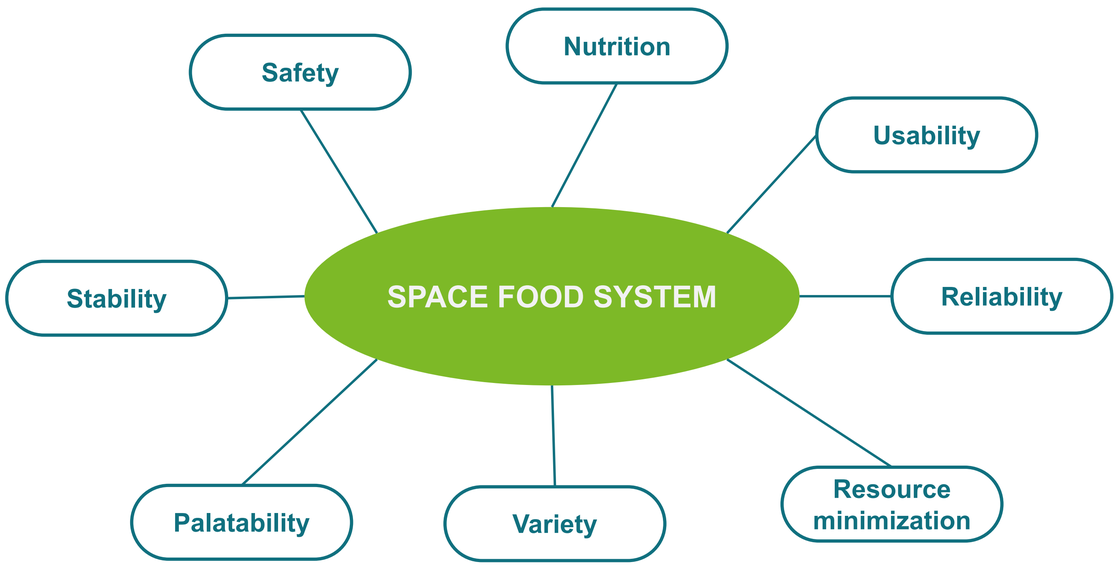
Terra Innovation Day

LIÈGE université Gembloux Agro-Bio Tech | LABORATOIRE SCIENCES GASTRONOMIQUES | SMART GASTRONOMY LAB

Fresh microbial biomass: a solution for the food of tomorrow, and a key for feeding astronauts

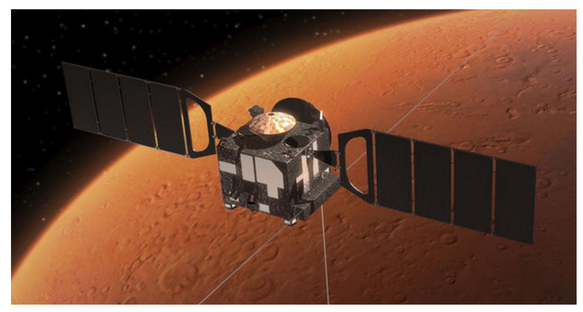
Nutrition in Space



Micro-Ecological Life Support System Alternative

MELISSA FOUNDATION

- European Space Agency (ESA)
- Regenerative, **circular**, **autonomous** life support systems
- Production of food, water and oxygen from mission waste
- 5 compartments
  1. Recycling of organic waste (food, urine, paper, non-food plants)
  2. Anaerobic photosynthesis: elimination of products from compartment 1 (VFA and NH_3)
  3. Nitrification and water recycling
  4. Photosynthesis of algae and plants: food production by micro-organisms
  5. Food production



Microbial biomass – Spirulina - *Arthrospira platensis*

What is spirulina ? What is contained in it ?

- Photosynthetic microorganisms
- Filamentous cyanobacteria (blue-green algae) - Size: 35 over 200 µm
- Requirements for its development: water slightly salty, highly mineralised, rich in carbonates and bicarbonates, alkaline, warm (>30°C)
- Source of natural molecules beneficial to nutrition and health: anti-oxidant, anti-inflammatory and immunomodulatory molecules
- **Proteins**, carbohydrates, lipids, vitamins, nucleic acids, pigments, minerals and oligoelements

