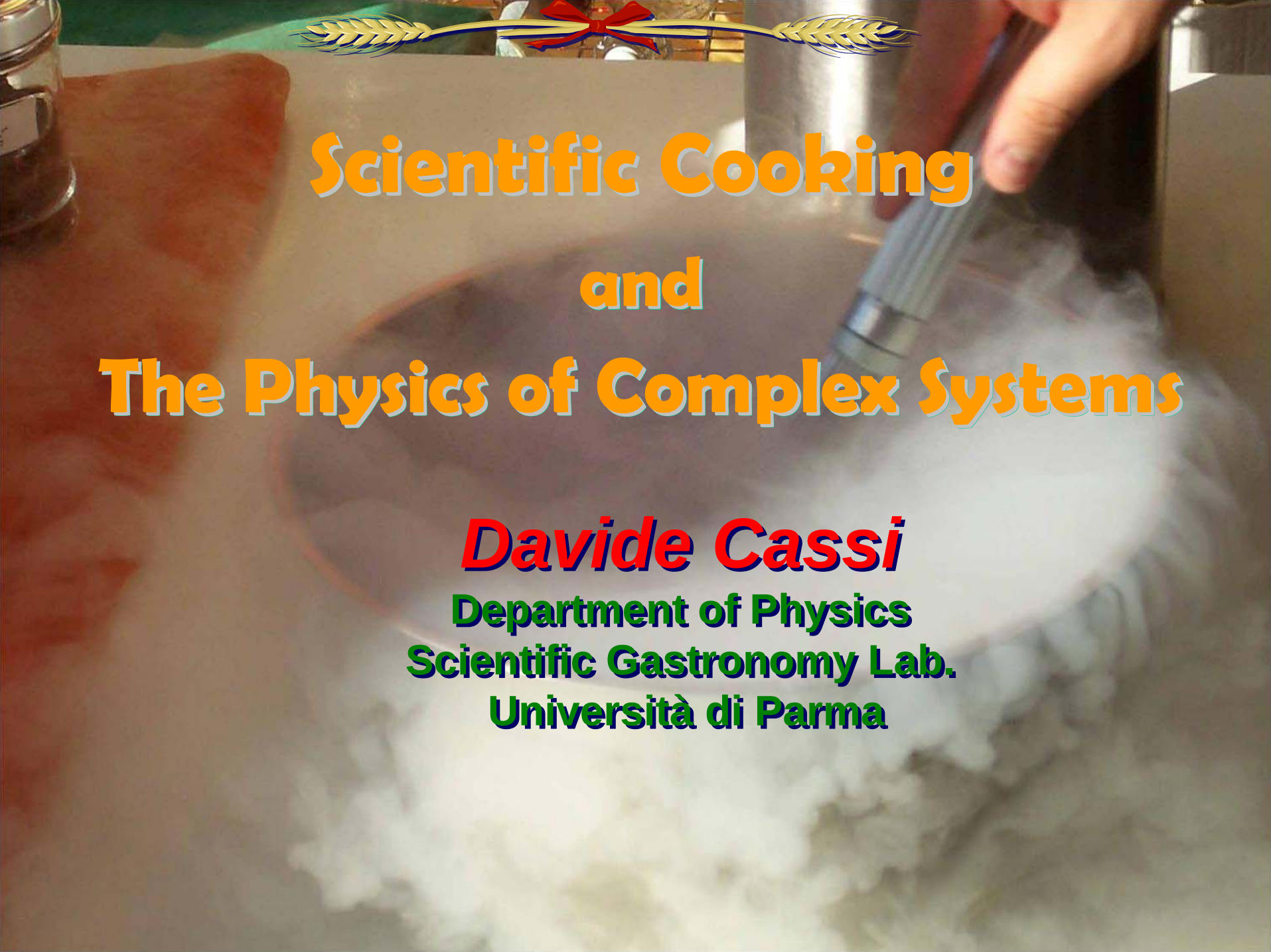

Scientific Cooking

and

The Physics of Complex Systems

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SCIENTIFIC COOKING

=

USE OF SCIENTIFIC METHOD AND SCIENTIFIC KNOWLEDGE TO CREATE NEW CULINARY TECHNIQUES AND NEW PRODUCTS (DISHES)

MULTIDISCIPLINARY APPROACH
TO ALL APSPECTS OF FOOD

OUR LAB IS A MEETING POINT OF SCIENTISTS AS WELL AS COOKS, ARTISTS, WRITERS…

IT DOESN'T LOOK LIKE A TYPICAL SCIENTIFIC LABORATORY:

IT HAS TO BE A PLEASANT PLACE TO STAY

WHY SCIENTIFIC COOKING?

