Introduction to the food matrix concept: implications for the protein transition

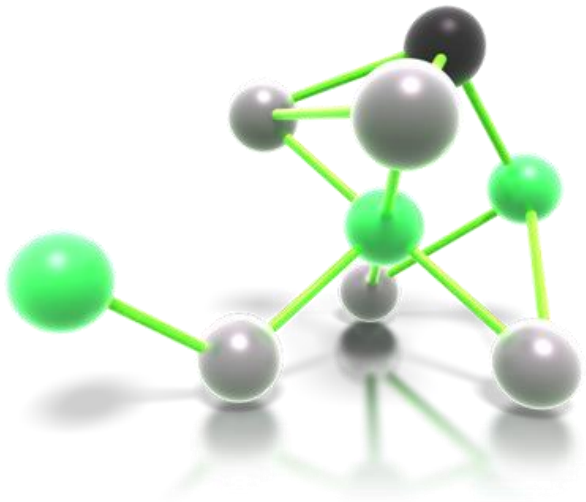
Professor Michelle McKinley, Centre for Public Health, School of Medicine, Dentistry & Biomedical Science, Queen's University Belfast

m.mckinley@qub.ac.uk

Funding

- NIHR
- UKPRP
- EU INTERREG
- EIT Food – European Institute of Innovation and technology
- Safefood

- Background
- The food matrix
- Implications



QUEEN'S UNIVERSITY BELFAST

Background

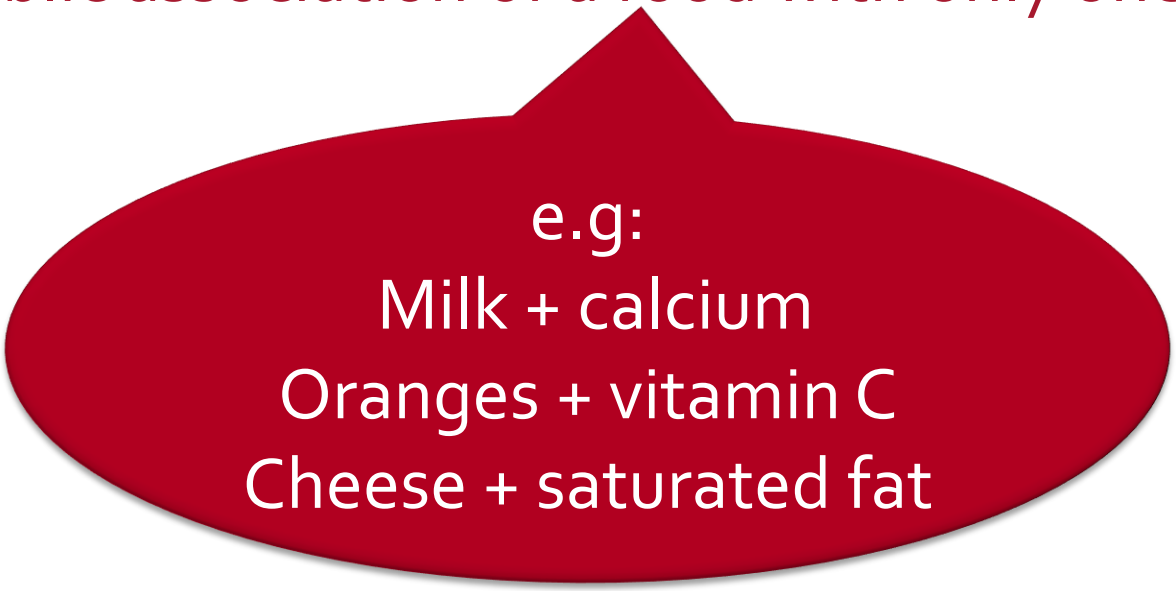
Early nutrition research

- **Earliest nutrition research** focused on the role of ***individual nutrients*** in relation to maintenance of health and prevention of disease – termed a **'reductionist' approach**
- **Responsible for many of the major advances in nutrition science, e.g.**
  - eradication of vitamin deficiencies
  - discovery of the role of folic acid in closure of the neural tube
  - establishing RDAs/DRVs

