

Understanding Manufacturing Processes in Prepared Foods

Prepared Consumer Foods Innovation Gateways, 3rd
June 2015

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MANUFACTURING IN



Comprehensive Reviews in Food Science and Food Safety

Food Process Engineering: The Last 25 Years and Challenges Ahead

Vol 2; 2003

S. Bruin, Th.R.G. Jongen

Delivered by Amazon, your food shopping: Web giant set to launch groceries service in Britain

- Internet company already offers the AmazonFresh service in Seattle
- Food wholesaler warned U.S. site now powerful enough to take on UK
- Shoppers who place an order by 10am get it delivered in time for dinner

By DAILY MAIL REPORTER

PUBLISHED: 01:38, 8 March 2014 | UPDATED: 12:50, 8 March 2014

- Raw material modification for functionality that matter to the consumer: nutrition, flavour, structure, colour.
- Value addition moved the industry from MAKE-SERVICE-CARE, with focus on LEAN-AGILE-VIRTUAL manufacturing
- **E-commerce**, satisfying consumer needs moving the industry more to SERVICE and CARE.
- Unit operations 'building block' approach miss opportunities for process innovation.
- Process Synthesis: Understanding data relating to raw materials and process to produce desired products at minimum cost

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* development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

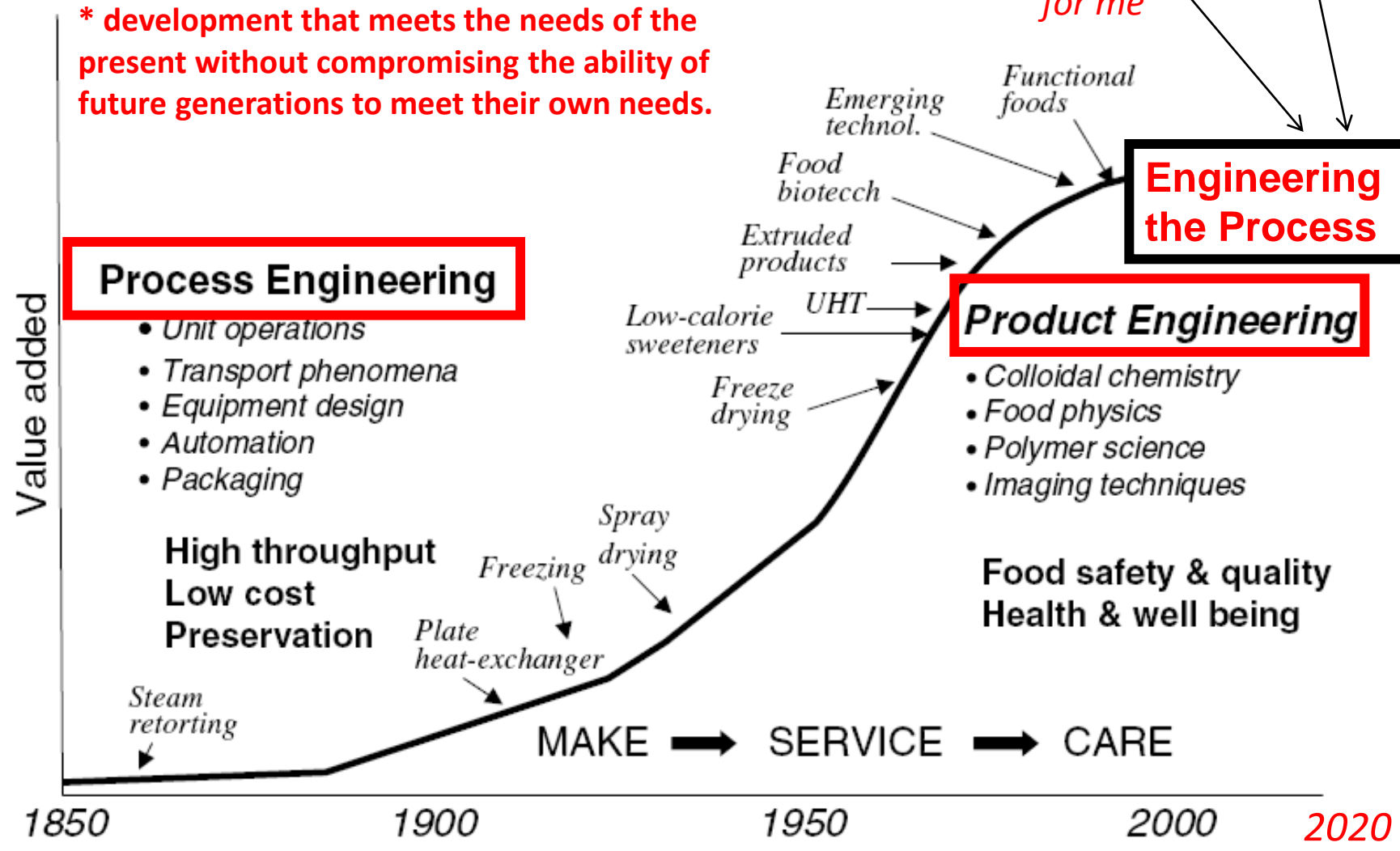
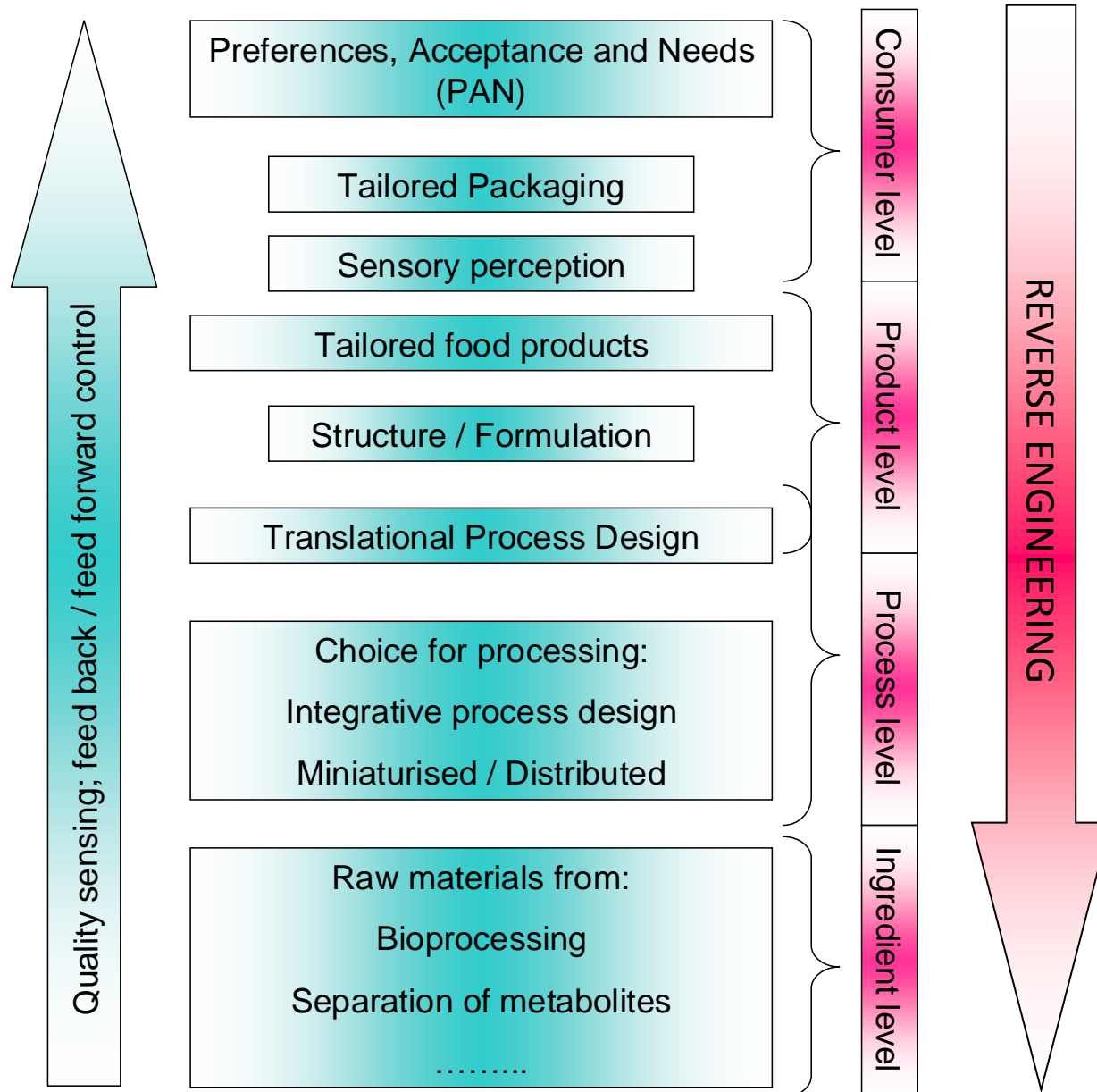


Figure 1. Evolution of the food industry in terms of value added to products and shift in emphasis from process engineering to product engineering. This transition has implied a change in concepts and techniques that support each approach.

