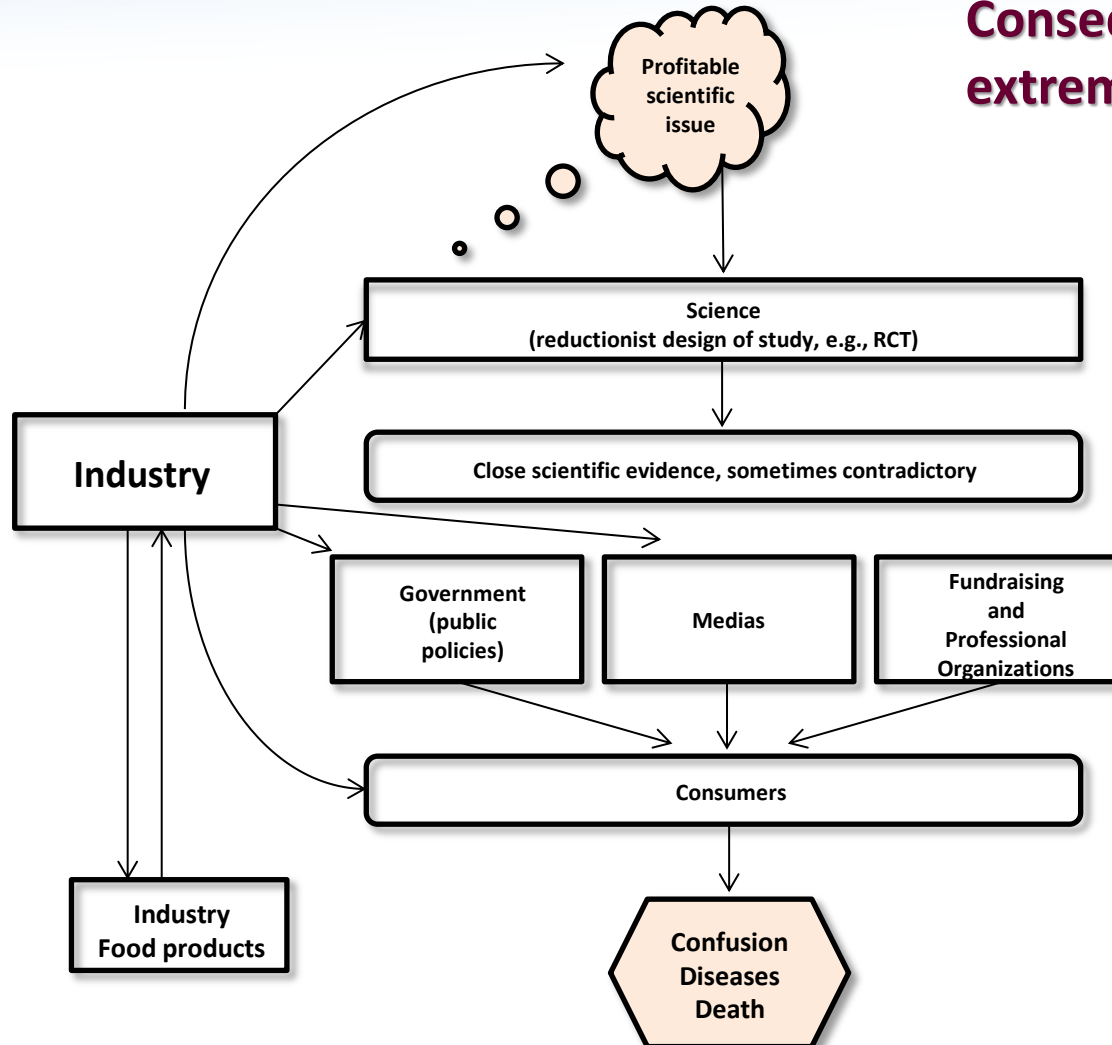


Fibre

Multi-functionality

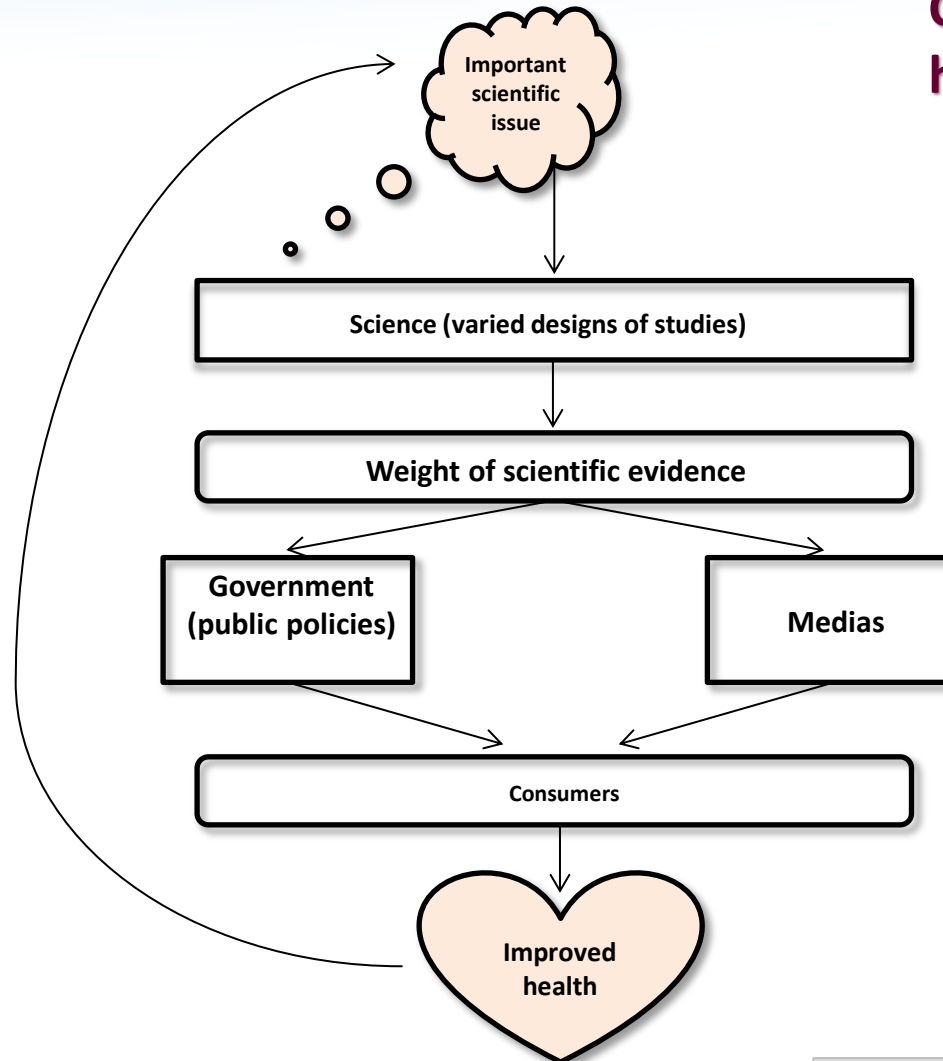
- Intestinal transit
- Satiety
- Glycemic response
- SCFA production
- Microflora
- ...

