15th

International Workshop

on Molecular and Physical Gastronomy

(IWMPG 15)

**6-7 May 2026**

**Centre de formation des apprentis Hôtellerie-Restauration de Colmar (France)**

Organized by:

**AgroParisTech-INRAE International Centre**

**for Molecular and Physical Gastronomy :**

**https://icmpg.hub.inrae.fr/international-activities-of-the-international-centre-of-molecular-gastronomy/iwmpg-workshops**

# Flavour

# from food and beverage

## Organization

### Committee:

Róisín Burke (Technological University Dublin, Ireland), Alan Kelly (University College Cork, Ireland), Christophe Lavelle (CNRS/MNHN, France), Hervé This vo

INRAE ICMPG AgroParisTech

Kientza (AgroParisTech-INRAE, France), Dan Vodnar (UAVSM of Cluj-Napoca, Romania)

contact: icmg@agroparistech.fr

**One can participate either physically or by video conference :**

**1. For physical attendance :**

Centre de formation des apprentis (CFA) Hôtellerie Restauration de Colmar
5 rue de la gare, 68000 Colmar (Alsace, France)
(https://www.google.fr/maps/search/centre+de+formation+des+apprentis+colmar/@48.0755573,7.3478457,694m/data=!3m1!1e3?hl=fr&entry=ttu&g_ep=EgoyMDI1MDYyMi4wIKXMDSoASAFQAw%3D%3D : It is close to the old Medieval city of Colmar, with a lot of good restaurants around).

**To reach the CFA:**

1. from Paris, train 2h30 min
2. Basel airport, 30 min train
3. Frankfurt airport + train

There are plenty of places to stay, but just in front of the railway station, there is a good hôtel (Grand Hotel Bristol)... with a convenient (and good) restaurant at the ground level.

In the city, plenty to visit, plenty of food and drinks. And around the city, the best wineyards of Alsace... plus a lot of "wistub" (traditional restaurants). Farther (45 min by car), you can visit "fermes auberges" in the mountain (where you eat the products of the farm, in particular munster cheese, Siaskaas, etc.). Wine and Cremant flowing everywhere.

## 2. For video conference:

**For the 6th:**

Time: May 6, 2026 06:00 PM Paris
Join Zoom Meeting
https://agroparistech-fr.zoom.us/j/95685280671?
pwd=r5MyQV7mbCTGZ4TJiBN8mCpWk28VMy.1
Meeting ID: 956 8528 0671
Passcode: 189873
Join instructions
https://agroparistech-fr.zoom.us/meetings/95685280671/invitations?
signature=wiS6vNfKm_WAa8zekAVohGDPSi1Oip_Spo5mx7auli0

**For the 7th:**

Time: May 7, 2026 06:00 PM Paris
Join Zoom Meeting
https://agroparistech-fr.zoom.us/j/98611098756?
pwd=0aSiqxGwzR1a4D9NyeKFJpTIpF2SbE.1
Meeting ID: 986 1109 8756
Passcode: 713410
Join instructions
https://agroparistech-fr.zoom.us/meetings/98611098756/invitations?
signature=GlV3MyQ1K0ZXj9VahDZggFuA5NIKOl9tedYu3lCCPJ4

## Purpose of the Workshop

*« La gastronomie est la connaissance raisonnée de tout ce qui se rapporte à l'homme en tant qu'il se nourrit»* (Gastronomy is the reasoned knowledge about man's nourishment)
Jean Anthelme Brillat-Savarin (1755-1826)

Writing about the application of the chemistry to the art of cookery:
*« In what art or science could improvements be made that could more powerfully contribute to increase the comforts and enjoyments of mankind »*
Sir Benjamin Thompson, Count Rumford, (1753-1814)

*« "Molecular gastronomy is the scientific activity consisting in exploring the mechanisms of phenomena occurring during dishes preparation and consumption."*
Hervé This and Nicholas Kurti, (1988)

The above quotations from the writings of two founders of Molecular and Physical Gastronomy express in a nutshell **the spirit and the objectives of the Workshop:** the emphasis will be on gastronomy rather than nutrition, on domestic and restaurant cooking rather than industry.
**The object of this workshop will be to bring together a group of scientists to discuss collectively the science behind the practices carried out in the kitchen.**
**What is a workshop?**
The *Oxford English Dictionary* defines a workshop as "a meeting at which a group of people engage in intensive discussion and activity on a particular subject or project".
Workshops, similar to seminars, are usually much smaller than conferences – a workshop can be an element of the conference structure.
Workshops typically tend to be:

- Interactive
- Educational
- Conversational

May we also point out that, as the name IWMPG « N. Kurti » indicates, this is a workshop and that **participants are encouraged to show experiments**.
Talks should preferably less than 20 min, so that discussion is promoted (of course, one can have more slides in order to be ready for the discussion).
**The primary goal is not to make speeches, but to give the information that can make a basis for active discussion in all scientific directions: materials and methods, results, interpretations, consequences, scientific strategy.**

Also, as workshops are more informal than conferences, we could keep the visio links open during the break and lunches, so that discussions can go on, and one could discuss other questions than suspensions during such times.

