UNLOCKING FLAVOUR IN PLANT-BASED: THE SCIENCE BEHIND YEAST INGREDIENTS AND HUMAN TASTE

05 JUN 2025

ANTOINE THOMAS
SENSORY AND FLAVOR DEVELOPMENT MANAGER
A.THOMAS@LESAFFRE.COM

Biospringer by Lesaffre

OUR AMBITION

Today, our ambition
is to be one of the leaders in the movement
around fermentation:

> **Working together to better nourish and protect the planet.**

This mission must guide our daily activities.

LESAFFRE IN 2025

11,000 employees

100 nationalities

1,200 employees who took part in a charity projects via ECHO

700 RD&I experts

52 Baking Center™

65 applied science centers

10 sensory analysis labs

180 our solutions are distributed in more than 180 countries

3 billion euros turnover

95 commercial subsidiaries

100 international partnerships

89% share of turnover from products sold having been manufactured by a GFSI* certified site

80 production sites in more than 55 countries

*Global Food Safety Initiative

OUR ACTIVITIES

The infinite potential of microorganisms (yeasts, bacteria…) enables us to position ourselves in the bread making, food taste and pleasure, healthcare and industrial biotechnology markets.

In each of these domains, Lesaffre's ambition is to be **one of the active leaders in the fermentation of microorganisms to better nourish and protect the planet.**

WE CREATE RESPONSIBLE TASTE

Biospringer by Lesaffre

10 factories
in the world

5 Culinary centers
(US, Brazil, France, China, Singapore)

1 Global Sensory Lab
In France

1 Central R&D
In France

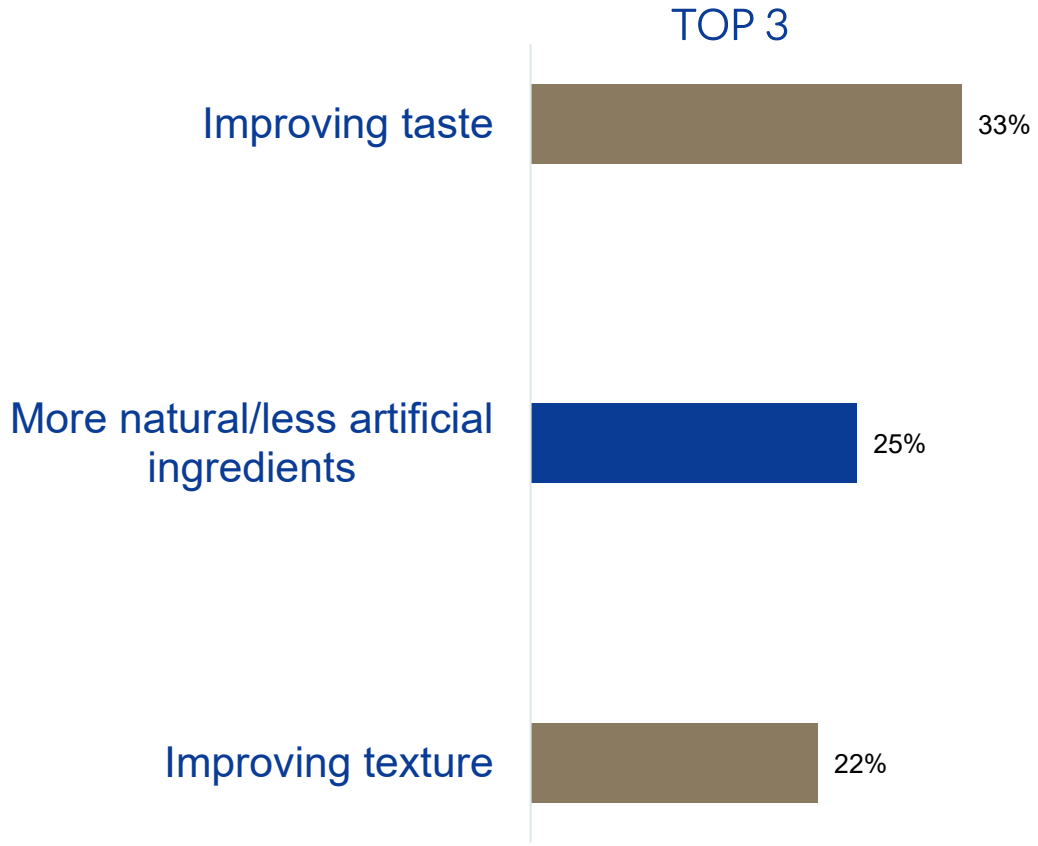
Formulate plant-based products with natural fermentation-based solutions:

- **Improve** mouthfeel
- **Bring** authentic taste
- **Elevate** protein content
- **Neutralize** off-notes
- **Reduce** fat and salt