Consequences of extreme reductionism

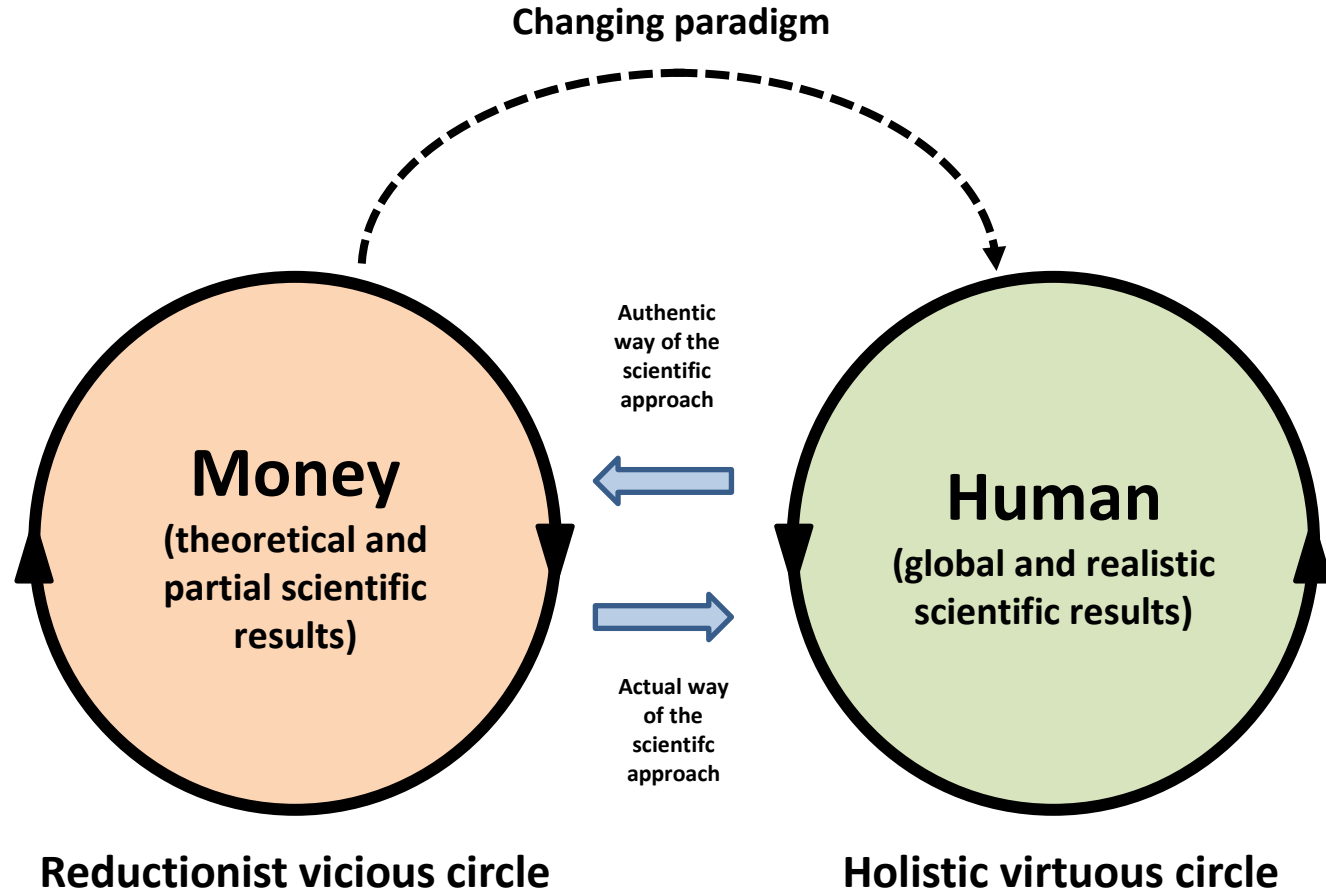


Adapted from Campbell (2013)