“If everything is changing, it would be absurd to claim to fix the destiny of an art based, in many respects, on fashion, and as unstable as it.

If taste is becoming more refined, the culinary art too has to conform to it.

To contrast the effects of modern super activity, cooking will become more scientific and precise.”

A.Escoffier - 1902

Need for new food:

Our lifestyles have dramatically changed during the last decades: our diet has to change accordingly

Scientific discoveries showed that some ingredients should be reduced and some others used in larger amounts to meet nutritional requirements

New ingredients are available and some old ingredients are more difficult to acquire

Our taste and our way of thinking of food are continuously changing…

New food has to be projected and built following severe constraints!

Modern science can provide the right tools to do it

PROCESSES OCCURRING IN COOKING

CHEMICAL PROCESSES

=

TRASFORMATION OF MOLECULES OF A KIND IN MOLECULES OF DIFFERENT KIND

STUDIED FOR TWO CENTURIES

PHYSICAL PROCESSES

=

REARRANGEMENT OF THE SAME MOLECULES ACCORDING TO NEW ARCHITECTURES

ONLY RECENTLY UNDERSTOOD

The bricks and the building :

the physical processes

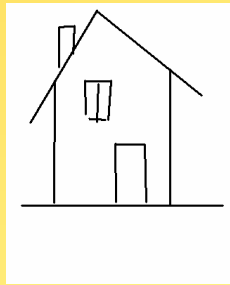
≠

THE HOUSE IS NOT REDUCIBLE TO BRICKS, LIME, ETC., EVEN IF WE KNOW THE EXACT AMOUNTS OF THEM!

THE MAYONNAISE IS A NEW AND DIFFERENT OBJECT WITH RESPECT TO YOLK, OIL, SALT AND VINEGAR, EVEN IF WE KNOW THE EXACT AMOUNT OF THEM!