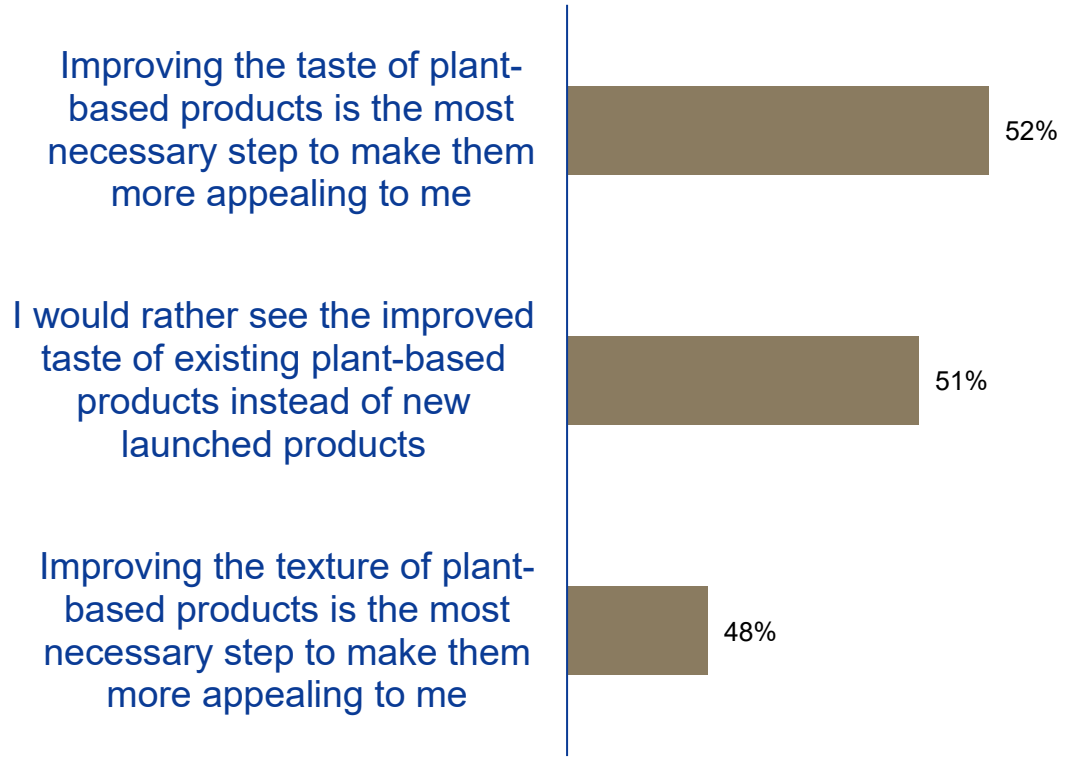
HOW IMPORTANT ARE THE TASTE & TEXTURE CHALLENGES IN PLANT-BASED FOODS ?

The demand for plant-based foods is rising, but many fall short on taste and mouthfeel.

"Which improvements would you like to see more in plant-based products?



"To what extent do you agree with the following statements?
(Reponses for "agree" or "strongly agree")



Source: Innova Trends Survey (Europe 2024)

WHAT ARE THE TASTE & TEXTURE CHALLENGES IN PLANT-BASED FOODS ?

1

Taste identity & reproduction

2

Masking undesirable notes

3

Depth & mouthfeel

Simply adding salt, fat, or umami is not enough to fully replicate the flavor complexity of traditional foods.

WHICH OTHER IMPORTANT CHALLENGES ?

Reducing Fat

Reducing Salt

Naturalness

Sustainability

Reducing Sugar

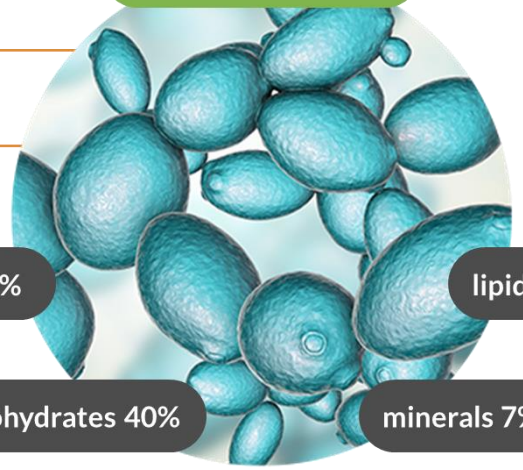
Nutritional Value

YEAST, A MICROORGANISM WITH AN UNLIMITED POTENTIAL

Fungi kingdom

size< 1/6000 – 1/8000 mm

Composed of :