**Mind that the texts from talks can be submitted as manuscripts for proceedings in the *International Journal of Molecular and Physical Gastronomy* (https://icmpg.hub.inrae.fr/international-activities-of-the-international-centre-of-molecular-gastronomy/journal-of-molecular-and-physical-gastronomy).**

**Schedule**

**Mind that all times given are Paris time**

# Tuesday May 5, evening:

19.30. Dinner at the restaurant of the Grand Hotel Bristol (confirm at icmg@agroparistech.fr)

# Wednesday May 6:

Zoom Meeting
https://agroparistech-fr.zoom.us/j/95685280671?pwd=r5MyQV7mbCTGZ4TJiBN8mCpWk28VMy.1

**9.00-10.00 : Session 1, Opening session**

1. Hervé This: Introduction (MPG, the IWMPG, active workshops)
2. Roisin Burke: A brief overview of the presentation topics.
3. Dan Vodnar: Organization of the workshop
4. Presentation of the participants

**10.00-12.30, Session 2 (Chairperson: Roisin Burke) : Flavour created by chemical processes (here, we could have a section on "pyrolysis", and also hydrolysis, glycation, for example)**

- Masking bitterness: parallels between pharmaceutical formulation and culinary applications of bitter foods (Dao T.-T. Nguyen and Pasquale Altomonte)

- Flavour Modification by Ideation of Space Dishes and Emerging Space Food Processes (Volker Hessel)

- Development and standardization of a clear Birria flavouring, and colorless seasonings in general, for use in snacks (Valeria Gonzalez Garcia, Luis Antonio Davila Aguilar)

**Q/A, Discussion**

**Lunch nearby**

**14.00-15.30 Session 3 (Chairperson: Patricia O'Hara) Flavour created by chemical processes (continuation of session 2)**

- Exploring the anatomy of Malaysian flavors (Sharim Karim)

- Analysis of Variations in Matcha Components Across Different Brands on the Tunisian Market (Maissa Dely, Hassouna Mnasser, Melika Mankai)

- Should we drink while eating? (Christophe Lavelle)

**Q/A, Discussion**

**15.30-16.00 Break**

**16.00-17.00 Session 4 (Chairperson: Anu Hopia) Flavour created by physical processes (the release of compounds by grinding, heating (no chemistry, but phase transition, i.e. flavour release) or chewing**

- Deconstructing the flavor release and nutritional benefits derived from cooking with olive oil (Zeynep Delen, Patricia O'Hara)

- Results from Seminars : cooking herbs, lentils, fish fumets, roux, beurre maître d'hôtel (Herve This vo Kientza)

Q/A, Discussion

# Thursday May 7:

Zoom Meeting
https://agroparistech-fr.zoom.us/j/98611098756?pwd=0aSiqxGwzR1a4D9NyeKFJpTIpF2SbE.1

**09.00-12.00 Session 5 : Experimental session**

1. Experiments: A Comparison of the Flavour Release from Four Different Gels, by Roisin Burke

2. Experiments: About bitterness,
by Pasquale Altomonte and Dao Nguyen
demo 1 : raw endive
demo 2: braised endive
demo 3: braised endive + orange+cheese
demo 4: liquid vs foam

presentation of the Cooking Notes by Kitchen Lab Food

**10.05-10.20: Break**

**10.20-12.15 Session 6 : (Chairperson: Hervé This vo Kientza) Experimental session (continuation)**

Reception of the Mayor of the City of Colmar, also representing the President of the European Collectivity of Alsace.

3. Experiment: Flavor perception of ammonium chloride: Exploring the sensory vocabulary of a culturally specific taste,
by Anu Hopia, Nanna Rintala, Julie Talvitie

4. Experiment: About flavour production,
by Herve This vo Kientza

5. The right terms for cooking,
by Hervé This vo Kientza

Q/A, Discussion

**Lunch nearby**

**13.30-16.30 Session 7: Education session : Building food for the future: bridging the gap between education, inclusive gastronomy, interculturality and sustainability (Chair person Reine Barbar and Roisin Burke)**

**13:30 – 13:45 Welcome & Introduction**

- Overview of the session's goals and the *Tradinnovations* project (Reine Barbar, Roisin Burke)
- Explanation of the alternative poster presentation format (one slide per project): Gaëlle Garrier, Bruno Souza Moreira Leite.

## 13:45 – 14:30 Part 1: Transforming Student Projects into Scientific Outputs

**13:45 – 14:00:** Process of submitting articles based on student projects (challenges: data quality, writing skills, time constraints, and the use of artificial intelligence tools). Flow diagram illustrating the transition from classroom projects to posters, abstracts, and other forms of dissemination, including the role of AI in supporting writing, data analysis, and formatting: Reine Barbar, Roisin Burke, Paulina Mata.

**14:00 – 14:15:** Case studies from the *Tradinnovations* consortium
By Bruno Souza Moreira Leite, Reine Barbar, Roisin Burke.

**14:15 – 14:30: Open Discussion** – How to better integrate publication objectives into PBL design?

## 14:30 – 15:30 Part 2: Dissemination Strategies – Lessons Learned and Future Directions

**14:30 – 15:00:** Review of dissemination activities (strengths, limitations, and key takeaways)
By Gaëlle Garrier, Reine Barbar

**15:00 – 15:30: Collaborative time** – How to improve visibility, impact, and sustainability? Focus on planning a future Erasmus-funded summer school and other perspectives (Tradinnovations network for educators, socioeconomic stakeholders in support of student's projects)
By Bruno Souza Moreira Leite, Reine Barbar, Roisin Burke

**15:30-16:15. Part 3: Coffee and Posters Session**

Enjoy a coffee while seeing student's posters from several countries: France, Portugal, Tunisia…

Quick pitches are planned on site, online, pre-recorded by students, by educators…

Posters include: target population, studied recipe, scientific methodology and innovations levers.