=

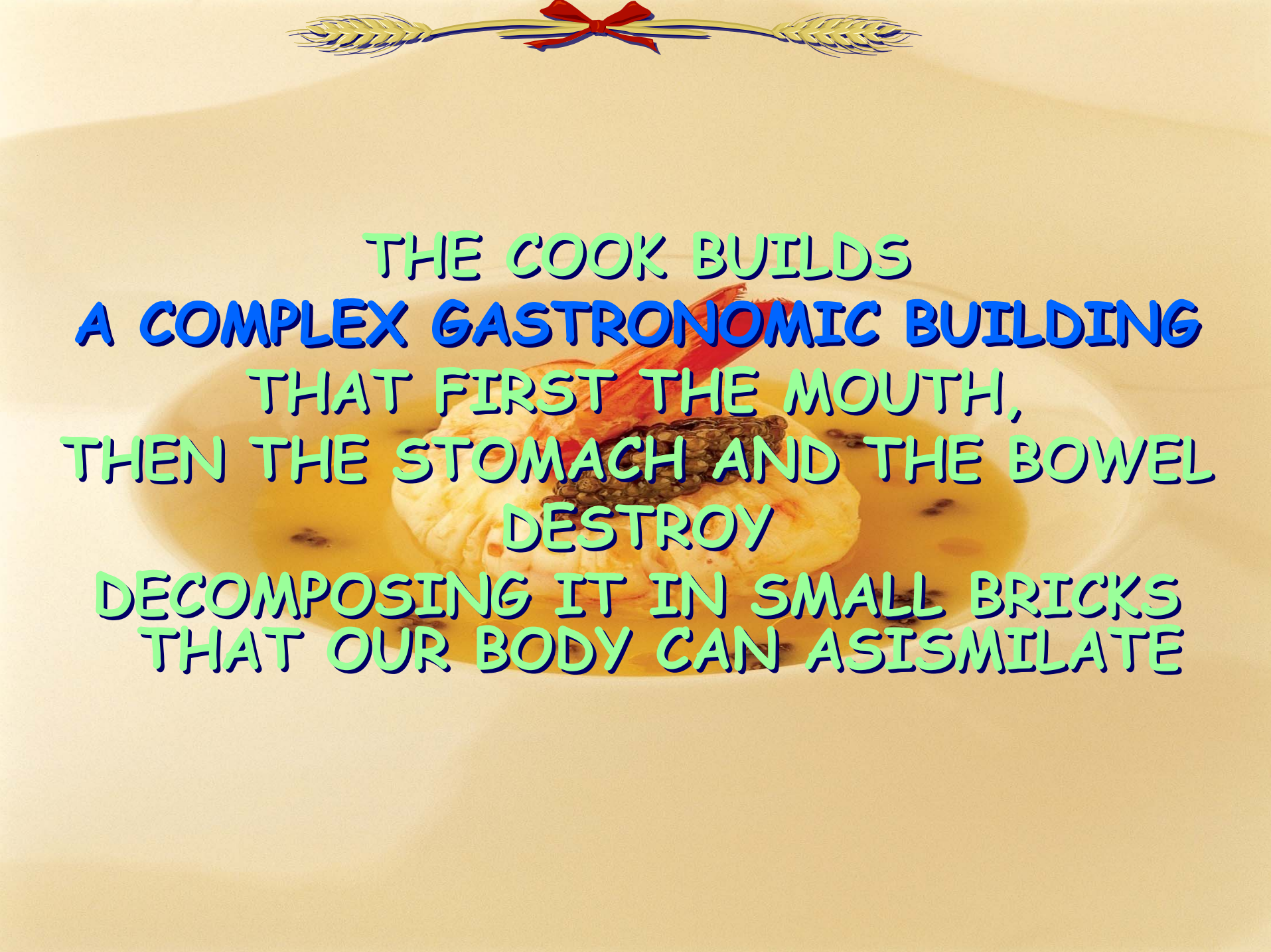
+



THE HOUSE AND ITS PROPERTIES ARE BETTER CHARACTERIZED BY ITS ARCHITECTURE THAN BY THE BRICKS DETAILS…

THE MAYONNAISE AND ITS PROPERTIES ARE BETTER CHARACTERIZED BY ITS INTERNAL STRUCTURE THAN BY THE EXACT AMOUNTS OF ITS INGREDIENTS


A complex system
is a system
whose properties
depend more
on its architecture
than on the details
of its components



THE COOK BUILDS
A COMPLEX GASTRONOMIC BUILDING
THAT FIRST THE MOUTH,
THEN THE STOMACH AND THE BOWEL
DESTROY
DECOMPOSING IT IN SMALL BRICKS
THAT OUR BODY CAN ASISMILATE