proteins 49%

lipids 4%

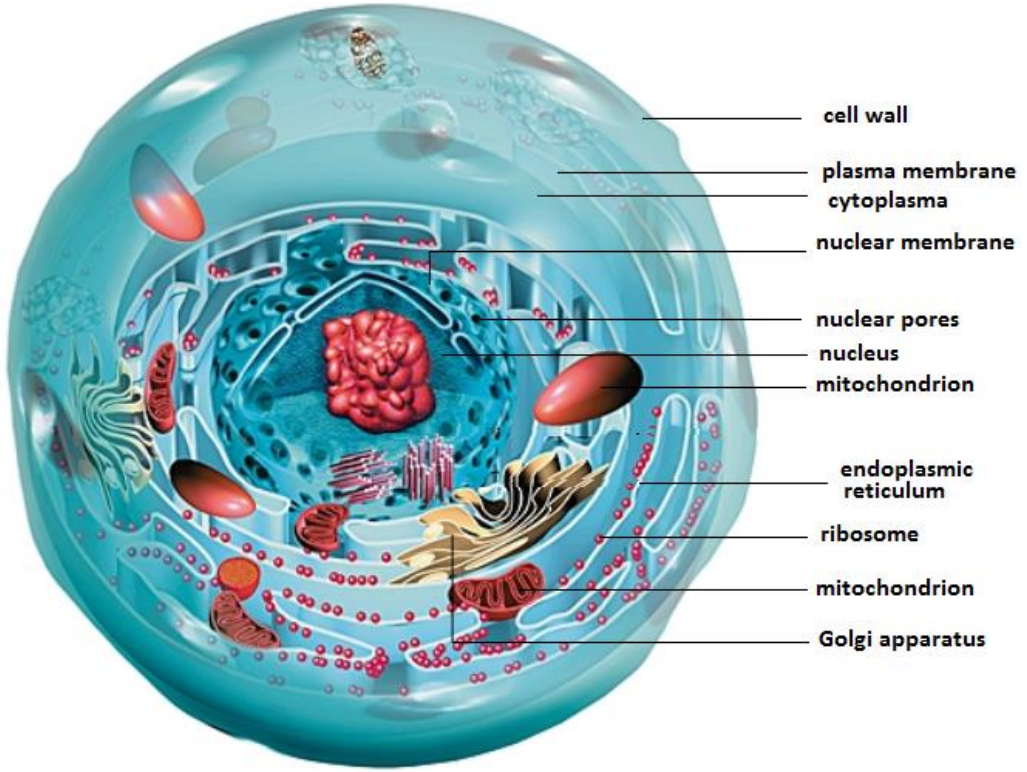
carbohydrates 40%

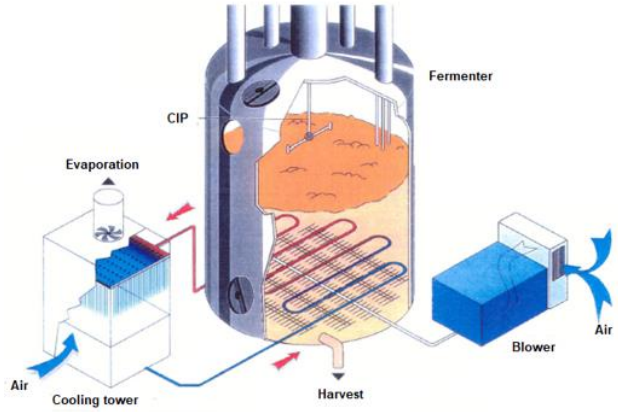
minerals 7%

* On dry matter basis

Did you know ?

A small 1cm yeast cube weighs about 1g and contains **10 billion living cells** of yeast!





In a short time, sugar and mineral nitrogen are transformed into organic nitrogen as protein and essential amino acids.

5 TASTES, 5 DIFFERENT MECANISMS

SALT **SOURNESS** **BITTERNESS** **SWEETNESS** **UMAMI**





Ion channels

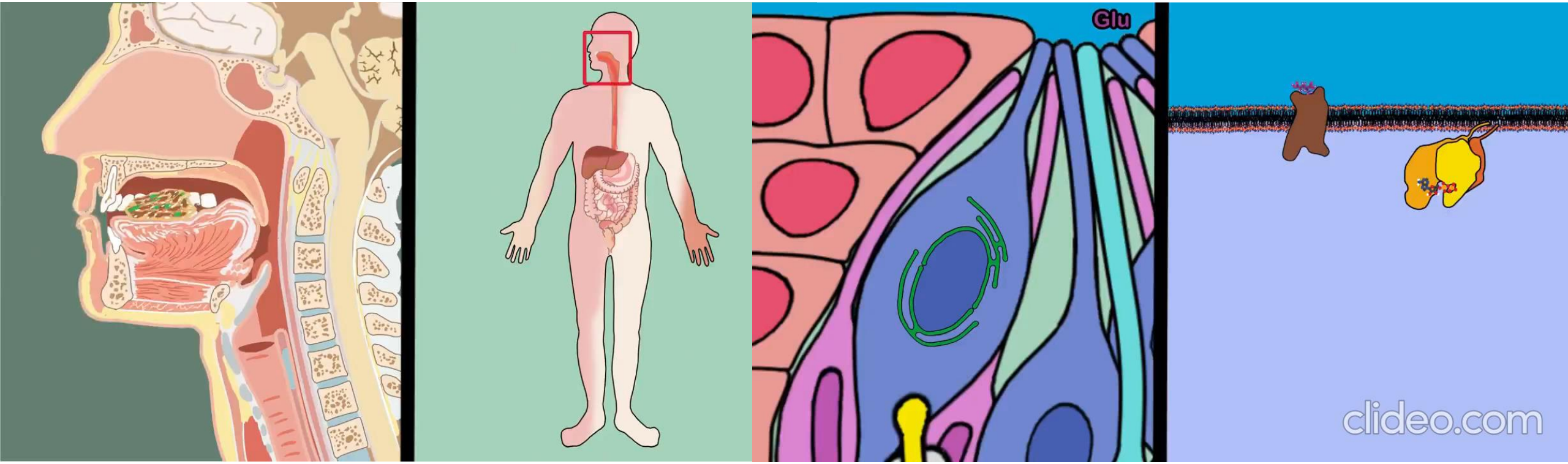
G-protein coupled receptors (GPCRs)