**16:15-16:30. Wrap-up and closing remarks**

**16.30-16.45 : Break**

**16.45-17.30 Session 8 (Chairpersons: Hervé This, vo Kientza, Roisin Burke, Christophe Lavelle, Dan Vodnar, Reine Barbar)**

1. Open meeting of the International Journal of Molecular and Physical Gastronomy, By members of the Editorial Board of the journal

2. Publishing the proceedings of this workshop.

3. Choosing the topic and the next workshop. Below some ideas proposed already

Educational section - How can we use AI to Expand the Frontiers of Molecular and Physical Gastronomy?

Formulating (chemical, physical, recipe) to improve Food

Modelling for MPG

Orders of magnitude for MPG

Experiments and calculations in MPG

Amino-carbonyl reactions (or Browning, instead?)

Flavour release

Flavor release and pleasure

Crystals and crystallization in cooking

Building food

Food and beverage interaction

Formulation for better food, education (physics, chemistry)

Molecular and physical gastronomy for formulation

Cooking with more than 20 tastes

Education : building curricula

Gastronomy: the cornucopia of cooking

How can we use AI to Expand the Frontiers of Molecular and Physical Gastronomy?

# Abstracts

# A Comparison of the Flavour Release from Four Different Gels

**Róisín Burke**

School of Culinary Arts and Food Technology,
Technological University Dublin (TU Dublin),
Grangegorman, Dublin 7, Ireland.

*Corresponding author: roisin.burke@tudublin.ie

**Keywords**:
Flavour release, gels, demonstration, texture, sensory perception.

Flavour release is significantly affected by the texture of gels (Boland *et al*., 2004) An experiment will be conducted to examine the effect of gelling agent type on the release of flavour in the mouth. Gellan gum, Agar, Gelatine and Potato starch solutions will be prepared and the same odorant compound added to each, in a range of concentrations (the same range for each gelling agent). The gelling solutions will be added to moulds of similar shape and dimensions, and they will be allowed to set. Then a sensory analysis will be carried out among the participants of the International Workshop of Molecular and Physical Gastronomy (IWMPG), using a triangle test. Intensity of flavour, texture and clarity of the gel will be assessed.

## References

Boland AB, Buhr K Giannouli P and van Ruth, SM. 2004.
Influence of gelatin, starch, pectin and artificial saliva on the release of 11 flavour compounds from model gel systems,

Food Chemistry. 86 (3): 401-411, Available at:
https://doi.org/10.1016/j.foodchem.2003.09.015

# Masking bitterness: parallels between pharmaceutical formulation and culinary applications of bitter foods

**Dao T.-T. Nguyen[1] Pasquale Altomonte[2]**

1. Independent researcher in pharmaceutical sciences & molecular gastronomy
2. Chef and independent culinary researcher

Kitchen Lab Food – Culinary Science Research
Geneva, Switzerland.

Correspondence: *info@kitchenlabfood.com*

**Authors contributions**

Dr Dao T.-T. Nguyen developed the scientific framework of the study and designed the formulation strategies inspired by pharmaceutical taste-masking approaches. Pasquale Altomonte designed and conducted the culinary experiments and contributed to recipe development.
Both authors analyzed the results and contributed to the writing of the manuscript.

**Keywords**

bitterness, bitter foods modification, TAS2R receptors, taste masking, pharmaceutical formulation, food matrix, sensory modulation.

**Abstract**

Bitterness perception arises from the activation of human bitter taste receptors belonging to the TAS2R family, which evolved as a protective mechanism against potentially toxic compounds. Many bioactive molecules naturally present in plant-derived foods (including polyphenols, sesquiterpene lactones, glucosinolates, and alkaloids) are potent activators of these receptors and contribute to the characteristic bitterness of numerous vegetables. Interestingly, an analogous sensory challenge exists in pharmaceutical sciences, where the intense bitterness of many active pharmaceutical ingredients (APIs) presents major formulation difficulties that can compromise patient compliance, particularly in pediatric medicines.

Over the past decades, pharmaceutical research has developed a wide range of taste-masking strategies designed to modulate bitterness perception without altering the molecular structure of the active compound. These approaches include microencapsulation, matrix engineering, viscosity modification, flavour modulation and receptor-level interactions that influence the temporal dynamics of taste perception.

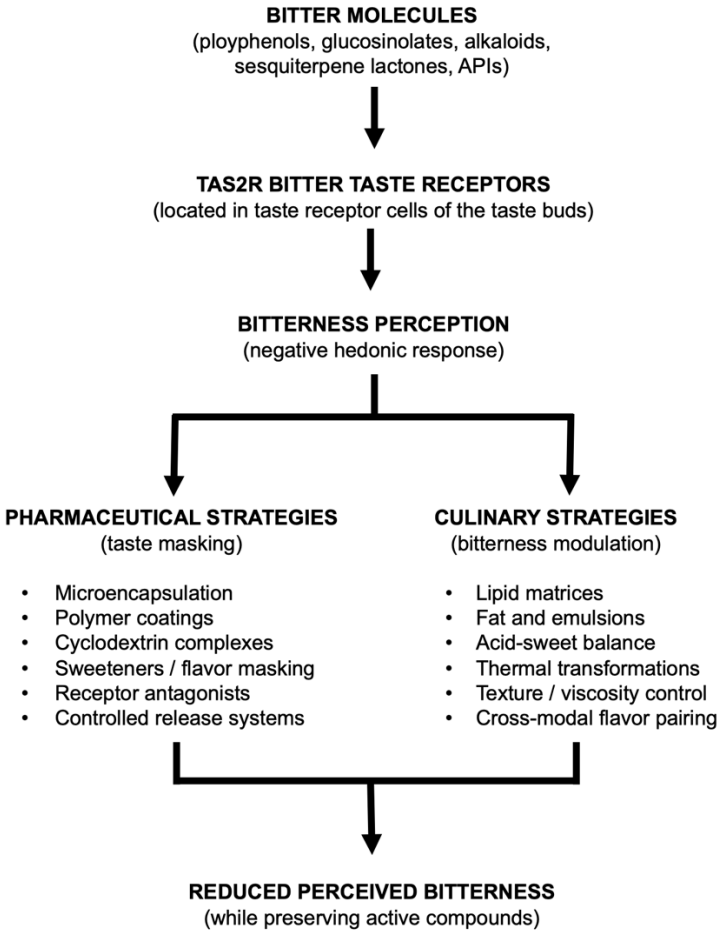
While these strategies are well documented in pharmaceutical formulation and in the development of functional foods, their translation into culinary practice has received little scientific attention. Yet many culinary techniques appear to rely on comparable physicochemical principles when preparing naturally bitter foods such as chicory, endive, radicchio or artichoke (ingredients that combine strong bitterness with high nutritional and phytochemical value).