GASTRONOMIC PROPERTIES ARE DEEPLY AFFECTED BY THE ARCHITECTURE, I.E. BY TEXTURE AND MICROSCOPIC STRUCTURE

THE RELATIONSHIPS BEETWEEN MICROSCOPIC STRUCTURES AND MACROSCOPIC PROPERTIES ARE STUDIED BY

THE PHYSICS OF MATTER

The internal architecture of matter

SIMPLE BRICKS

SMALL ATOMS AND MOLECULES

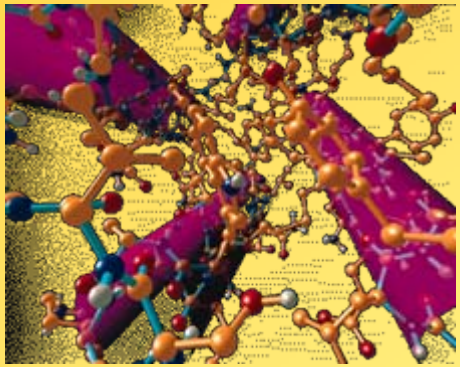
SIMPLE BUILDINGS

GASES, LIQUIDS, SOLIDS

The internal architecture of matter

COMPLEX BRICKS

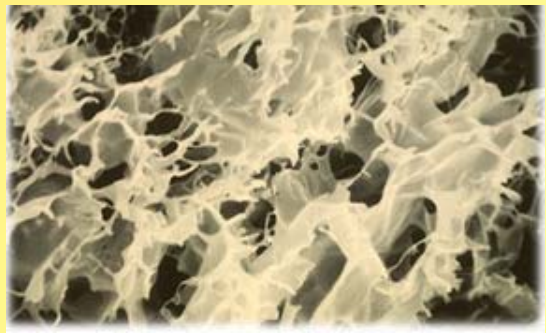
MACROMOLECULES, POLYMERS



COMPLEX BUILDINGS

BETWEEN LIQUIDS AND SOLIDS

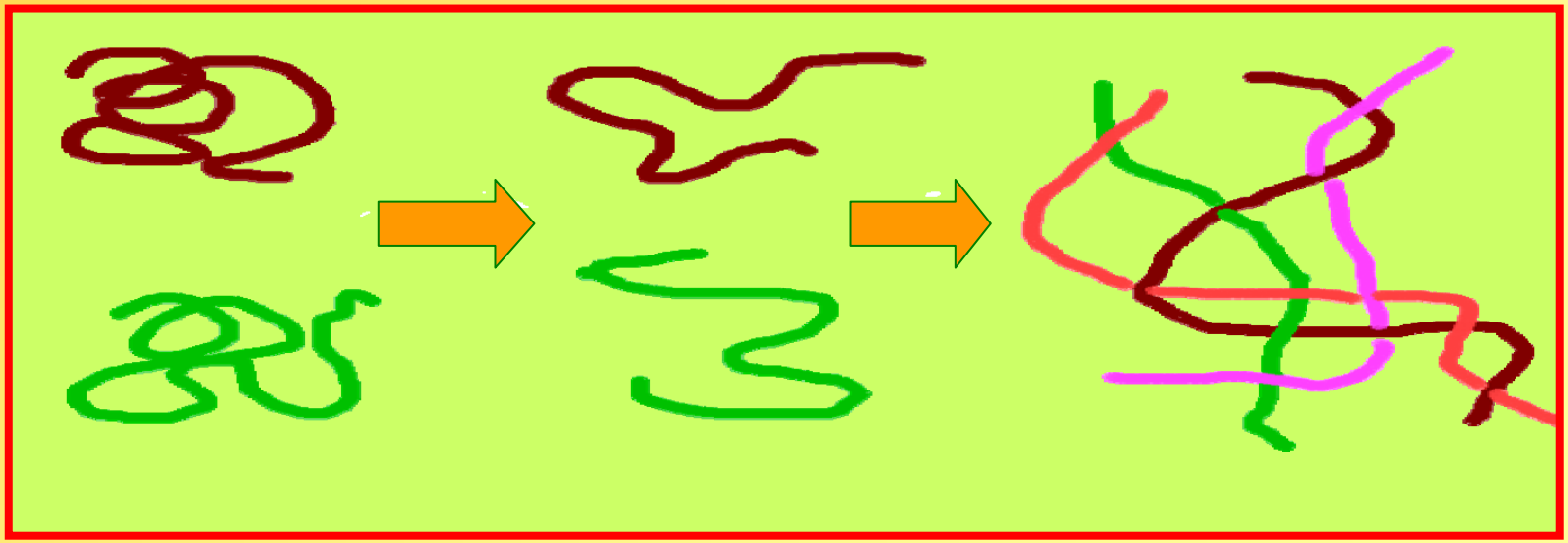
SOFT MATTER



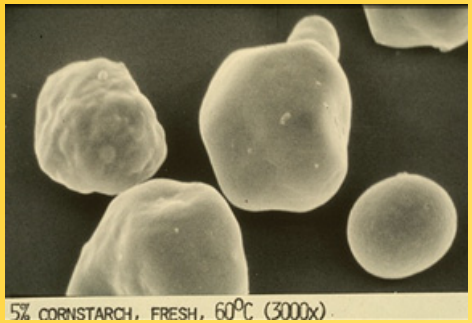
The architecture of soft matter

A: GELS

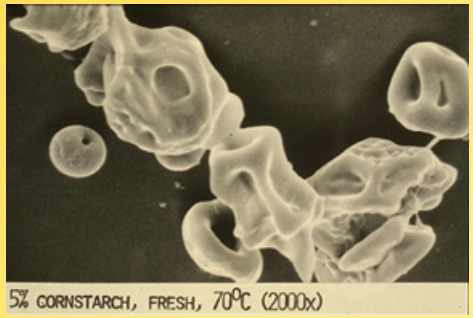
Polysaccarides and proteins swell and unwind and get entagled forming a network able to absorb large amounts of water



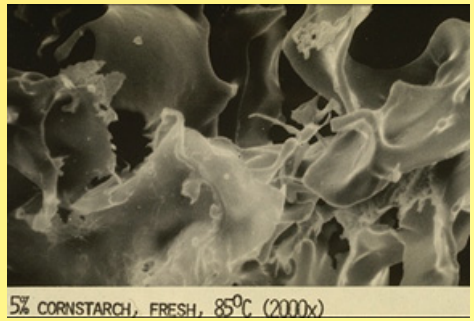
EXAMPLES: Breadcrumb, pasta, boiled egg, polenta, aspic, jam…