Food Quality & Manufacturing

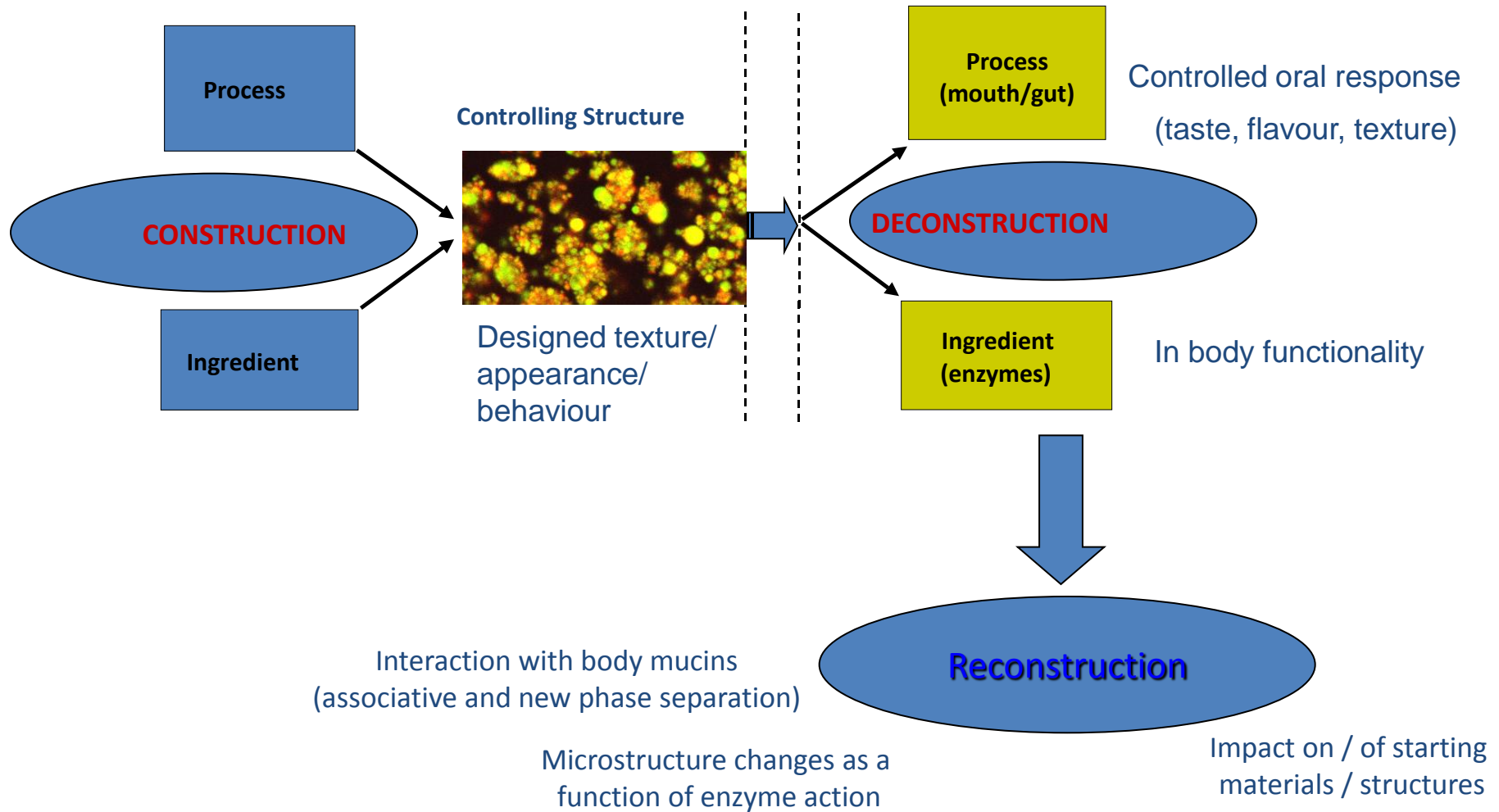




- Trends & Drivers:
 - Increasing cost and scarcity driving importance of **security of supply**, use of fewer materials and less energy including water for all outputs as well as more reliance on **renewable resources**.
 - The rise of the **digital economy** and an associated increase in **customised products** will have an impact on traditional products. Integration is expected to have more of an influence on innovation than will new R&D.
- National Competencies (2025)
 - **Understanding designing and manufacturing formulated products**
 - ‘Plug and play’ manufacturing
 - Design & manufacture for small-scale & miniaturisation
 - **Systems modelling & integrated design/simulation**
 - Flexible and adaptive manufacturing
 - Combining product development steps in parallel / concurrent engineering

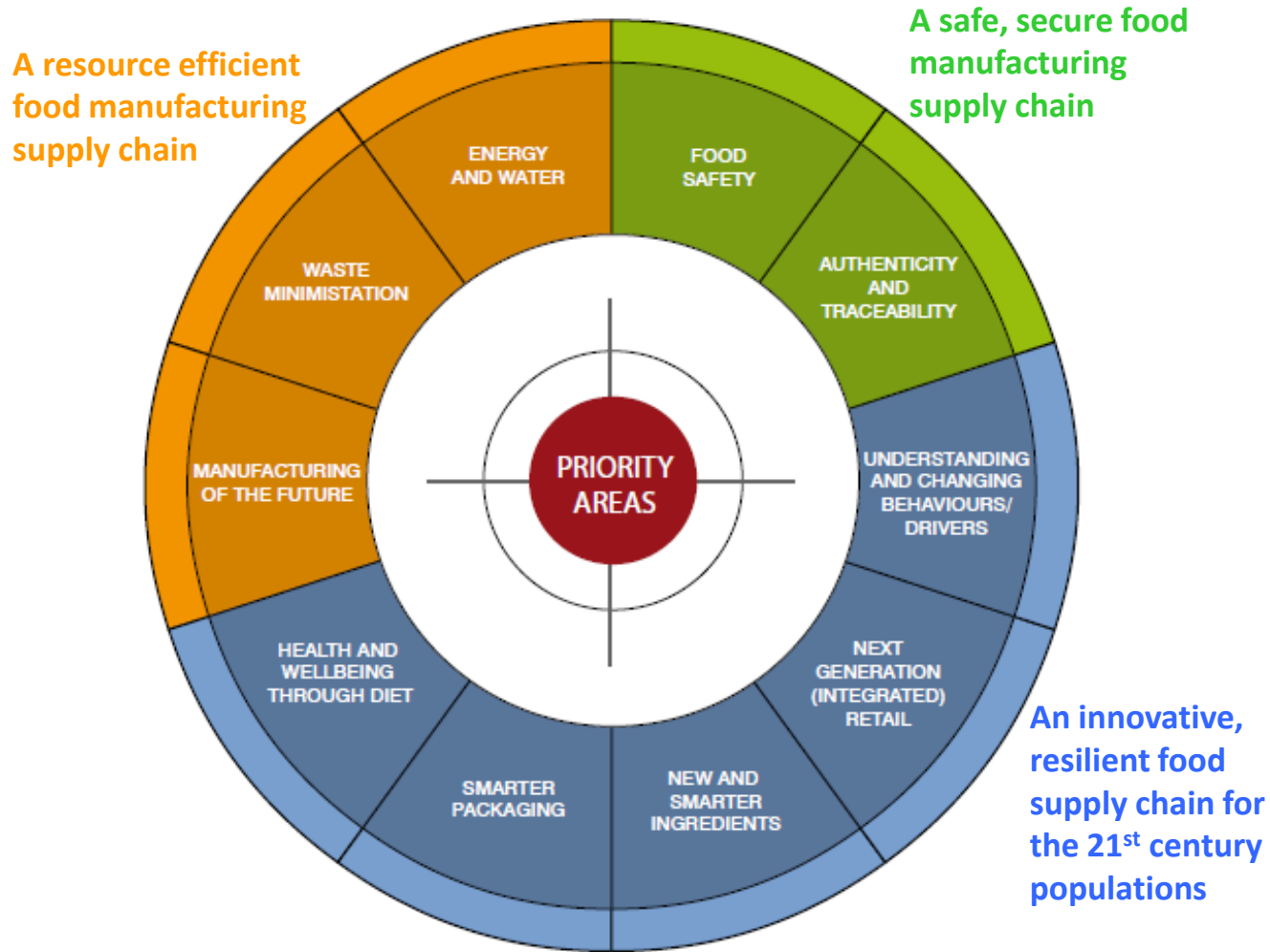
“Manufacturing in 2050 will look very different from today, and will be virtually unrecognisable from that of 30 years ago....as manufacturing becomes faster, more responsive to changing global markets and closer to customers...exposed to new market opportunities and more sustainable”

- **Mass personalisation of low-cost products, on demand**
 - “Direct customer input to design will increasingly enable companies to produce customised products”
- **Distributed production**
 - The **production landscape** will include capital intensive **super factories** producing complex products; **reconfigurable units** integrated with the fluid requirements of their supply chain partners; and **local, mobile and domestic production** sites for some products.
 - **The factory of the future may be at the bedside, in the home, in the field, in the office and on the battlefield.**
- **Digitised manufacturing value chains**
 - they will create new ways to bring customers into design and suppliers into complex production processes.