In this study, we explore the conceptual and mechanistic parallels between pharmaceutical taste masking and culinary approaches to bitterness modulation. Using model culinary formulations based on naturally bitter vegetables, we investigate how structural organization of food matrices, lipid dispersion, acidity, thermal treatment and cross-modal sensory interactions can influence the perceptual expression of bitter compounds while preserving their molecular integrity.

This work proposes a formulation-based framework for understanding bitterness modulation in culinary systems inspired by pharmaceutical taste-masking principles. By bridging pharmaceutical formulation science and molecular gastronomy, this interdisciplinary perspective highlights how concepts originally developed in drug delivery may inform the scientific design of culinary preparations involving bitter but nutritionally valuable ingredients.

**Figure: Conceptual framework linking bitter taste perception, pharmaceutical taste masking, and culinary bitterness modulation**

Bitter molecules present in foods or pharmaceutical formulations activate TAS2R bitter taste receptors located in taste receptor cells. This activation triggers signal transduction pathways leading to bitterness perception. Both pharmaceutical formulation science and culinary practice have developed strategies to modulate this perception, either through taste masking technologies or through modifications of the food matrix and sensory interactions.




## References

Coupland JN, Hayes JE. 2014. Physical approaches to masking bitter taste: lessons From food and pharmaceuticals, *Pharmaceutical Research*, 31, 2921-2939. DOI 10.1007/s11095-014-1480-6

Ley JP. 2008. Masking bitter taste by molecules, *Chemosensory Perception*, 1, 58-77. DOI 10.1007/s12078-008-9008-2

Gaudette NJ, Pickering GJ. 2013. Modifying bitterness in functional food systems, *Critical Reviews in Food Science and Nutrition*, 53(5), 464-481. DOI 10.1080/10408398.2010.542511

Tian Z, Zhao H, Huang XH, Wang XS, Qin L. 2025. Bitterness of medicine food homology substances: mechanisms, identification, and reduction strategies, *Food Reviews International*, 4(9), 2950-2967. DOI 10.1080/87559129.2025.2509098

Smutzer G, Cherian S, Patel D, Sang Lee B, Lee K, Sotelo AR, Mitchell KDW. 2020. A formulation for suppressing bitter taste in the human oral cavity, *Physiology & Behavior*, 226, 113129. DOI 10.1016/j.physbeh.2020.113129

Mennella JA, Spector AC, reed D, Coldwell S. 2013. The bad taste of medicines: overview of basic research on bitter taste, *Clinical Therapeutics*, 35(8), 1225-1246. DOI 10.1016/j.clinthera.2013.06.007

# Recent results from the French monthly Seminaire de gastronomie moléculaire (Seminar on molecular gastronomy)

**Herve This vo Kientza**

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## Abstract

Each month since Septembre 2000, the International Centre of Molecular and Physical Gastronomy [1] organizes a meeting named "seminar on molecular gastronomy" in a culinary school (Lycée Guillaume Tirel, Paris) [2], for testing experimentally culinary precisions [3].
In the recent times, many seminars produced experimental results regarding the topic "Flavour release from food and beverage". Some of them will be discussed.

1. The first result that will discussed is about cooking lentils in salted water, compared to pure water [4].
2. The second result will be about blanching aromatic herbs, again in salted water: is there an effect of the presence of salt? [5]
3. Next we shall discuss the making of fish fumets, including the experimental of many precisions, such as about the duration of cooking, often said to create bitterness when it is longer than 20 min [6] [7].
4. About roux, an assumption was tested, about the making of the flavour, and the role of the ingredients (butter, flour) [8].
5. Finally, about the making of beurre maître d'hôtel and beurre Colbert, the names of recipes will be discussed [9].

**Keywords**

Culinary precisions, flavour,

**References:**

[1] Inrae-AgroParisTech International Centre of Molecular and Physical Gastronomy, https://icmpg.hub.inrae.fr/international-activities-of-the-international-centre-of-molecular-gastronomy

[2] https://icmpg.hub.inrae.fr/travaux-en-francais/seminaires/resultats

[3] This H. 2017. Les précisions culinaires, Quae/Belin, Paris, France.