5% CORNSTARCH, FRESH, 60°C (3000x)



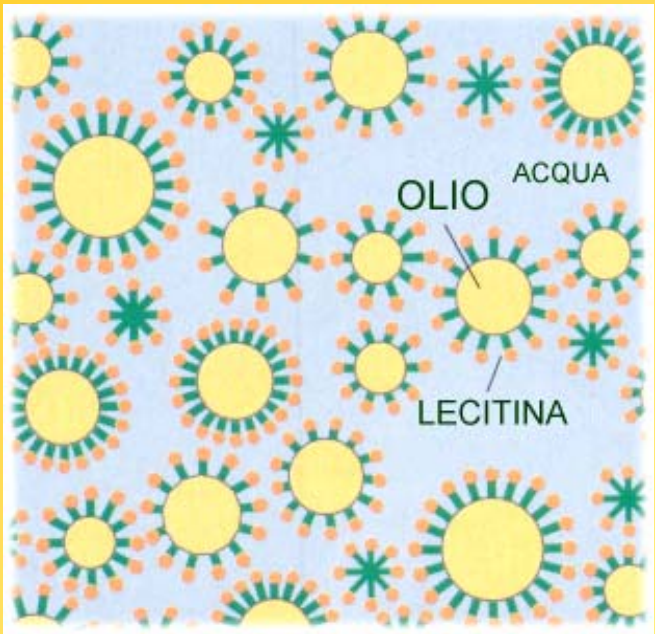
5% CORNSTARCH, FRESH, 70°C (2000x)



5% CORNSTARCH, FRESH, 85°C (2000x)

B: EMULSIONS

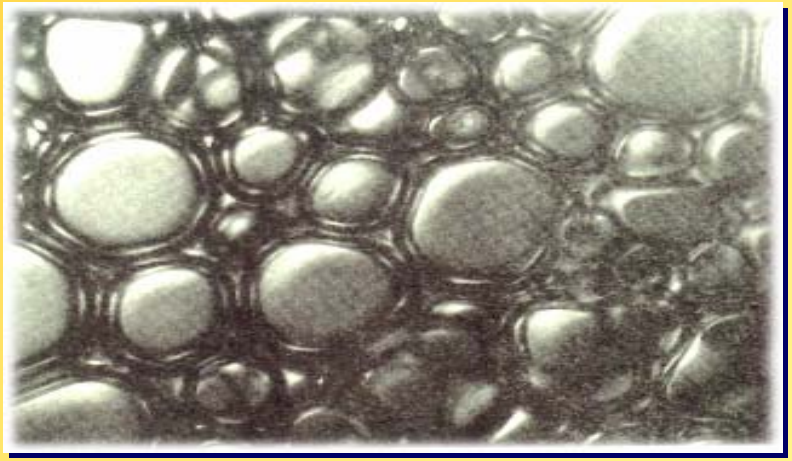
Fats and water mix thanks to the surfactant molecules, which surround the droplets of either



Examples Mayonnaise (oil in water), milk (fat in water), butter (water in fat), ganache, …

C: FOAMS

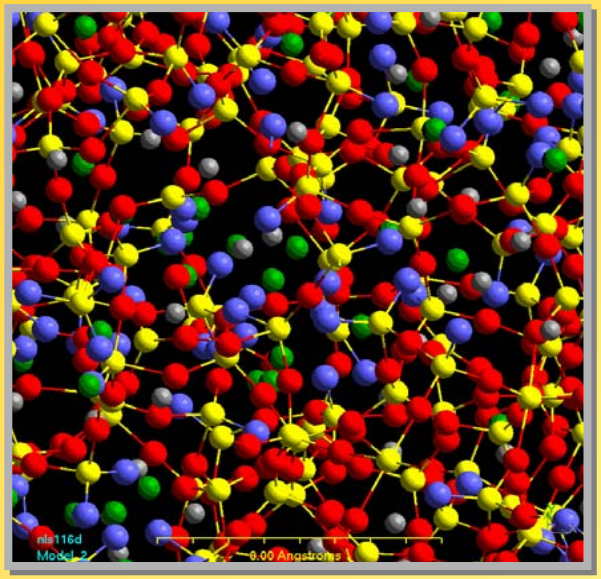
Gas bubbles surrounded by surfactant molecules, inside water or fat