25 types of GPCR
(TAS2Rs)
> The number of receptors makes it difficult to neutralize bitterness

1 type of GPCR
(T1R2/ T1R3)

1 type of GPCR
(T1R1/ T1R3)

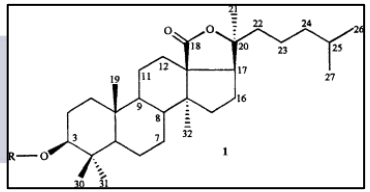
5 TASTES, 5 DIFFERENT MECANISMS

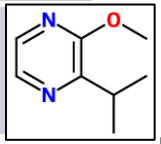


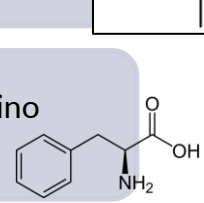
Source: Oral Physiology: Mastication, Gustation, Salivation, Deglutition - Molecular Animations of the Cell (YouTube)

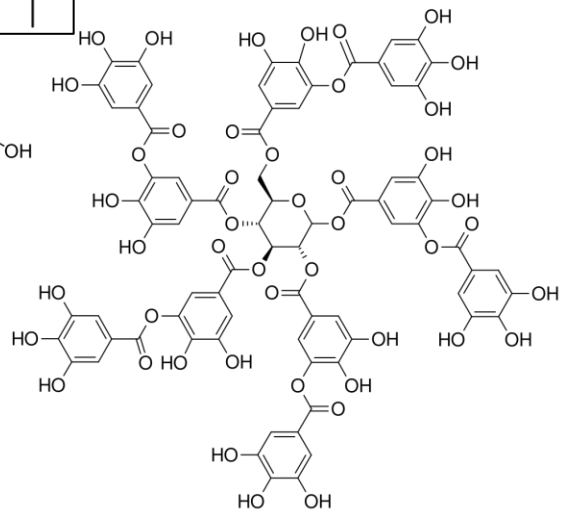
PLANT DERIVED OFF NOTES AND LINKED COMPOUNDS

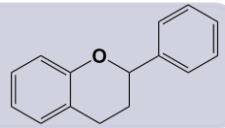
SAPONINS	• Bitterness, metallic • Triterpenoid saponins, Steroidal saponins
METHOXYPYRAZINES	• Beany, musty, pea, green (typical pea-like) • 2-methoxy-3-isopropylpyrazine, 2-methoxy-3-sec-butylpyrazine, 3-isobutyl-2-methoxypyrazine
PEPTIDES AND AMINO ACIDS	• Bitterness, astringency • Phenylalanine, Leucine, Valine, Isoleucine and other hydrophobic amino acids • Peptides with short sequences (<8 residues)
TANNINS	• Astringency • Hydrolysable tannins with gallic acid or ellagic acid as base • Condensed tannins, Pseudotannins, Complex tannins
FLAVONOÏDS	• Bitterness • Catechin, a flavan-3-ol, building block of condensed tannins • Chlorogenic acid, Quercetin
LIPIDS OXIDATION PRODUCTS	• Green, beany, fatty, oily, rancid, floral, solvent • Aldehydes, alcohols, ketones, furans (C5, C6, C9)
PHENOLIC ACIDS	• Bitterness, astringency, sourness • Examples p-hydroxybenzoic acid, salicylic acid, gallic acid, ellagic acid (benzoic acid derived) and p-coumaric acid, caffeic acid, ferulic acid (cinnamic acid derived)