PRIORITY AREAS FOR RESEARCH TO MAINTAIN AND ENHANCE THE UK'S COMPETITIVE POSITION IN GLOBAL FOOD MANUFACTURE



EPSRC Centre for Innovative Manufacturing in Food

EPSRC CENTRE FOR INNOVATIVE
MANUFACTURING IN



£5.6m to be spent on Research
Started 1st December 2013
www.manufacturingfoodfutures.com

Prof Tim Foster, Prof Shahin Rahimifard and Prof Ian Norton



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Biomaterials Group



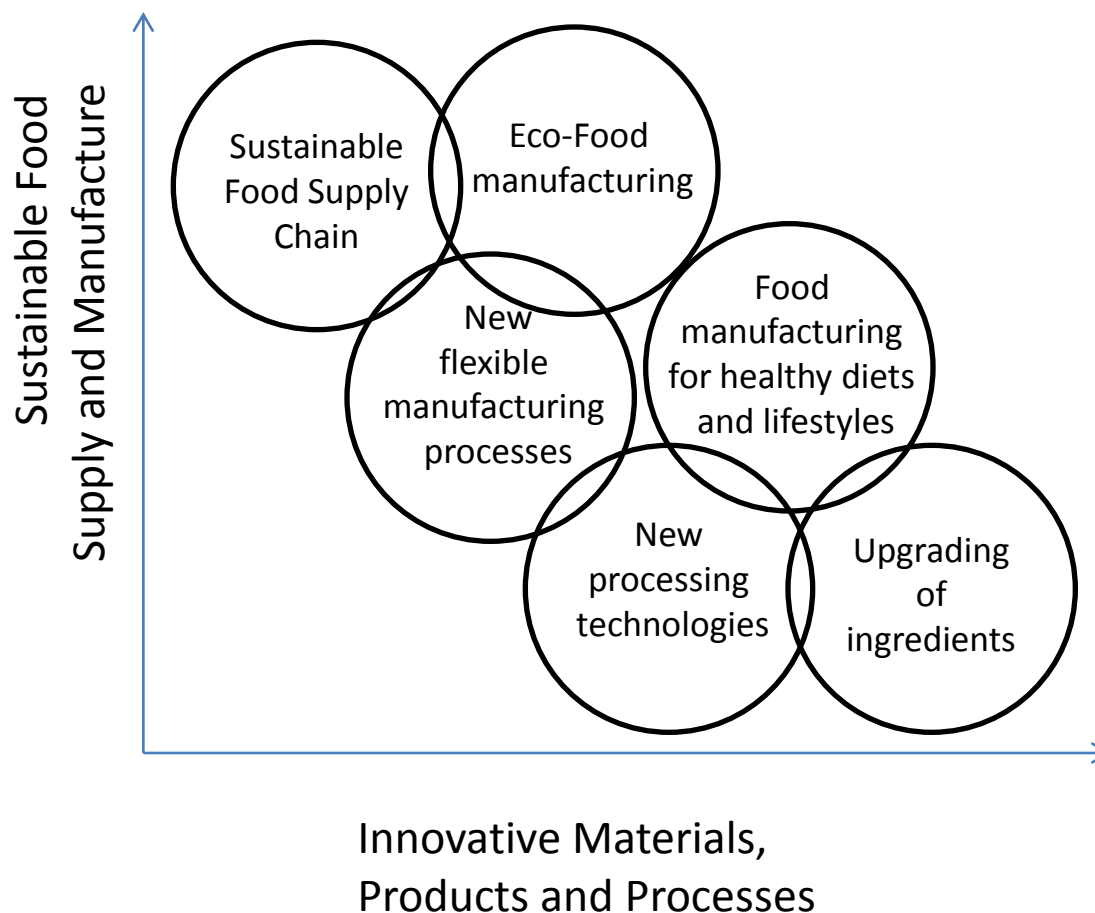
Centre for Sustainable Manufacturing
and Recycling / Reuse Technologies:
SMART



UNIVERSITY OF
BIRMINGHAM

Centre for Formulation
Engineering

Our Focus



The two Centre Grand Challenges and their six Research Themes

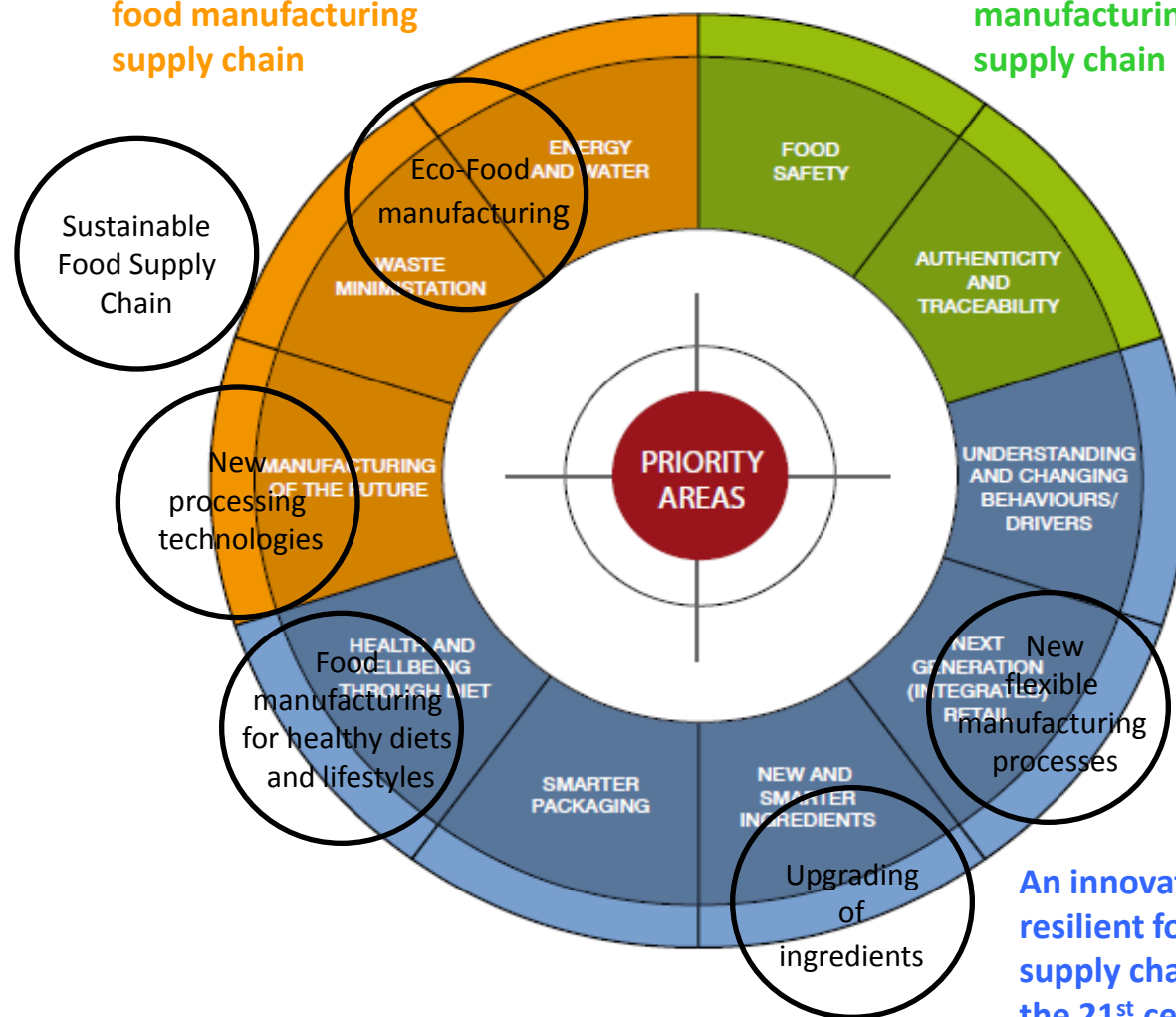
Co-creating products of the future –
With ingredient and process developments

Our Focus

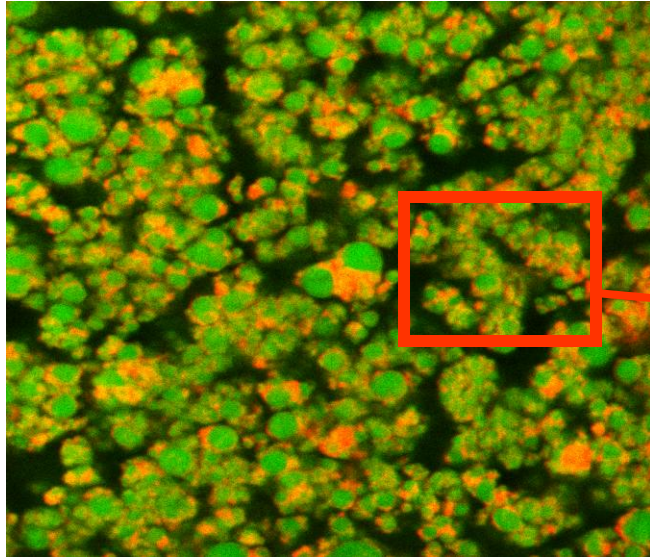
PRIORITY AREAS FOR RESEARCH TO MAINTAIN AND ENHANCE
THE UK'S COMPETITIVE POSITION IN GLOBAL FOOD MANUFACTURE