Reductionist approach - limitations

QUEEN'S UNIVERSITY BELFAST

- **Possible limitations**:
  - Discrepancy between observational and clinical trials
  - Public association of a food with only one nutrient

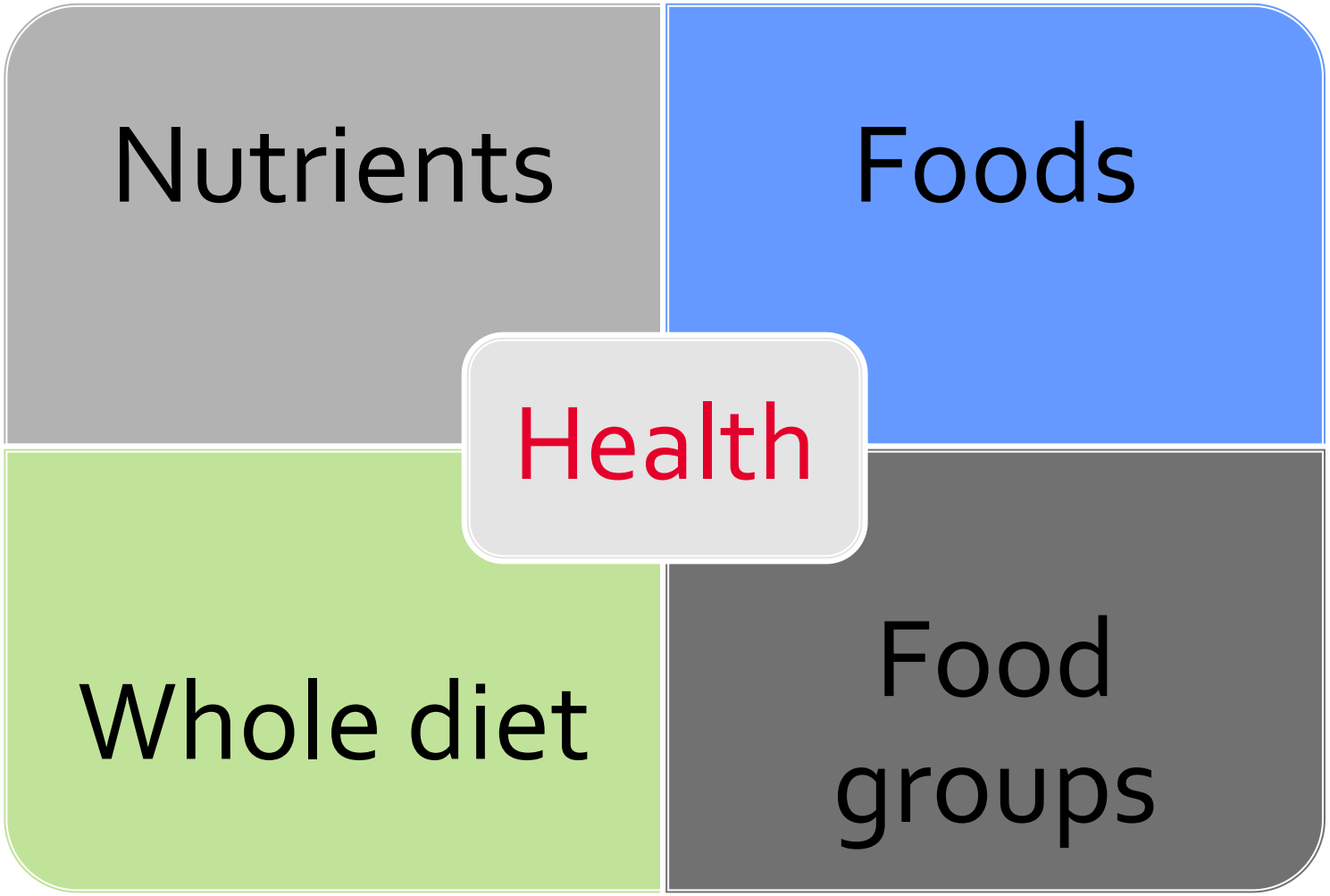


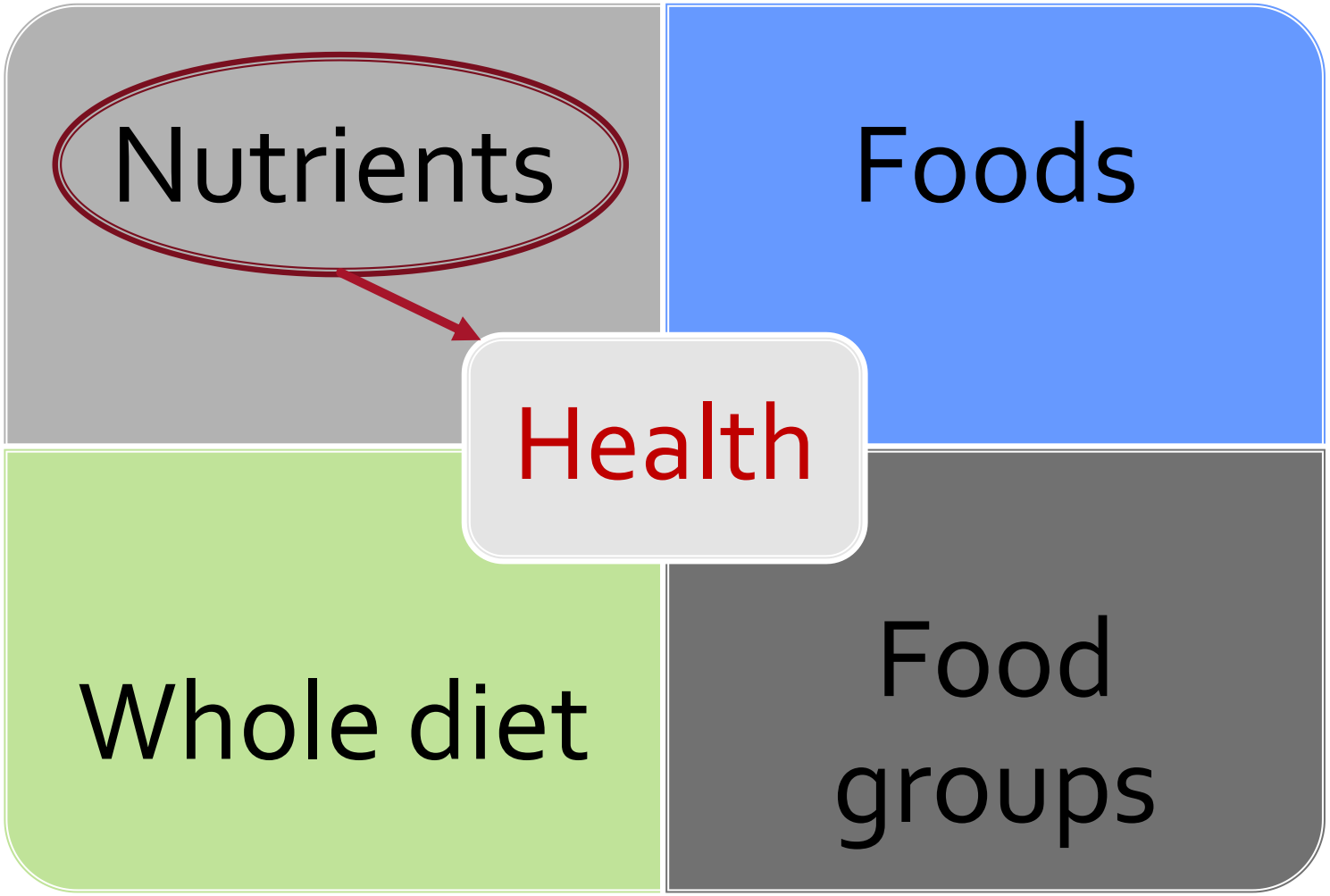
Fardet & Rock, Adv Nutr 2014;5:430-446

Reductionist approach - limitations

- **Possible limitations**:
  - Discrepancy between observational and clinical trials
  - Public association of a food with only one nutrient
  - **Oversimplification of nutrition** – leading to classification of some foods as 'super foods' because of one piece of information about its nutrient content and some foods demonised for the same reason