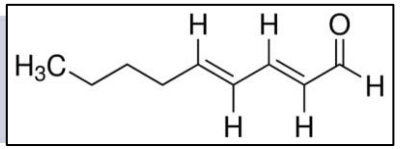


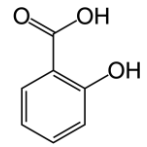










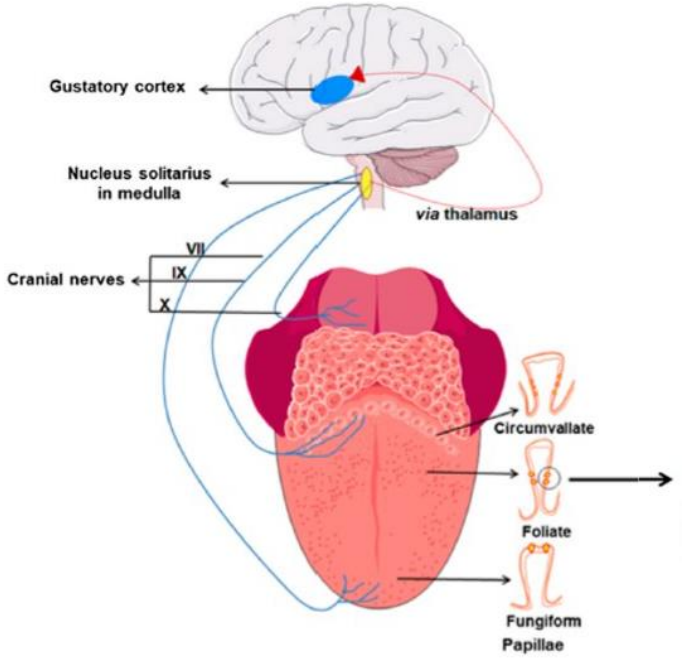


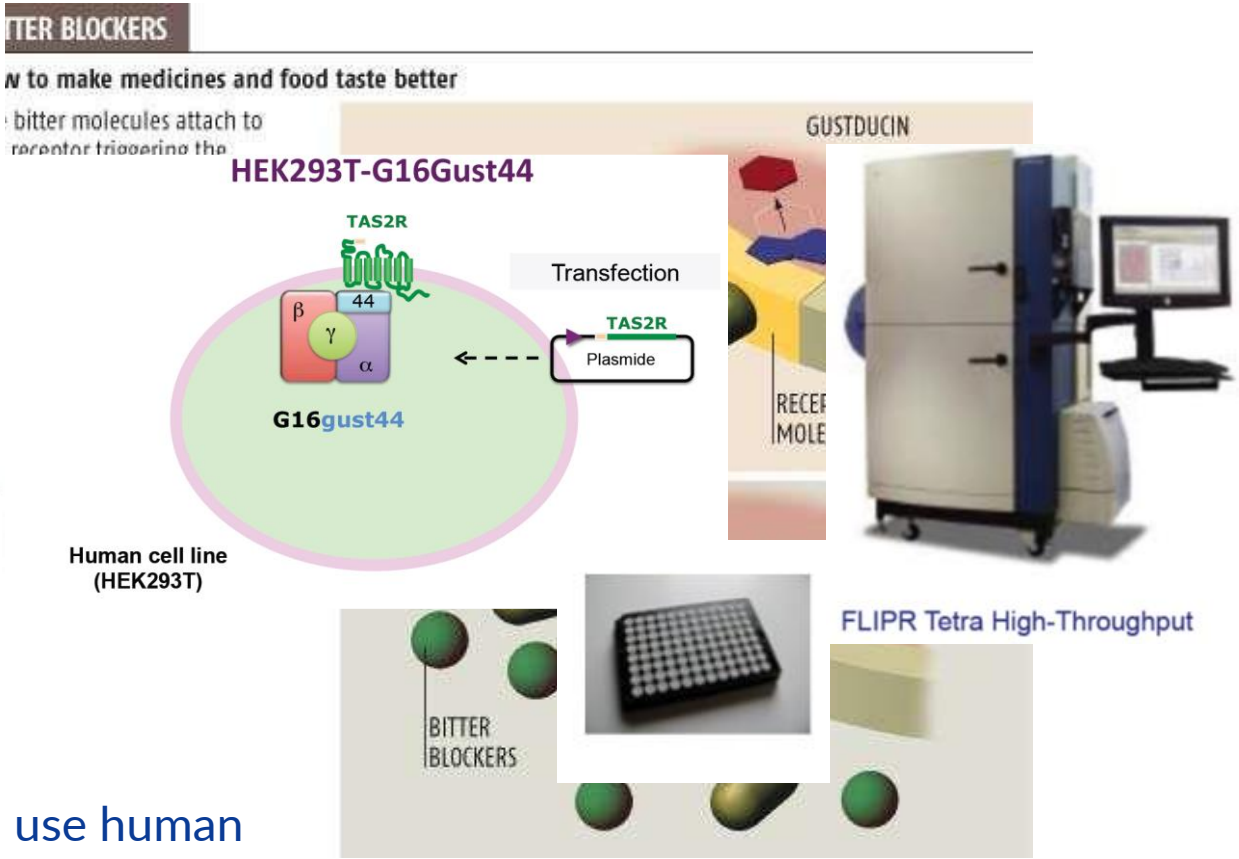
=> Can come from the raw material itself (enzyme, ion, chemical profile) or can be processed related (storage, moisture, heat treatment, ph variation)