A resource efficient
food manufacturing
supply chain

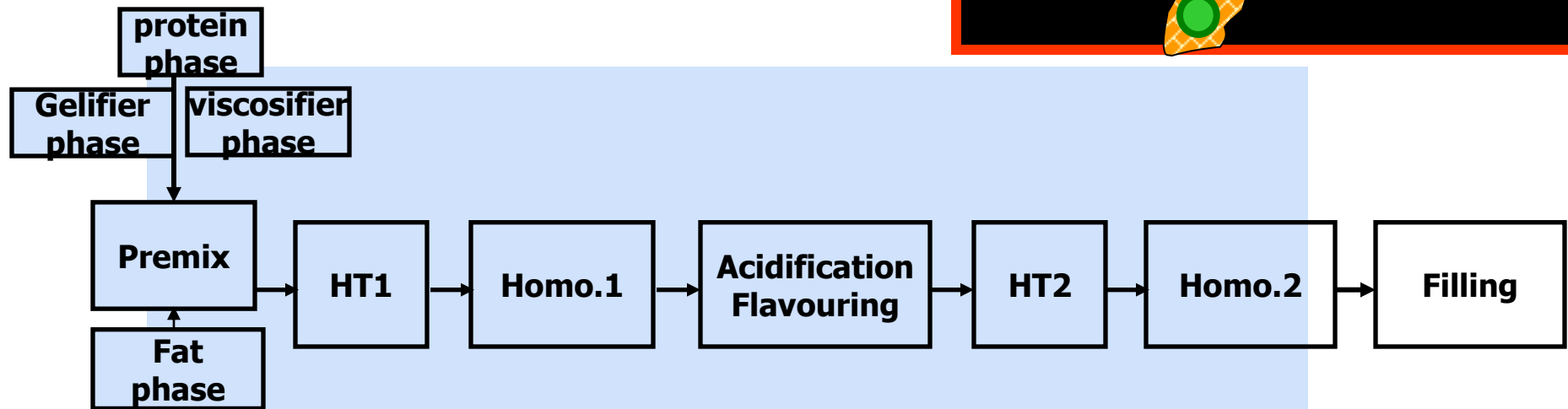
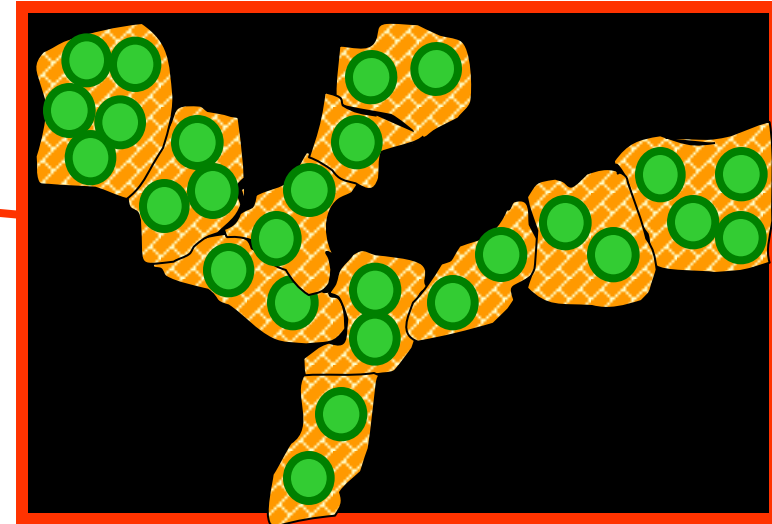
A safe, secure food
manufacturing
supply chain



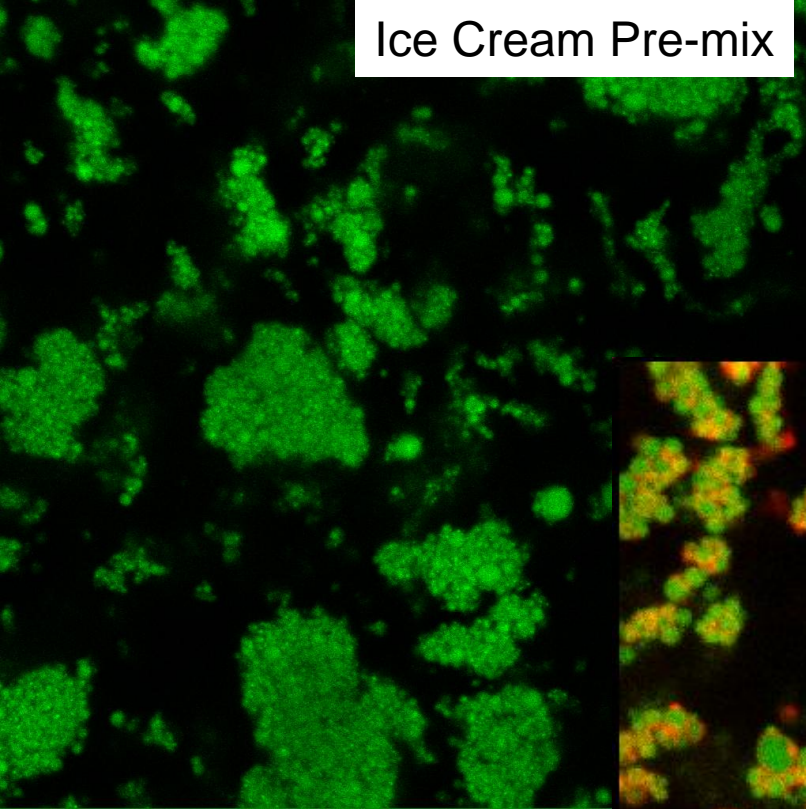
An innovative,
resilient food
supply chain for
the 21st century
populations



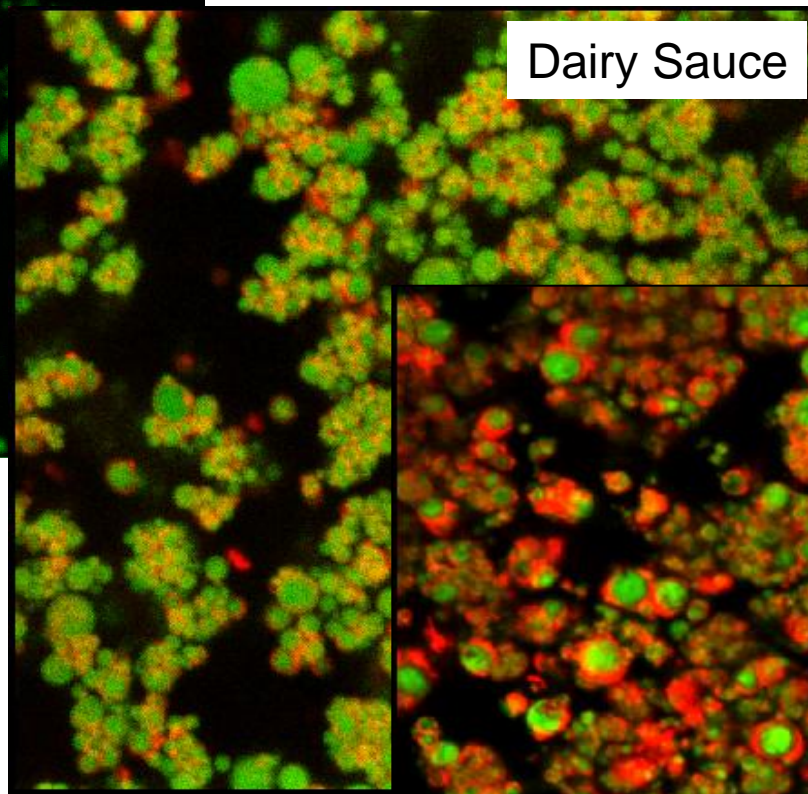
Black: LBG / water phase
Orange: milk protein phase
Green: fat phase