Examples: whipped egg white, (air in water)
whipped butter (air in fat),…

D: GLASSES

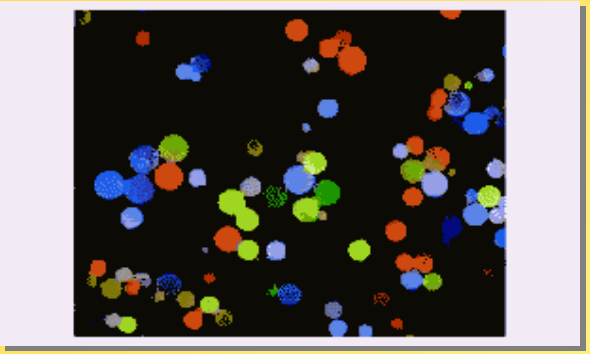
Molecules occupy fixed positions, like in a solid, but their arrangement is disordered, like in a liquid



Examples: caramel, candies, ...

E: SUSPENSIONS

Solid microparticles are scattered in a liquid, without dissolving



Examples: several sauces (pesto, …), pinzimonio, ...

The new scientific cuisine

a brief review of dishes and techniques

GELS

Egg curd

Starch gnocchi

Starch wafer

EMULSIONS AND FOAMS:

Soya lecithin sauces

New Italian meringue

COOKING IN MELT SUGAR:

Absolute turbot

Absolute donuts

PASTA

With soya lecitin

Of chikpea flour

LIQUID NITROGEN:

Ice cream

Frozen crust, …

Egg curd

A gel is formed at room temperature by adding alchool, then it is washed in water and kneaded

Starch wafer

A gel of starch with vegetable juice is cooked at high temperature between two plates

Soya lecithin sauces

- Obtained adding other ingredients to a light foam of lecithin and water
- Usually without eggs and oil

The new pastas of the Italian scientific cuisine

Soja lecithin pastas

- use of a natural surfactant
- great capacity of capturing fine sauces
- more ductile and malleable
- better texture “al dente"

Gelified starch gnocchi (without gluten)

- use of a starch paste
- dissolve very quickly in the mouth (action of the ptyaline)

Pastas of the future: towards a geometrical engineering of the pastas

Until now the "scientific" improvements of the quality of the pastas are mainly due to chemistry biology: one works on the microscopic details

The study of the geometrical and structural aspects with the methods of statistical physics is rather recent

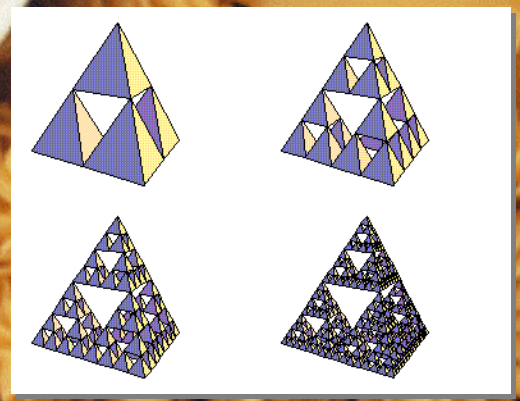
Pastas of the future: towards a geometrical engineering of the pastas

Next goals

Control geometry of the gluten network to control the dynamics of drying and cooking

Control of positions and sizes of starch particles to improve cooking and surface properties

Project of new pastas (shape and surface)



Absolute turbot

fried in melted glucose

Absolute turbot

fried in melted glucose

Absolute turbot

fried in melted glucose

Absolute turbot

fried in melted glucose

Absolute turbot

fried in melted glucose

Liquid nitrogen ice cream

- 78% of dry air is nitrogen
- Boling point at room pressure = -195.8 ºC
- Liquid nitrogen is not used to reach such a low temperature, but to get the quickest cooling possible in gastronomy...)
- The quicker is the cooling of a liquid, the smaller are the formed crystals
- A thin powder of microcrystals has a greatthikening power

Unconventional ice cream:

- Less amount of ice, less mouth freezing
- Great flavour extraction and enhancement
- Extremely soft texture
- Can tranform almost any liquid in an ice cream

Other dishes with Liquid nitrogen

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Antipasti
A base di Latticini - Stile di cucina: Scientifica -