[4] https://icmpg.hub.inrae.fr/content/download/1886/12472?version=1

[5] https://icmpg.hub.inrae.fr/content/download/1855/12255?version=2

[6] https://icmpg.hub.inrae.fr/content/download/1180/6678?version=1

[7] https://icmpg.hub.inrae.fr/content/download/1447/8899?version=1

[8] https://icmpg.hub.inrae.fr/content/download/1504/9282?version=1

[9] https://icmpg.hub.inrae.fr/content/download/1808/11631?version=1

## Tradinnovations in Action: Transforming Student Projects into Research and Dissemination Opportunities"

**By Reine Barbar, Roisin Burke, Bruno Souza Moreira Leite**

This session aims to critically reflect on recent educational and dissemination experiences within Project-Based Learning (PBL) frameworks applied to food systems and culinary heritage as part of Erasmus+ *Tradinnovations* project. Drawing on student-led projects conducted over the past two academic years, the session will explore both the opportunities and challenges associated with transforming student work into scientific outputs.

A first focus will address the process of article submission based on student projects, including common difficulties (e.g., variability in data quality, writing skills and time constraints) and strategies to better integrate publication objectives within PBL design. The workshop will also open a discussion on potential scholarly contributions led by educators, such as the study on traditions and innovations perceptions among partner countries, museum-based learning activities, and research initiatives linked to food policies in Montpellier. Contributions from *Tradinnovations* consortium will provide complementary perspectives and case studies.

A second part will examine the dissemination strategies implemented over the past two years, highlighting their strengths and limitations. Lessons learned will inform a forward-looking discussion on improving visibility, impact, and sustainability, including the organization of a future Erasmus-funded summer school.

To enhance the visibility of current student work while avoiding repetitive oral presentations, the session proposes an alternative format based on concise, one-slide poster presentations. Each project will be structured around three key elements: target population, studied recipe, scientific methodology and innovation levers. This format aims to foster efficient knowledge sharing, stimulate discussion, and encourage cross-project comparisons.

Overall, the session will provide a collaborative space to co-develop best practices for integrating education, research and dissemination within PBL project like *Tradinnovations*

**Introduction**

1. Overview of the session's goals and the *Tradinnovations* project
By Reine Barbar, Roisin Burke
2. Explanation of the alternative poster presentation format (one slide per project)
By Gaëlle Garrier, Bruno Souza Moreira Leite

**Part I. Transforming Student Projects into Scientific Outputs**

Process of submitting articles based on student projects (challenges: data quality, writing skills, time constraints, and the use of artificial intelligence tools). Flow diagram illustrating the transition from classroom projects to posters, abstracts, and other forms of dissemination, including the role of AI in supporting writing, data analysis, and formatting
By Reine Barbar, Roisin Burke, Paulina Mata.

Case studies from the *Tradinnovations* consortium
By Bruno Souza Moreira Leite, Reine Barbar, Roisin Burke

Open Discussion – How to better integrate publication objectives
into PBL design?

**Part 2: Dissemination Strategies – Lessons Learned and Future Directions**

Review of dissemination activities (strengths, limitations, and key takeaways)
By Gaëlle Garrier, Reine Barbar

Collaborative time – How to improve visibility, impact, and sustainability? Focus on planning a future Erasmus-funded summer school and other perspectives (*Tradinnovations* network for educators, socioeconomic stakeholders in support of student's projects)
By Bruno Souza Moreira Leite, Reine Barbar, Roisin Burke

**Part 3: Coffee and Posters Session**
Enjoy a coffee while seeing student's posters from several countries: France, Portugal, Tunisia…
Quick pitches are planned on site, online, pre-recorded by students, by educators…
Posters include: target population, studied recipe, scientific methodology and innovations levers.

**Wrap-up and closing remarks**

**References:**

Barbar R, Burke R, Souza Moreira Leite B. 2024. Tradinnovations Erasmus+ academic cooperation partnerships. A scientific road trip at the crossroads of local food heritage and societal needs. In *13. International Workshop on Molecular and Physical Gastronomy (IWMPG 13)*, May 2024, Paris, France. ⟨hal-04797181⟩

Barbar R. 2025. Implementation and experimentation of Erasmus+ Tradinnovation PBL : lessons and projections.. International Journal of Molecular and Physical Gastronomy, 11 (2), 11. ⟨10.17180/ijmpg-2025-art02⟩. ⟨hal-05451028⟩

Aubert-Mouchot E. 2025. Redonner du pouvoir d'agir aux résidents en maison de retraite : un levier de lutte contre la dénutrition. Actes de la journée des innovations et des politiques pour une alimentation durable.

Pierrot T. 2025) Nourrir les souvenirs : ingénieurs et futurs chefs réinventent la gastronomie au service des séniors. Actes de la journée des innovations et des politiques pour une alimentation durable.

https://www.institut-agro-montpellier.fr/actualites/1ere-summer-school-en-slovenie-sur-le-projet-erasmus-tradinnovations

# Exploring the Anatomy of Malaysian Flavors

**Prof Dr. Shahrim Karim**

Faculty of Food Science and Technology
Universiti Putra Malaysia
shahrim @upm.edu.my

Malaysian cuisine is renowned globally for its unparalleled depth, characterized by a complex interplay of aromatic herbs, pungent ferments, and vibrant spices. This presentation explores the fundamental components of the Malaysian flavor profile and the traditional culinary techniques used to derive them. At the heart of this exploration is the rempah—a foundational spice paste where fresh galangal, turmeric, and lemongrass are transformed through mechanical bruising to release essential oils. The discussion further investigates the "Science of the Funk," analyzing how fermented agents like belacan (shrimp paste) provide an umami backbone, and how the "bridge" of santan (coconut milk) emulsifies heat into a velvety finish. By examining the balancing act between the acidity of asam jawa (tamarind) and the smoky sweetness of gula melaka (palm sugar), this presentation illustrates how flavor is systematically built rather than merely seasoned. Ultimately, the presentation argues that Malaysian flavor is a physical manifestation of the nation's "cultural crossroads," where indigenous Malay techniques, Chinese wok-craft, and Indian spice heritage converge to create a singular, multisensory gastronomic identity of the Malaysian cuisine.