↓

Phycocyanin, chlorophyll and carotenoids

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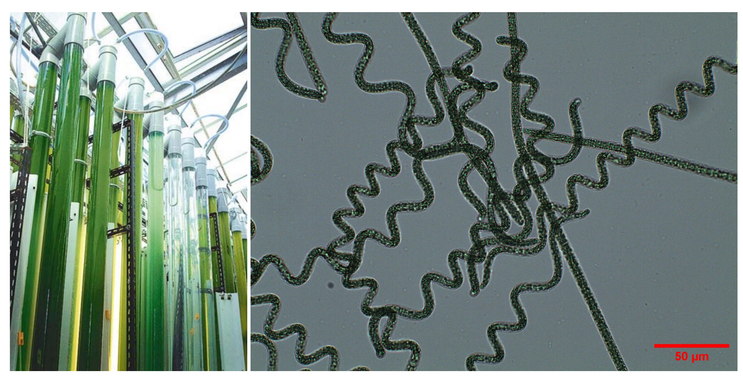
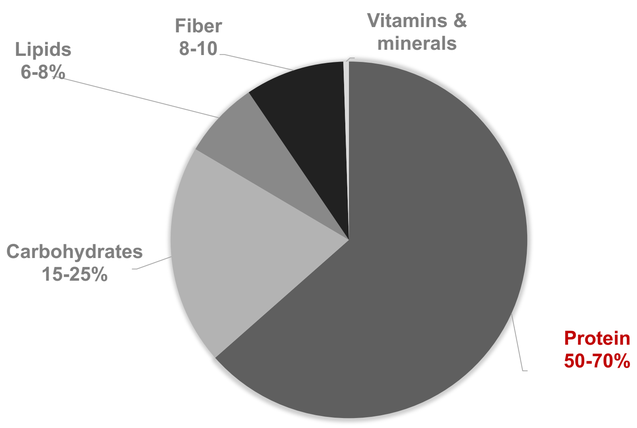
Specific to cyanobacteria
Functional colorant: anti-oxidant, anti-inflammatory and anti-cancerous

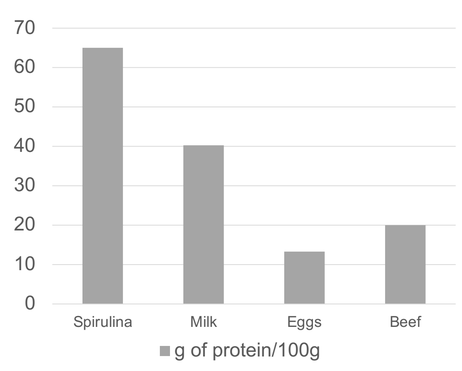
Most abundant protein in spirulina: 15% of fresh weight, 20% of dry weight



NUTRITIONAL COMPOSITION



PROTEIN CONTENT OF FOODS



Which forms should it be used ?

	Fresh	Dry
Benefits	Sensory properties	Conservation
	Nutritional properties	Integration into formulations
	Reduction of post-harvest steps	
	Direct incorporation into the formulation	
	No thermal treatment	
Disadvantages	Conservation	Heat treatment at high temperatures
		Unpleasant smell and taste
		Added in very small quantities

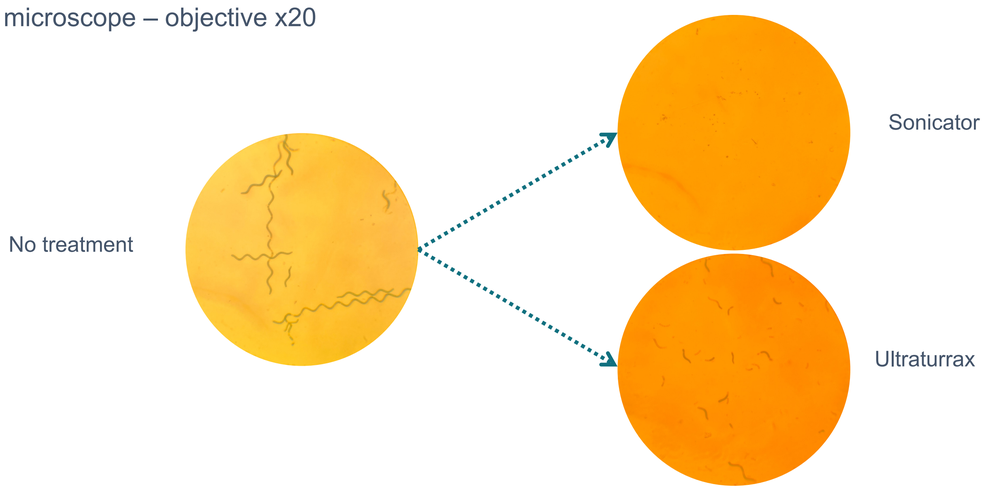
Food formulation

Cell lysis

Goals and methods

- Cellular disruption – release of bioactive compounds
- Emulsification and texturisation of biomass: **stabilisation** of food products
- **Mechanical** methods
- Evaluation of cell disruption
  - Absorption spectroscopy – dosage of phycocyanine
  - Texture, viscosity, microscopic, colour analysis

Optical microscope – objective x20



Storage methods: important impact on bioactive compounds

- Preserve and maintain functional and nutritional properties
- Impact on total protein, antioxidants, phycocyanin etc.
- Examples
  - **Oven-drying** (loss of water and high temperature): damages heat-sensitive molecules and reduces the number and compounds
  - **Lyophilisation** (low temperatures and solid state of water): protection of primary structure, time consuming, costly and may reduce antioxidant properties
  - **Rapid freezing**: avoids risk of increased water volume and thus damage to cell walls and release of solutes

Product development

- **Dry** matter: in powder form (cf. spatial context)
- **Fresh** matter: microbial biomass

Products characterisation

- Texture and colour analysis
- Consumer sensory analysis
- Product shelf life (Aw)
- Nutritional analysis

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