Caprese inaspettata

Tempo occorrente | Difficoltà | Costo piatto | *R481*

Costo ingredienti a porzione 1,47
Grado di lavorazione 1,5
Contributo costi fissi 2,20
Costo piatto 4,41
Ricarico ..... 70,0 %
IVA ..... 0,75 (10 %)
Prezzo di vendita 8,24
Utile 3,09

Attrezzature: *Centrifuga ; Bastardella; Frusta; Ramaiolo;*

Ingredienti a porzione	g.			
Mozzarella filoni	**20**	*11,5 %*	**0,09**	*6,1 %*
Pomodori maturo tondo a grappoli	**50**	*28,7 %*	**0,06**	*3,7 %*
Sale fino	**1**	*0,3 %*	**0,00**	*0,0 %*
Tabasco gr 60	**0**	*0,1 %*	**0,19**	*12,6 %*
Worchestershire sauce	**0**	*0,0 %*	**0,09**	*6,1 %*
Origano	**0**	*0,0 %*	**0,00**	*0,0 %*
Glucosio fluido	**3**	*1,7 %*	**0,01**	*0,6 %*
Olio extra vergine oliva	**1**	*0,3 %*	**0,00**	*0,3 %*
Fiori colori e profumi	**0**	*0,1 %*	**0,45**	*30,6 %*
Germogli assortiti	**50**	*28,7 %*	**0,40**	*27,2 %*
Pepe bianco	**0**	*0,1 %*	**0,06**	*4,2 %*
Azoto liquido	**50**	*28,7 %*	**0,13**	*8,5 %*

Procedimento
Mettere le fettine di mozzarella nel microonde a piena potenza per circa 2 minuti.
Mettere subito in forma per ottenere dei bicchierini.
Centrifugare i pomodori precedentemente lavati.
Condire il succo di pomodoro con l olio, il sale, l origano, il glucosio, il tabasco, il worchester ed un pizzico di pepe bianco.
Condire leggermente i germogli con sale ed olio.
Procedere alla preparazione del sorbetto di pomodoro aggiungendo l azoto necessario.
Porre al centro del piatto di portata i germogli, adagiarci sopra i due cestini di mozzarella, riempirli con il sorbetto di pomodoro e guarnire a piacere.
Servire subito, si puo versare dell-azoto sul piatto per un maggior impatto coreografico

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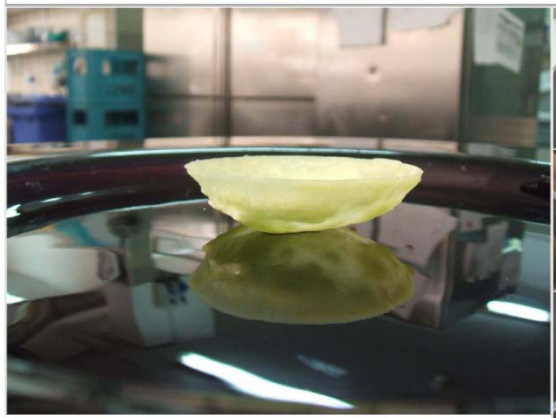
Basi di cucina
A base di Verdure - Stile di cucina: Azoto -

R1421

Coppetta di sedano

Roberto Bendinelli



Tempo occorrente | Difficoltà | Costo piatto

Dose ricetta per 100 pz.
5 dl. Succo di sedano - 10 g. Succo di limone (limoni) - 10 g. Miele - 10 g. Sale fino - 10 ml. Olio extra vergine oliva - 5,1 l. Azoto liquido

Procedimento
Unire tutti gli ingredienti e mescolare fino al completo discioglimento di tutti gli ingredienti. Raffreddare il composto con un po' di azoto per ridurre il coefficiente di adesione. ● Mettere lo un ramaiolo piccolo a bagno nell'azoto e far raffreddare completamente. Estrarre il ramaiolo dall'azoto facendo ben attenzione a lasciare abbondantemente azoto al suo interno e immergerlo per metà nel composto ottenuto. Contare 4 secondi, estrarre immediatamente il ramaiolo dal succo ed immergerlo completamente nell'azoto per non più di 2 secondi. Estrarre il ramaiolo e staccare delicatamente la coppetta ottenuta ●
Conservazione: -18°C x 180 giorni
Note:
Energia e Nutrienti: 19 Kcal - Glucidi 4g. - Proteine 1g. - Lipidi 0g.


Bon Appetit!