**Keywords:**
Malaysian cuisine, fresh herbs, spice paste, flavor

# Flavour Modification by Ideation of Space Dishes and Emerging Space Food Processes

**Volker Hessel**

*School of Chemical Engineering, Adelaide University, Adelaide, Australia*
*ARC Centre of Excellence Plant for Space (P4S), Adelaide, Australia*

Space gastronomy can create opportunities for culinary innovation and flavour release unknown to Earth.

## Jollof Rice in Orbit

Engineered flavour delivery systems in space, such as controlled-release emulsions or encapsulated spice droplets, allow to harness unique flavours, analogous to time-programmed pharmaceutical formulations. Key for this flavour release are delayed transport kinetics of odorants and and Maillard-derived flavour expression.

## Nebular Bar Snack

Heating of dishes is a major key to release flavour and is in space is much different to Earth. This was demonstrated for a nutrient-dense duckweed snack, including duckweed, pumpkin seeds, lentils, blueberries, and honey. This space snack was designed of components of high and low heat conductivity. Under microgravity, heat convection is turned off and only heat conduction is effective. Both simulation and experiment demonstrated that the Nebular Snack could be heated up selectively in its heat-conductive honey zones, providing unique flavours.

## Cheesy AstroDough

The flavour of cheese and bread might alter in space as compared to its terrestrial counterpart, because of their adjusted formation and texture of the space plant-based feedstock, as well as changes in the fermentation and maturation stages due to decreased convective forces. This was demonstrated for a brunch type dish, “Cheesy AstroDough”, with fermented constituent cheese, bread, and separate beverage. Space bread is likely to vary in colour based on its nutrient enrichment.

## Plasma Flavour Mitigation

Plasma technology in space is an emerging non-thermal food processing tool to alter biomolecular and organoleptic properties of foods. Cold plasma demonstrated to improve the aroma of a model space food system (freeze-dried strawberries) by mitigating freeze-drying aroma losses. Cold plasma significantly reduced the negative impact of freeze-drying on aroma.

# Flavor perception of ammonium chloride: Exploring the sensory vocabulary of a culturally specific taste

**Study proposal by Anu Hopia, Nanna Rintala, Julia Talvitie**

## Study Rationale at IWMPG/Colmar

This exploratory workshop phase aims to generate a preliminary sensory vocabulary for ammonium chloride ($NH_4Cl$). Ammonium chloride is rather rare compound in Eurupean fiid cultures. However, Especially in the Nordic countries and the Netherlands, ammonium chloride has an established role as part of food culture, especially in sweets. According to EU legislation the use of this compound is permitted in confectionary products (category 5) as quantum satis level, meaning that its concentration is not limited in this category. However, for example in Finland typical level of ammonium chloride in ”salty licorice” sweets is 2-4 %. In the existing descriptive sensory literature, ammonium chloride has received only limited characterization as an isolated stimulus. Accordingly, this study focuses on eliciting spontaneous descriptors across a controlled concentration range and in a simple food-relevant matrix.

## Participants

Participants will be recruited among attendees of the International Workshop on Molecular and Physical Gastronomy (IWMPG). Participation will be voluntary and based on convenience sampling. The expected sample size is approximately 15–30 individuals with diverse cultural and professional backgrounds. No prior sensory training will be required.

Before participation, participants will be provided with an information sheet describing the purpose and procedure of the study. Informed consent will be obtained through a clear yes/no question confirming their willingness to participate.

Participants will be informed that participation is voluntary and that they may withdraw from the study at any time, without giving a reason.

**Stimuli**

Five samples will be prepared to explore the sensory characteristics of ammonium chloride ($NH_4Cl$) across concentrations in water and, in one case, in a simple food-relevant matrix.

The samples will be presented in the following order:

- Blank solution: water
- $NH_4Cl$ low concentration (0.5% w/w) in water (5 g $NH_4Cl$ + 995 g water)
- $NH_4Cl$ medium concentration (2% w/w) in water (20 g $NH_4Cl$ + 980 g water)
- $NH_4Cl$ medium concentration (2% w/w) in 10% (w/w) sucrose solution (20 g $NH_4Cl$ + 100 g sucrose + 880 g water)
- $NH_4Cl$ high concentration (5% w/w) in water (50 g $NH_4Cl$ + 950 g water)

**Rationale of selecting the study samples**

Using water as the primary matrix allows the sensory contribution of ammonium chloride to be assessed with minimal interference from other taste-active components. The sucrose-containing sample is included to examine how a simple food-relevant matrix modifies the perception of ammonium chloride at an intermediate concentration.

The selected $NH_4Cl$ concentrations create a range from mild to intense *salty licorice* -like perception while remaining within a range that is plausible for ammonium chloride-rich confectionery products. The highest concentration is intended to function as an upper-anchor stimulus for descriptor elicitation rather than as a direct model of a single commercial product.

All samples will be prepared fresh on the day of the workshop and served at room temperature in identical coded cups.