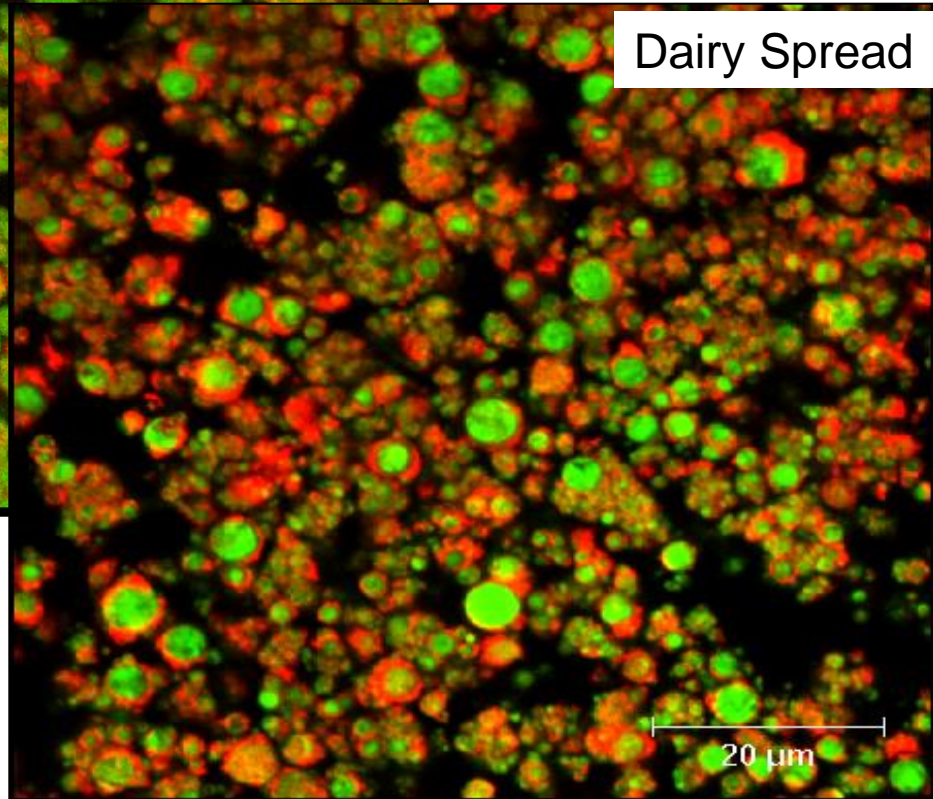
Ice Cream Pre-mix



Dairy Sauce

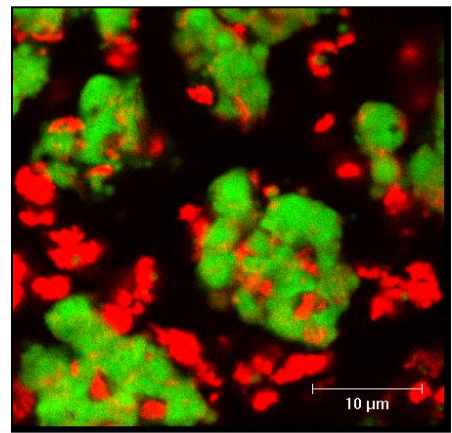
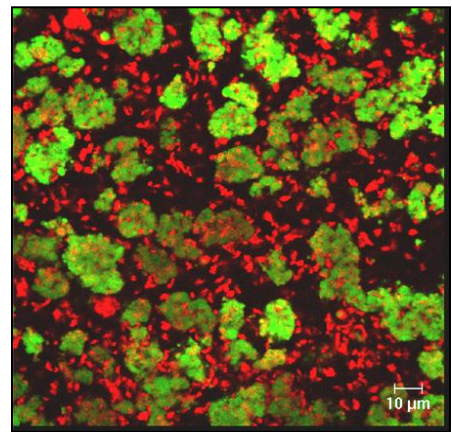
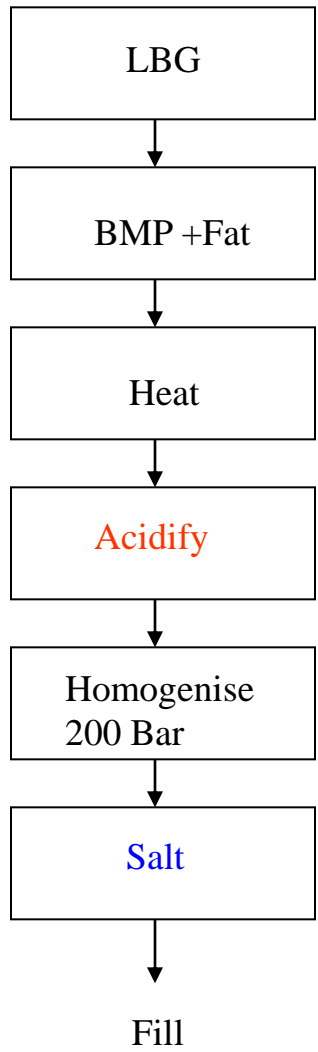


Dairy Spread



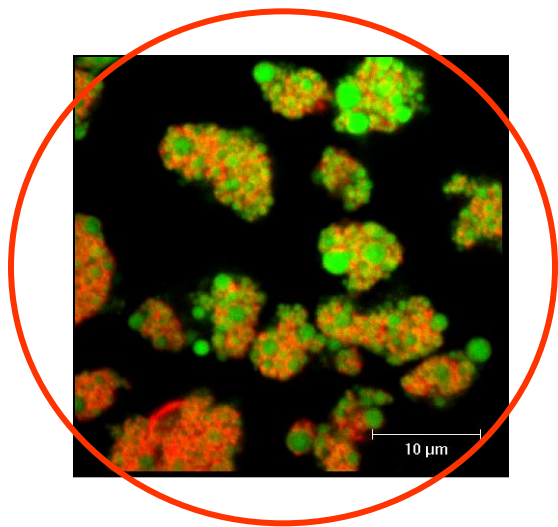
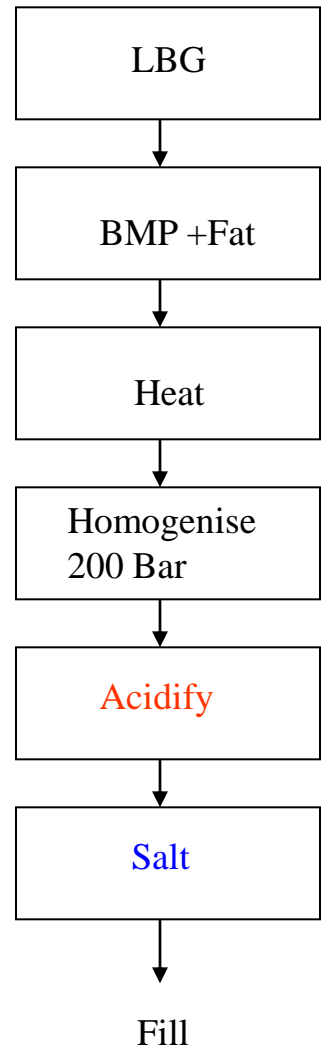
Increasing Protein Phase Volume