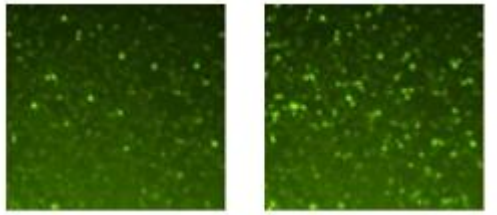
Source: Nizo Consortium "Reducing flavour and texture issues with legume-based foods and ingredients" 2023

BITTER BLOCKERS

The science of cellular-based functional taste receptor assay

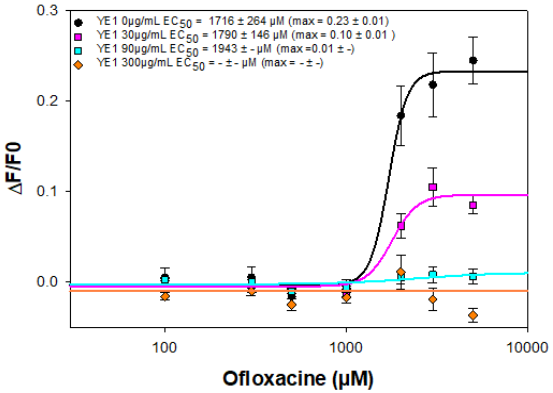






Fluorescence reading

TAS2R9



Partnership with INRAe CSGA to use human cellular receptor models to understand the effects of our solutions on bitter taste.

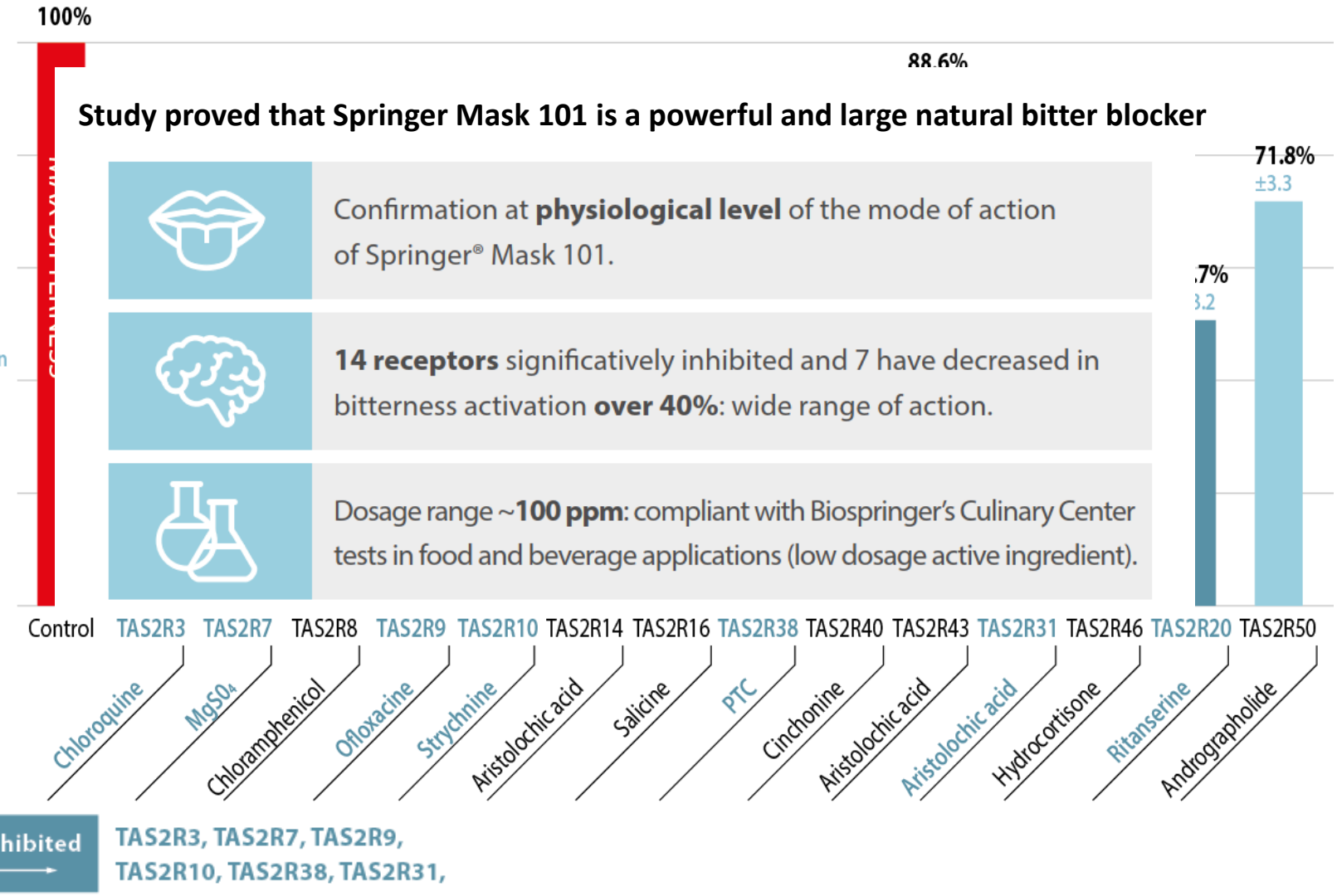
SPRINGER MASK: A SIGNIFICANT INHIBITING EFFECT ON 14 BITTER RECEPTORS

Study proved that Springer Mask 101 is a powerful and large natural bitter blocker