Samples will be presented in a fixed and structured order (blank → low → medium → medium + sucrose → high). This sequence allows direct comparison between the aqueous and sucrose-containing samples at the same ammonium chloride concentration before exposure to the most intense stimulus. The highest concentration sample will be presented last to reduce carryover effects on subsequent evaluations. A common order will be used for all participants to support a shared reference framework during group discussion.

**Procedure**

The workshop will follow an iterative sensory elicitation approach combining individual evaluation with immediate group discussion after each sample.

**Individual Evaluation and Descriptor Elicitation**

Participants will evaluate the samples one at a time. For each sample, they will first assess it individually in silence and will be instructed to:

- Taste the sample.
- Write down a minimum of three words or short expressions describing the sensory experience. Participants will be encouraged to consider taste, aroma-related associations, tactile or trigeminal sensations, and temporal effects, while not being limited to these categories.

In addition, participants will rate:

- Overall intensity (on a simple numerical scale, e.g. 0–10).
- Familiarity of the sensation (e.g. “How familiar is this taste to you?”).

Water will be provided for rinsing between samples. Participants may also expectorate samples and discontinue participation at any point if the sensations become uncomfortable.

**Group Discussion and Consolidation of the vocabularly**

Immediately following the individual evaluation of each sample, participants will engage in a moderated group discussion focusing on that specific sample. The goals of this phase will be to:

- Share and compare descriptors.
- Identify common terms and recurring sensory themes.
- Clarify differences in perception and terminology across participants.

Descriptors will be recorded and subsequently grouped into broader categories such as basic taste qualities, trigeminal sensations, chemical or mineral notes, associative descriptors, and aftertaste or temporal characteristics.

**Design Considerations**

The use of a fixed and structured sample presentation order is consistent with the exploratory nature of the study, where the primary objective is descriptor elicitation rather than precise quantitative comparison. Presenting samples in a controlled sequence is expected to reduce carryover effects while helping participants progressively articulate the sensory properties of ammonium chloride. At the same time, any apparent concentration-related changes in the descriptor set should be interpreted as exploratory, because they may partly reflect order and learning effects.

The iterative evaluation–discussion format is specifically designed to support real-time descriptor development and shared vocabulary formation. While this approach may introduce some degree of social influence, it is considered appropriate for the primary aim of constructing a preliminary sensory lexicon in a workshop setting.

**Data Processing**

The collected descriptors will first be compiled into a raw lexicon preserving the original participant wording. Thereafter, synonymous or closely related terms will be merged through transparent qualitative coding, while culturally specific terms will be retained before higher-level grouping whenever analytically relevant. Descriptor

frequencies will be calculated to identify the most salient sensory attributes of ammonium chloride across samples.

The resulting structured descriptor set will serve as the basis for selecting candidate attributes for a subsequent quantitative consumer study.

# Should we drink while eating?

**Christophe Lavelle**

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In 2010, UNESCO has inscribed “the gastronomic meal of the French” on the Representative List of the Intangible Cultural Heritage of Humanity [1]. In its argument, it is mentioned that “the Important elements [of this gastronomic meal] include the careful selection of dishes from a constantly growing repertoire of recipes; the purchase of good, preferably local products whose flavours go well together; the pairing of food with wine; the setting of a beautiful table; and specific actions during consumption, such as smelling and tasting items at the table”.

Indeed, this need and attention for adequate drink pairing while eating is still usually considered today as a typical French obsession, with its specific rules. Starting with medical issues in the Antiquity (Galien, for instance, wrote that some wines helped to digest), it then goes to more “hedonic” considerations with authors such as François Pierre de la Varenne, Grimod de La Reynière and, last but not least, Jean-Anthelme Brillat-Savarin and his famous Physiologie du goût published 200 years ago [2], in which the twelfth aphorism says “the order of consumables is from the most substantial to the lightest; the order of beverages is from the mildest to the most fragrant and aromatic”.

A Chardonnay with a lobster? A Cabernet Sauvignon with a duck? A brief overview of the vast literature on food and wine pairings reveals that choices are often based on personal opinions, the underlying physiological reality of which is difficult to grasp [3,4]. The complexity of our sense of taste and smell and its significant variability between individuals discourage any attempt at scientific rationalization and often condemns the choice of the “ideal” wine to a mere subjective, empirical approach (remembering that the same applies also for food pairing [5])!

However, a few general “rules” still seem to emerge, which, while not universally accepted (every rule is bound to be broken), appear to offer some shared guidelines, regarding various aspects such as:

– the order of service: young wines should be served before older wines, whites before reds, light wines before full-bodied wines, and sweet wines last; the wine should progress in quality throughout the meal. In other words, a wine should never make one regret the previous one (this is basically the Brillat-Savarin aphorism!).

– the harmony with food: the tannins in red wine pair well with red meat, the acidity of white wine enhances the flavors of fish and seafood; conversely, vinaigrette overpowers red wines, desserts overpower dry whites, and so on. Furthermore, there are some “classic” pairings that can be explained rationally. Champagne and caviar? The bubbles soften the saltiness of the caviar. Port and Stilton? The sweet and savory contrast is appealing. Lobster in a butter sauce and Chardonnay? It's a similar pairing. Cabernet Sauvignon and fatty meat (beef or lamb)? The tannins make fatty meats more digestible. Sauvignon Blanc with seafood? The acidity enhances the seafood. Conversely, it seems wise to avoid overly pronounced imbalances or overpowering combinations: a Loire Sauvignon Blanc (rather dry and acidic) with a crème brûlée (rich and sweet)? The wine's acidity will be too prominent. A spicy dish with a full-bodied Carignan? The heat of the spices will be too intense.