New Textures



Hardness

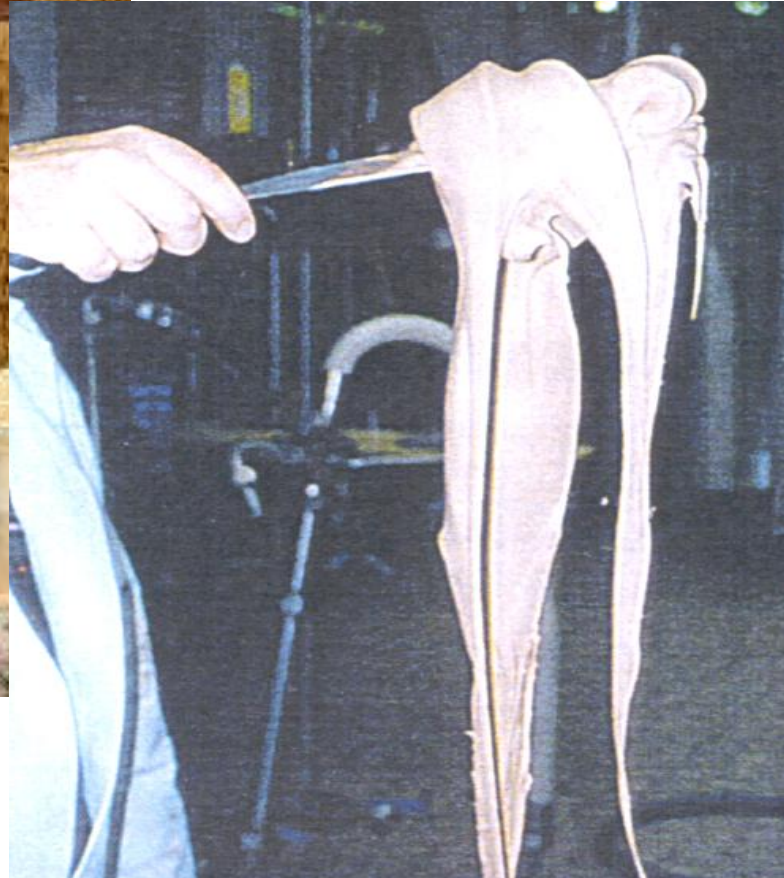
80



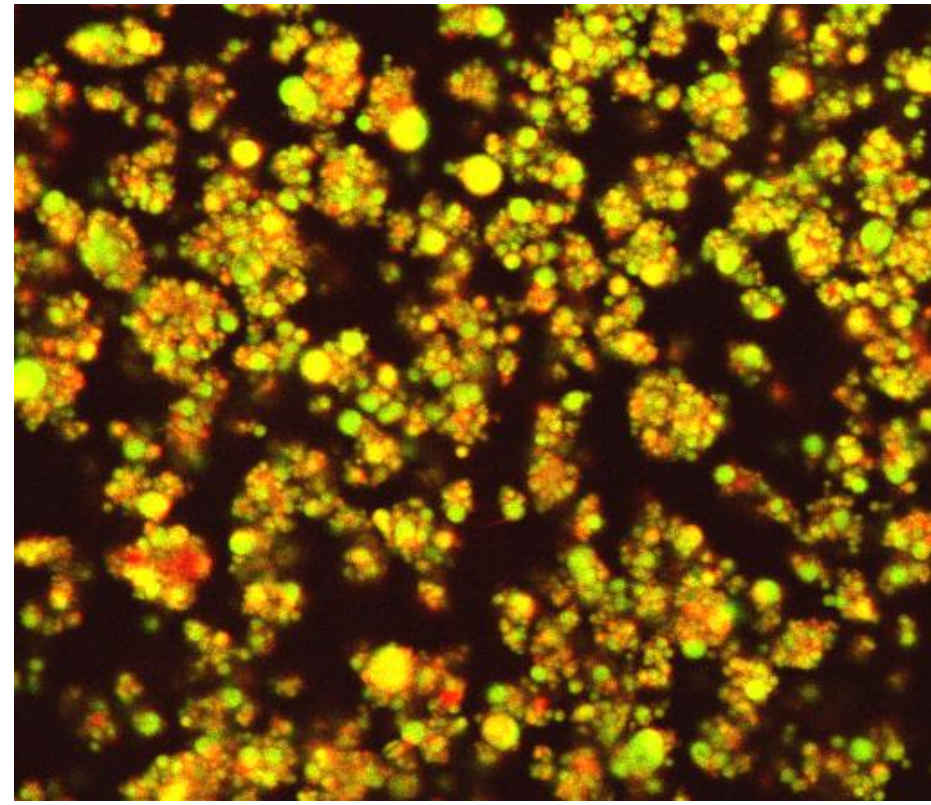
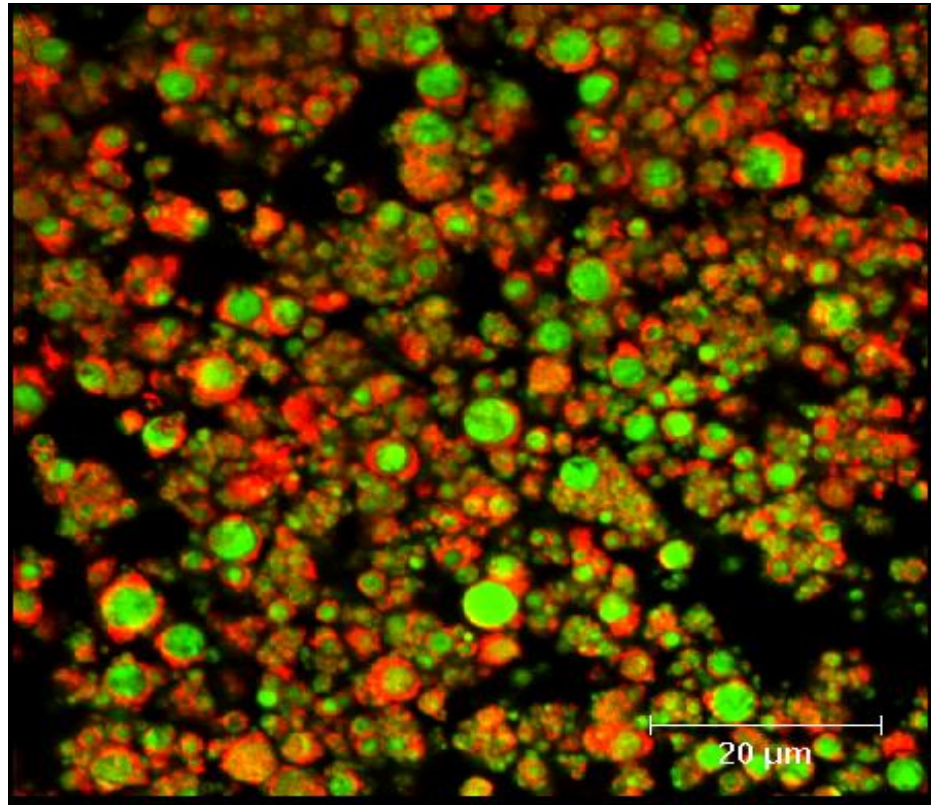
'Stretchy'

25

New Textures



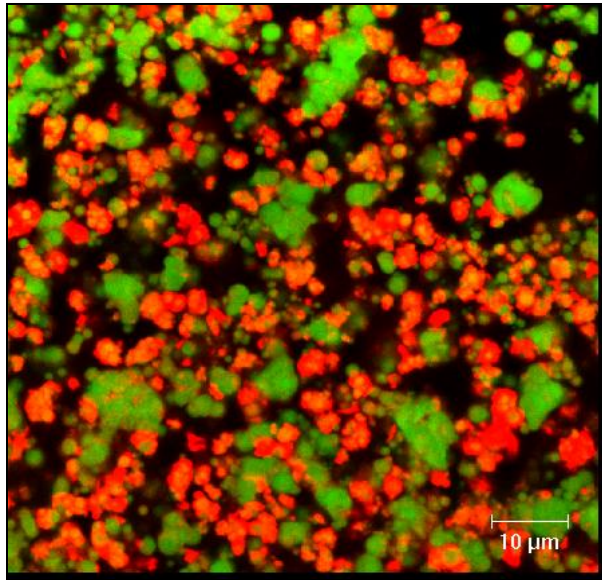
Ingredient Interchangeability: Proteins



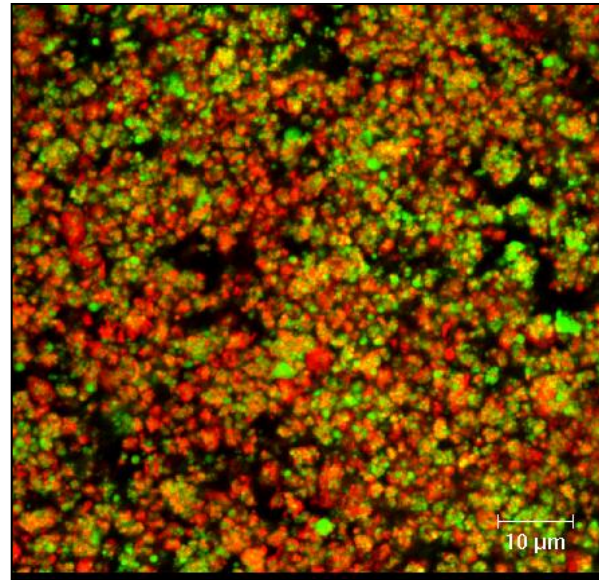
x% LBG
x% Gelatin
x% Milk Protein
22% Fat