Fardet & Rock, Adv Nutr 2014;5:430-446

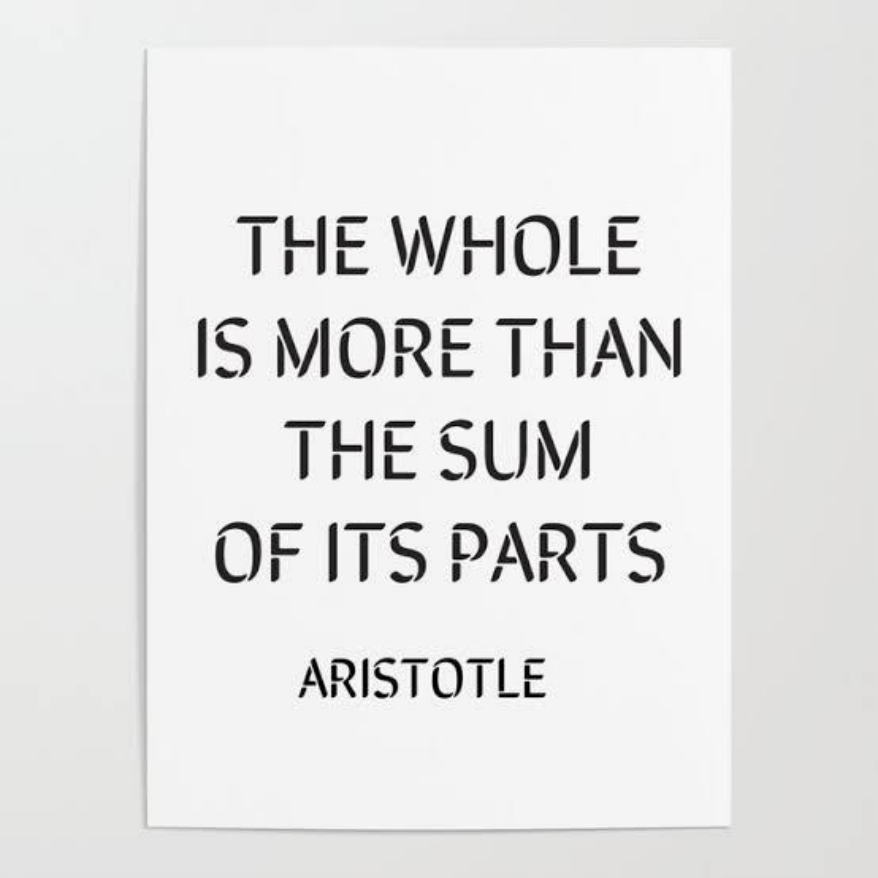

Nutrients
Foods
Health
Whole diet
Food groups

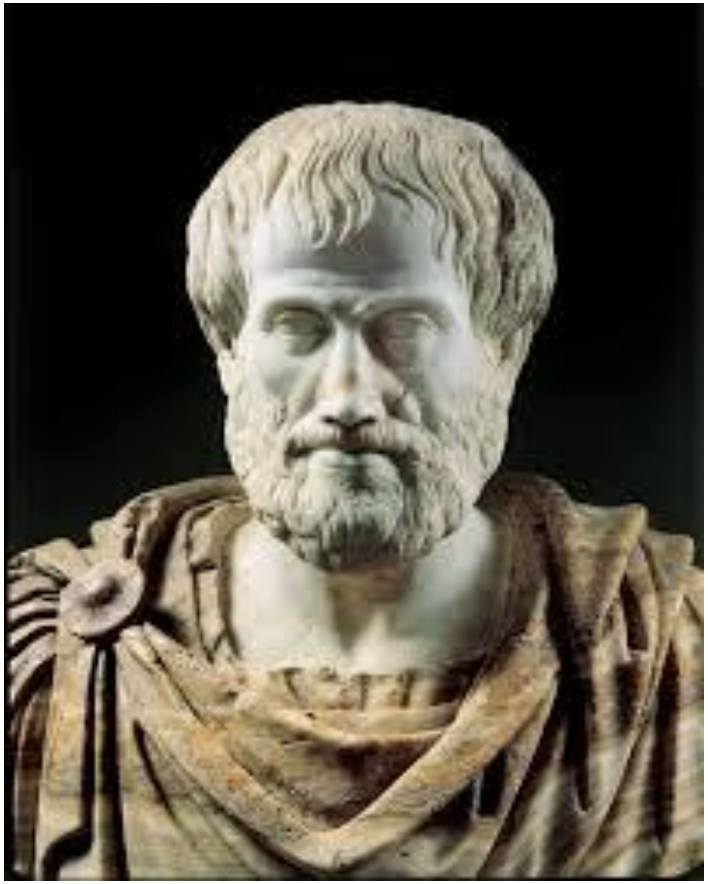

Nutrients
Foods
Health
Whole diet
Food groups

Recent nutrition research

- **Earliest nutrition research** focused on **a reductionist approach…….**
- **More recently**, approaches that seek to understand the unique features of **foods, food groups and whole dietary patterns** have emerged as a ***complementary*** approach to advancing nutrition science - **a more holistic stance**

Holistic approaches acknowledge that:



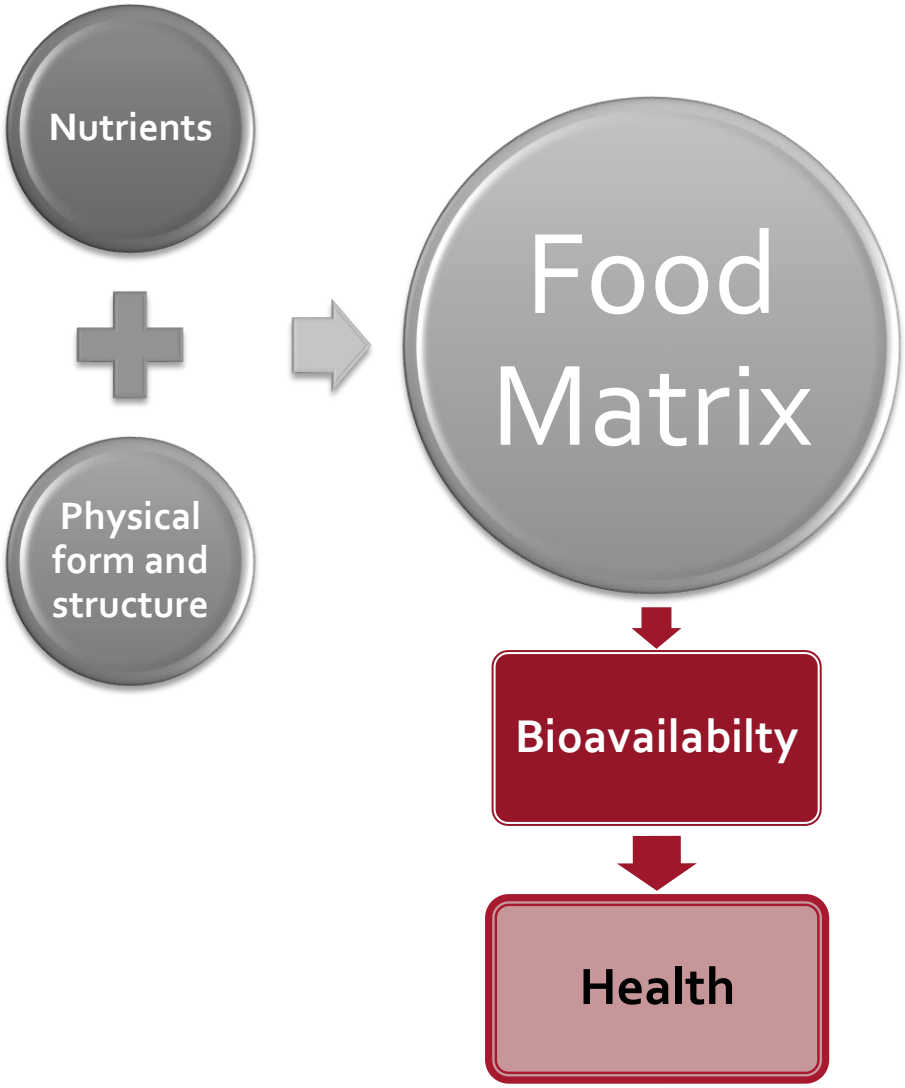


The food matrix

What is the food matrix?

QUEEN'S UNIVERSITY BELFAST

Foods consist of a large number of nutrients that are contained in a complex physical structure.
The nature of the food structure and the nutrients therein (i.e., the food matrix) will determine the nutrient digestion and absorption, thereby altering the overall nutritional and health properties of the food.



The food matrix – affects nutrient bioavailability

QUEEN'S UNIVERSITY BELFAST

Carotenoids in carrots - present in either crystalline form or bound to proteins, within chromoplasts - disruption of the cell wall is needed to release them.

Bioavailability (the fraction of the ingested nutrient that is available for absorption and for metabolic processes) of carotenoids in carrots prepared in a number of different ways:

Form of carrots	Total carotenoids recovered
Raw, bitesize chunks	3%
Cooked, bitesize chunks	6%
Pulped, raw	21%
Pulped, cooked with rapeseed oil	39%

Hedren E, Diaz V, Svanberg U. Eur J Clin Nutr 2002;56:425-430

The food matrix – affects nutrient bioavailability - Almonds

QUEEN'S UNIVERSITY BELFAST

Discrepancy between the Atwater factor predicted and empirically measured energy values of almonds in human diets[1–4]

Janet A Novotny, Sarah K Gebauer, and David J Baer

Digestibility of fat from whole nuts may be lower than that for other foods:

- Estimated energy content almonds 170 kcal/ 28g serving .
- The energy content of almonds in the human diet was found to be 129 kcal/ 28g serving.
- The Atwater factors, when applied to almonds, resulted in a 32% overestimation of their measured energy content.

The food matrix – affects nutrient bioavailability - Calcium

QUEEN'S UNIVERSITY BELFAST

200ml milk

880g raw spinach

QUEEN'S UNIVERSITY BELFAST

Implications

Implications for the protein transition

QUEEN'S UNIVERSITY BELFAST

- Foods are complex **mixtures of nutrients** sitting within **unique physical structures** $\Rightarrow$ unique food matrices
- **Nutrient content alone** does not necessarily predict a food's effect on health outcomes
- The protein transition is **not a single nutrient** transition
- Health effects of one protein-rich food matrix won't necessarily be the same as the health effects of another protein-rich food matrix – **holistic evaluation of foods**
- How can we consider the **complementary benefits of different food matrices** in the protein transition?

QUEEN'S UNIVERSITY BELFAST

THANK YOU