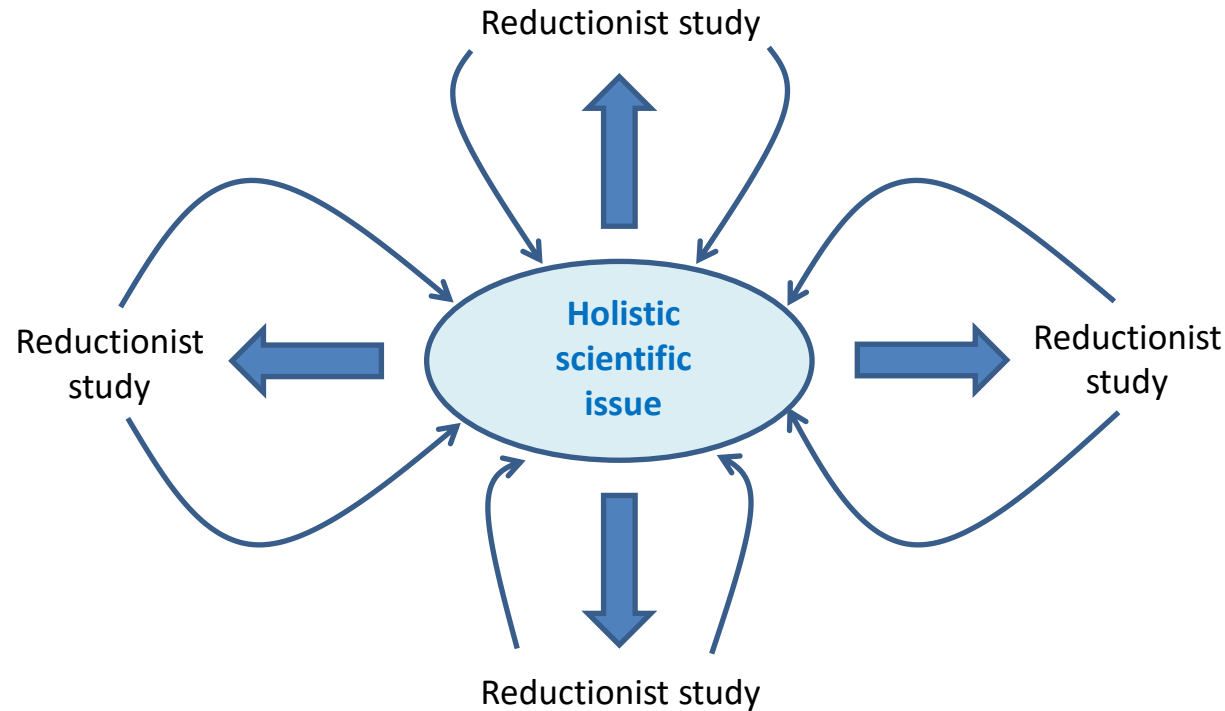
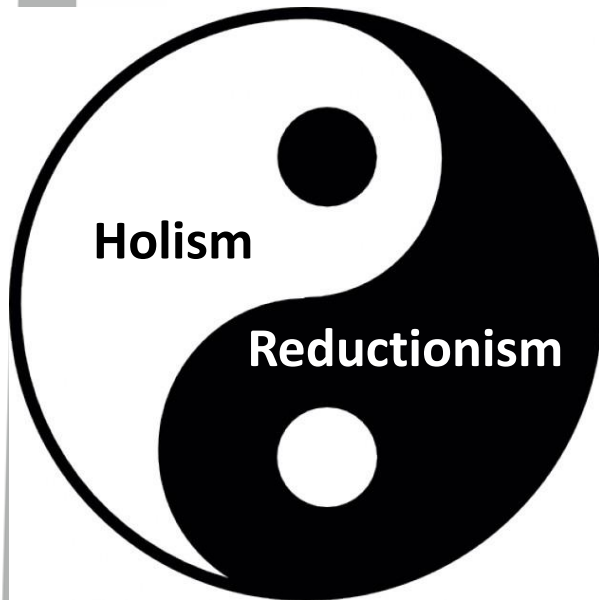
Consequences of holistic approach



Adapted from Campbell (2013)



Both approaches are not mutually exclusive: An indispensable marriage



Holistic virtuous circle

Conclusions & Perspectives: consequences of the reductionist paradigm

Reductionist paradigm



Fractionated-recombined ultra-processed foods



Increases of chronic diseases of industrialization

Conclusions & Perspectives: consequences of the holistic paradigm

- 1) **Developing traditional and modern minimal processing to preserve food matrix and health potential:**
 - Pre-fermentation, pre-germination/sprouting, soaking, flaking, soft thermal treatments, less refining, less fractionation...
 - ultraviolet-C, modified-atmospheres, heat shocks, ozone treatments, high pressures, Pulsed Magnetic Fields...
- 2) **Processing at the service of foods:**
 - Healthy
 - Sustainable
 - Palatable
 - Safe
- 3) **The holistic concepts of multifunctionality and synergism**
- 4) **Human studies:**
 - Developing « in real life conditions » human studies?
 - In epidemiological studies, considering quality of life, complex diet and degree of food processing
 - Using omics high throughput approaches: from few biomarkers to metabolomic profiles



- Both approaches are necessary but one needs to re-equilibrate and to go from holism to reductionism and not the opposite
- Stop separating human nutrition and food science in public research