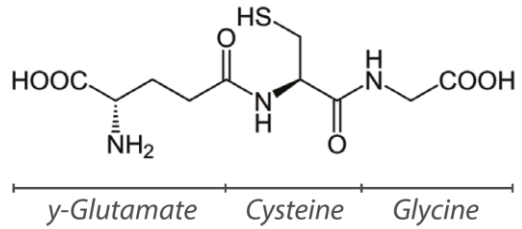
Confirmation at **physiological level** of the mode of action of Springer® Mask 101.

14 receptors significatively inhibited and 7 have decreased in bitterness activation **over 40%**: wide range of action.

Dosage range ~**100 ppm**: compliant with Biospringer's Culinary Center tests in food and beverage applications (low dosage active ingredient).



WHAT IS KOKUMI AND HOW DOES IT IMPROVE TASTE PERCEPTION?



Glutathione (γ-Glu-Cys-Gly)

WHAT IS KOKUMI?

Not a basic taste, but a **taste sensation** that amplifies richness, depth, mouthfeel and modulates flavors

Naturally found **in fermented products,** slow-cooked meat, aged cheese

Key kokumi-active compounds: **γ-glutamyl di and tripeptides**

150+ molecules linked to kokumi perception

Glutathione (GSH) : One of the main kokumi compounds which naturally occurs in yeast

WHAT IS KOKUMI AND HOW DOES IT IMPROVE TASTE PERCEPTION?

HOW DOES KOKUMI WORKS?

1

Binding to receptors
Kokumi compounds attach to calcium-sensing receptor (CaSR) on taste cells [2,3]

2

Signal activation
Triggers G-protein signaling, leading to PLC-IP3 pathway activation [2,3]

3

Release of intracellular calcium sending stronger "taste" signals to the brain [3,4]

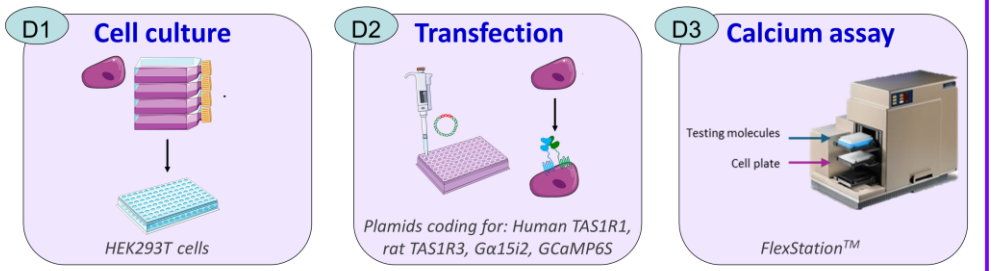
SENSORY BENEFITS OF KOKUMI

Makes plant-based foods feel ***richer and more satisfying***

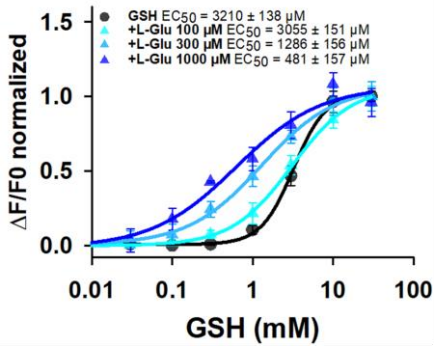
Increases ***umami, fattiness, and complexity***

OUR LATEST DISCOVERY ON GLUTATHIONE ACTIVATING UMAMI RECEPTOR

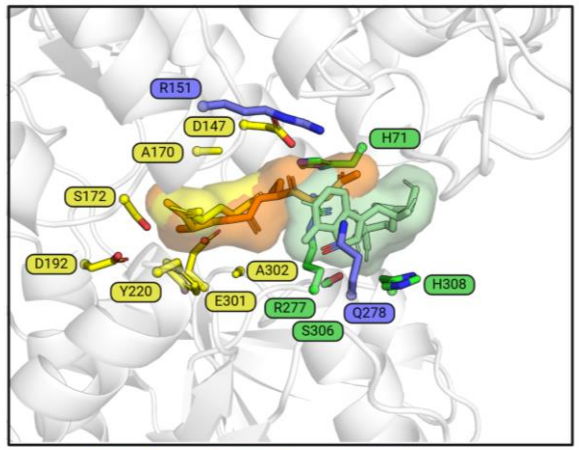
METHOD — **Umami taste receptor functional assay**