x% LBG
x% Gelatin
y% Soy Protein
22% Fat

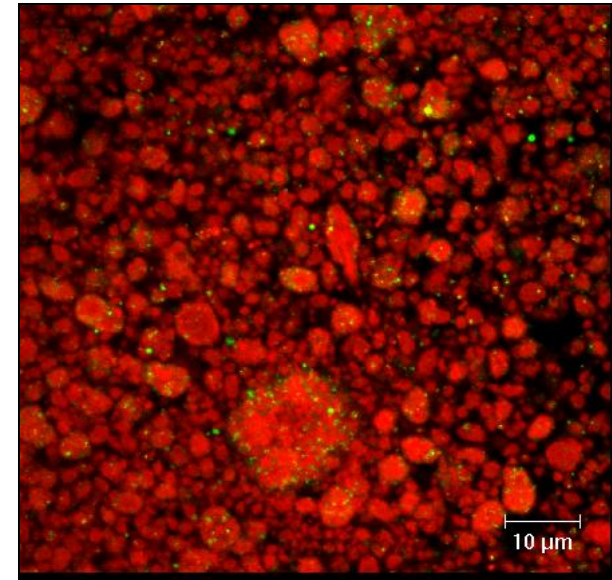
Philadelphia



Full Fat

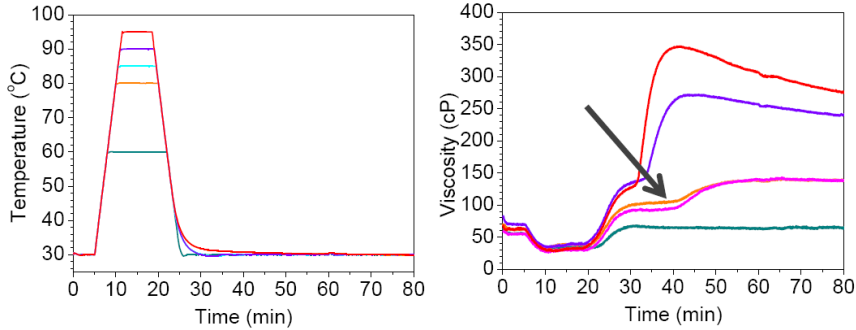


Low Fat

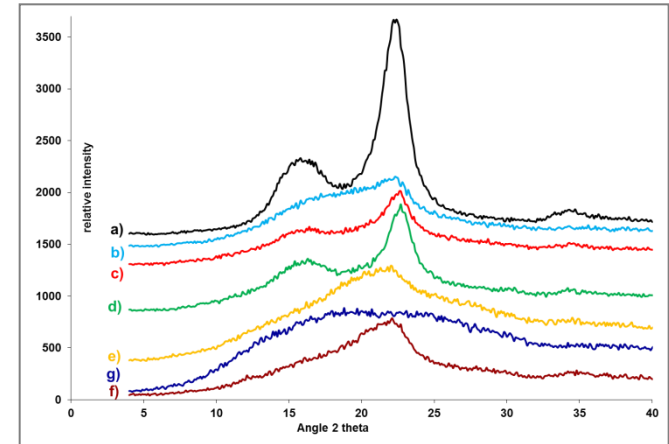


Zero Fat

New Structures from Cellulose



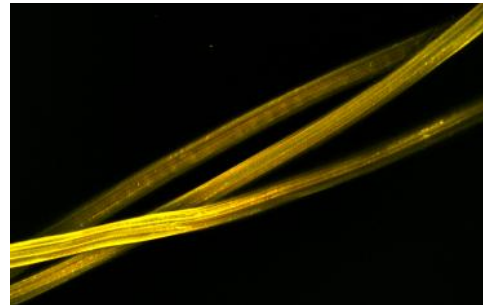
Starch-like processing histories



Controlled de-crystallisation and re-crystallisation



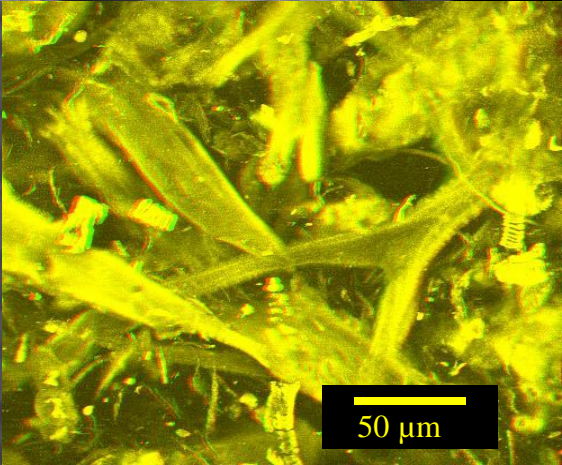
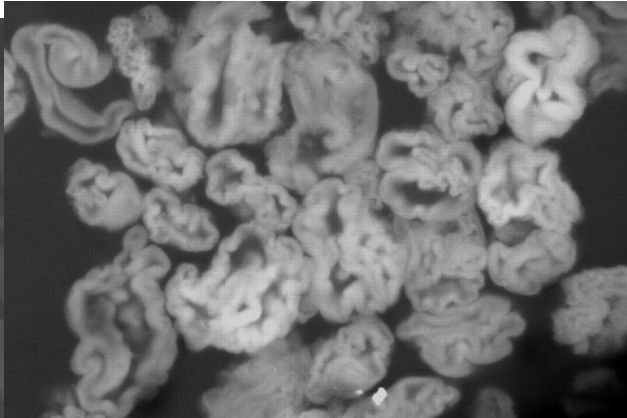
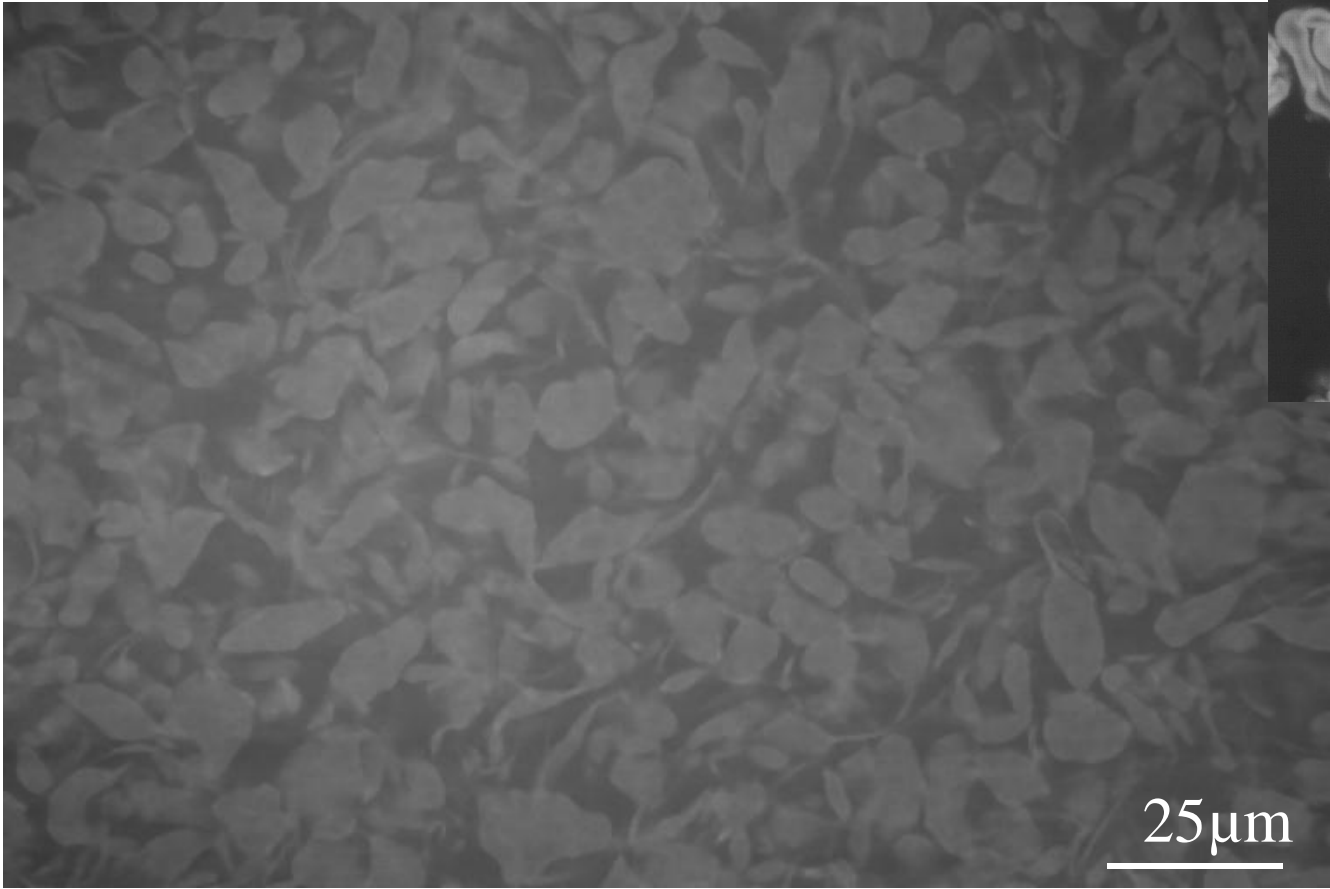
Fibrillation in high shear for new rheologies