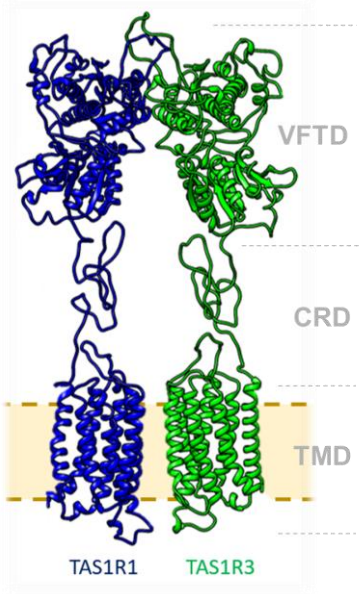


Functional expression of umami taste receptor hTAS1R1/rTAS1R3 (wild type) and 21 point mutants.



Synergy
between GSH and L-Glu

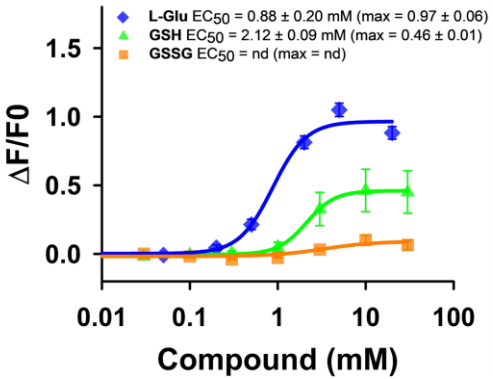


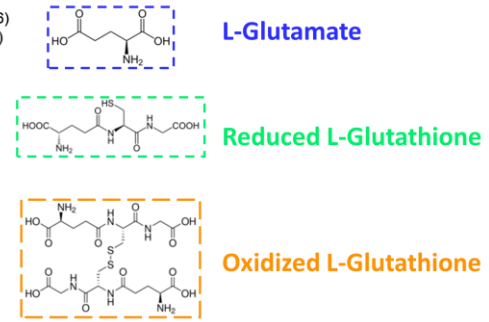


RESULTS

Activation of TAS1R1/TAS1R3 by GSH

Agonists





CONCLUSION

- In contrast with L-Glu, GSH is a partial agonist of hTAS1R1/rTAS1R3 receptor.
- GSH synergizes with L-Glu.
- Critical residues for GSH binding (orange) are located in the VFTD of TAS1R1. GSH makes contact with 8 critical residues. The binding site of GSH overlaps with that of L-Glu (yellow) and IMP (green).

KOKUMI: MORE THAN GLUTATHIONE

Springer Cocoon 4101/0 MG L: 26 kokumi molecules identified (relative intensity normalized to alanine)

Molecular Class	Compound Name	4101/0 MG L
Amino Acid	**Alanine**	**1000000**
Amino Acid	His	275
Amino Acid	methylCys	118
Amino Acid	methylCSO	54
Amino Acid	allylCSO	46
Amino Acid	PeCSO	20
Modified Peptide	Glu-CysDDE	796
Modified Peptide	Glu-ethylCys	41
Organic acid	Creatinine	423
Organic acid	Creatine-1	133
Organic acid	Creatine-2	92
Peptide	Glu-Gly	105765
Peptide	Glu-Cys*-Gly	53681
Peptide	Glu-Cys*	28758
Peptide	Glu-Ala	1299
Peptide	Pro-Glu	1098
Peptide	Pro-Pro	1080
Peptide	Pro-Val	1018
Peptide	Ser-Pro	707
Peptide	Glu-Abu	656
Peptide	Glu-Val	592
Peptide	Glu-Gln	533
Peptide	Glu-Abu-Gly	509
Peptide	Arg-Pro	176
Peptide	Glu-Glu	162
Peptide	Val-Pro	75

KEY TAKEAWAYS

1. Taste remains the number one challenge for plant-based product category
2. Yeast and, more broadly, microorganisms can be used as biological factories to produce key natural compounds, and can also bring taste complexity with thousands of different compounds in extracts (mainly peptides).
3. Combining cellular-based functional taste receptor assays with other expertise, such as sensory analysis and physical-chemical analysis, helps us expand our knowledge of basic tastes and flavor properties of natural extracts.
4. Bitter blockers and off notes maskers can help improving the taste of plant-based products, and need to be adapted to each formulation – combination of different solutions can be powerful to obtain a broader effect.
5. Kokumi helps plant-based foods achieve the depth, indulgence, and craveability consumers demand naturally, while also supporting healthier formulations.

THANK YOU!

ANY QUESTION?

ANTOINE THOMAS
SENSORY AND FLAVOR DEVELOPMENT MANAGER
A.THOMAS@LESAFFRE.COM

Biospringer
by Lesaffre