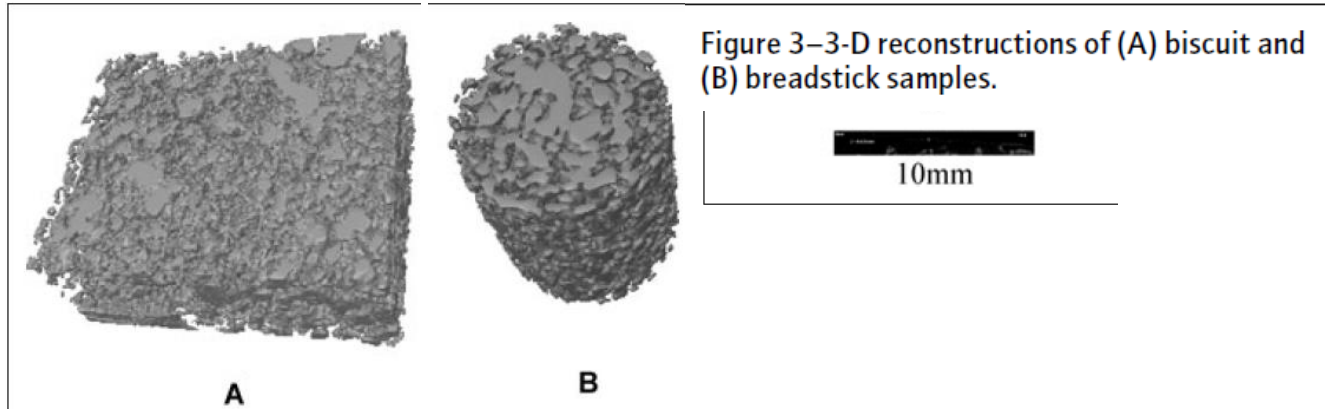
Encapsulation and functionalisation



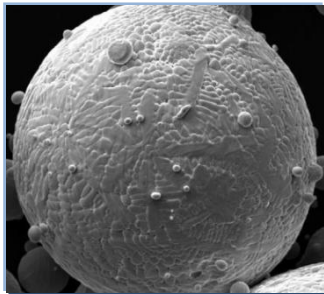
Filler Phase Interchangeability



- Additive manufacture



- HIP / Additive layer manufacturing & flash sintering

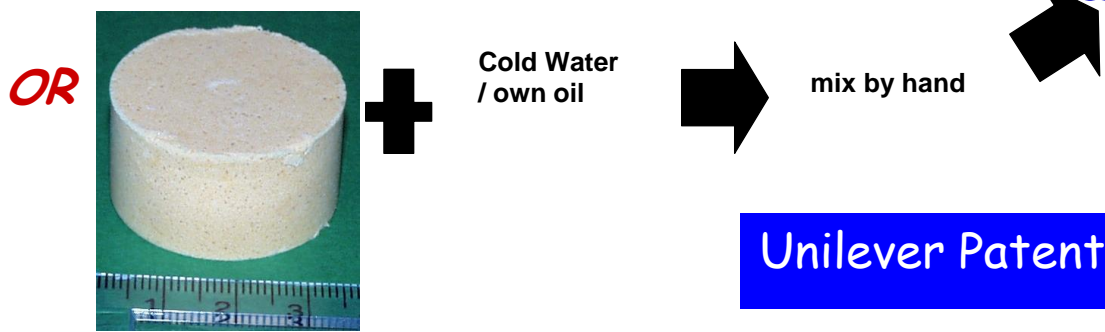
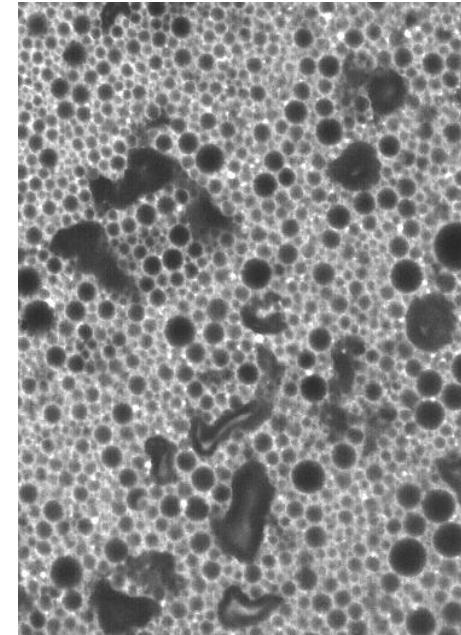
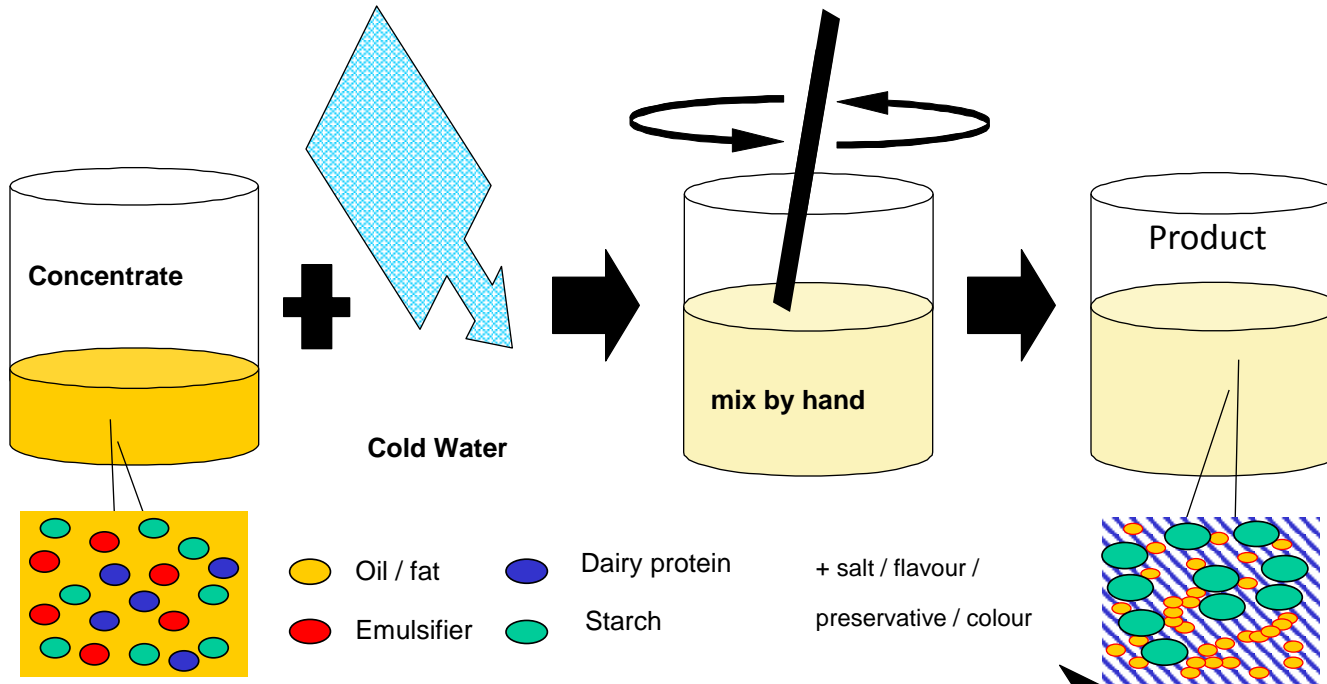


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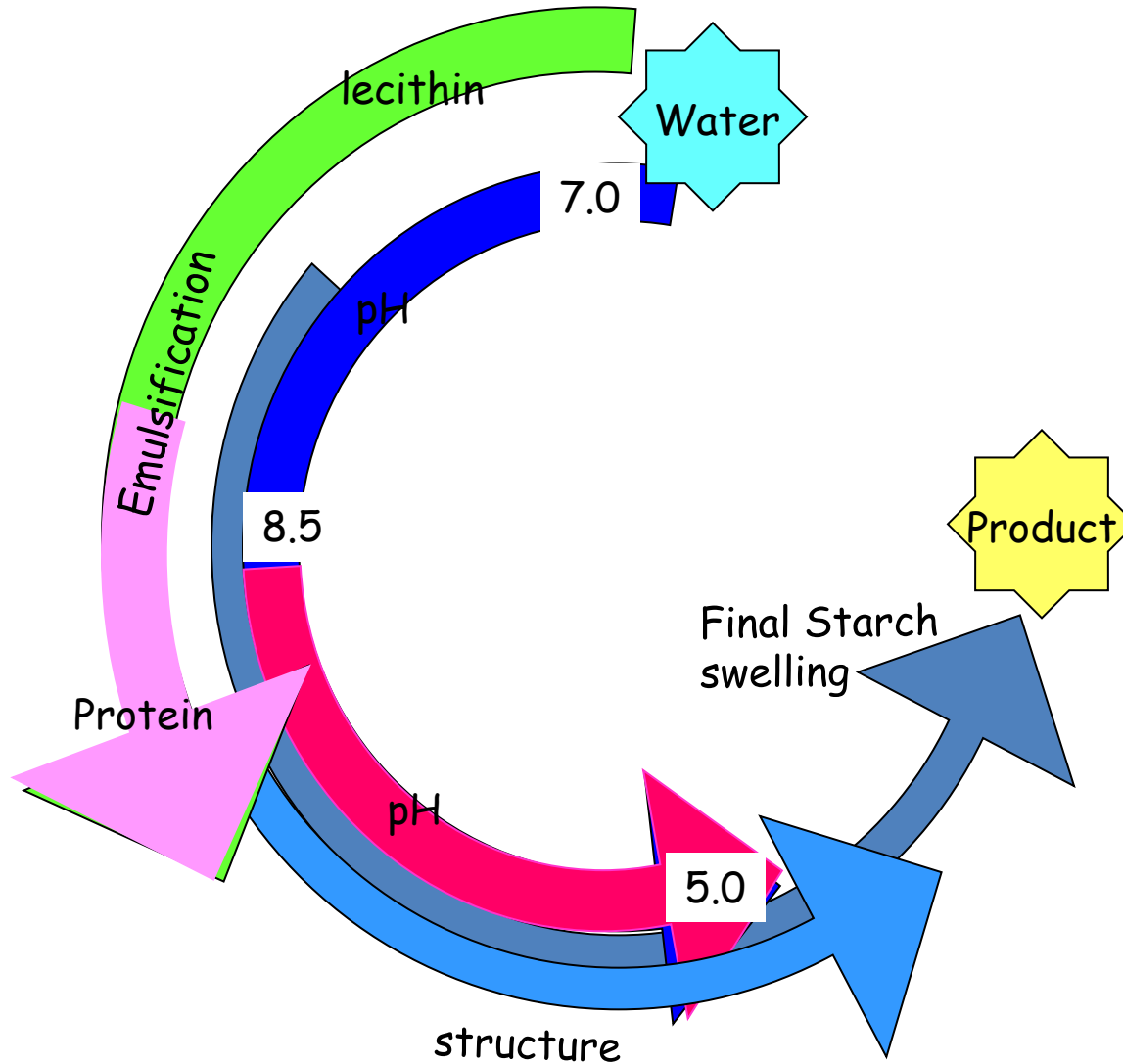
Melt extruded
cellulose

Instant Emulsions



Unilever Patent Protected

Instant Emulsion Process





Industry Report

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Thank you for your attention.