To further complicate matters, let's remember that food influences wine as much as wine influences food! Should we then drink before eating? Eat before drinking? Both, of course, and the fact that the pairing evolves during tasting only enhances its appeal. Especially since several factors influence this evolution; first, saliva (and therefore, a fortiori, the presence of food in the mouth) influences the release of aromatic compounds, modifying the wine's aromas; second, the wine changes in the glass (temperature changes, oxidation) during tasting.

Considering all of this, let's learn to flexibly enjoy the diversity of food and wine pairings and not be afraid to stray from the beaten path: the delightful discoveries that await us are often well worth the risk of the rare disappointments that might occur!

[1] https://ich.unesco.org/en/decisions/5.COM/6.14

[2] Brillat-Savarin J.-A. 1825. Physiologie du goût, Sautelet, Paris.

[3] Lavelle C. 2017. Associations mets-vins: accords… et désaccords. In Les accords mets-vins. (Ed Pitte JR). CNRS Editions.

[4] Lavelle C. 2018. Accords mets-vins: est-ce scientifique? Un oeil en salle n°4.

[5] Lavelle C, This H. Food pairing: is it really about science? In Handbook of Molecular Gastronomy (Ed Lavelle, C., Burke, R., Kelly, A. and This, H), CRC Press, 2021

# Deconstructing the flavor release and nutritional benefits derived from cooking with olive oil

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**Keywords:**
food science, nutritional value, flavor ingredients, green beans, olive oil

When used for sautéing, or low temperature frying, extra virgin olive oil can provide flavor and nutritional alterations in certain foods that make them more palatable and healthier. Using an example from the popular Turkish dish *zeytinyağlı fasulye*, we will show how each of the molecular components in the ingredients (green beans, onions, tomatoes, and olive oil) interact during the cooking process. These changes include physical alterations in the cellulose and lignin fibers of the beans, release of flavor enhancing amino acids that also participate in a Maillard reactions, chemical isomerization of lycopene from the tomato, and reduction of oxidation from the antioxidants in the extra virgin olive oil.

## References

Delen Nircan Z. 2021. Gelelim fasulyenin faydalarına . https://sarkac.org/2021/06/gelelim-fasulyenin-faydalarina/

Dhingra D. 2011. Dietary fibre in foods: A Review. *Journal of Food Science and Technology*, 49.3, 255. https://doi.org/10.1007/s13197-011-0365-5.

Fielding JM, Rowley K.G, Cooper P, O' Dea K. 2005. Increases in plasma lycopene concentration after cosumption of tomatoes cooked with olive oil. *Asian Pacific Journal of Clinical Nutrition*, 14.2, 131. PMID: 15927929.

Tamanna N, Niaz M. 2015. Food processing and Maillard reaction products: effect on human health and nutrition." *International Journal of Food Science*, 2015.1, 526762, https://doi.org/10.1155/2015/526762.

# Cooking is mainly a question of exchange

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**Keywords:**
exchange, plant tissues, animal tissues, stock, broth, NDSF

**Abstract:**
In most culinary processes, plant tissue or animal tissues are thermally processed, in an environment that can be a gas or a liquid. During the processes, some compounds are released from the plant or animal tissue into the environment, and, sometimes compounds from the environment can move toward the inside of the plant or animal tissues.
The same kind of processes occur during eating, but mastication adds some complexity as the food is divided during the exchange.
However such processes are very poorly known. For example, more than 5 millions scientific and technologic articles were published about tea, and no one discusses how the compounds from the tea leaves move into the aqueous solutions.

Magnetic resonance spectroscopy studies had shown that the heat treatment of plant tissue in aqueous solution led primarily to the formation of three sugars (D-glucose, D-fructose, and sucrose), amino acids, and organic acids in solution. Based on this, an initial model was developed, recognizing the importance of diffusion from the xylem and phloem channels. However, further studies of onion (Allium cepa L.) tissues revealed additional exchanges via the symplastic system. These exchanges were observed directly under an optical microscope and also established through calculations in studies of sodium ion transfer in plant tissue. A general model is

currently under development. For animal tissues, a similar model could be proposed, using the vascular network in place of the vascular tissues of plant tissues, but it would also need to account for muscle tissue contraction during collagen denaturation.

# Using the NDSF to envision flavour release

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**Keywords**

Flavour release, NDSF, odorant compounds, taste compound, environment, kinetics

**Abstract**

Using the New Dispersed System Formalism (NDSF), all gels and suspensions of class 1 and 2 were described. These various systemps release taste compounds, odorants compounds and other compounds important for sensory appreciation in specific ways that can be envisioned from their NDSF formula.

As a first approach, the formula can be used in a qualitative way in order to establish curves describing the release of hydrophiliic or hydrophobic compounds.

# Analysis of Variations in Matcha Components Across Different Brands on the Tunisian Market

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**Abstract**

Matcha is a powdered green tea from the Camellia sinensis L. plant, intended for both hot and cold drinking. Selecting the right matcha is crucial to its manufacture. This study organoleptically and physicochemically evaluated three types of matcha tea powder, measuring color (Lab*), water content, water solubility index, water holding capacity, pH, ◦Brix, as well as protein and lipid contents. In addition, flavonoids, total polyphenols and antioxidant activity were assessed. Matcha M1 showed the best antioxidant performance and the highest protein content (27,656 ± 0,134%), significantly higher than M2 and M3. It also showed the highest luminosity (L*), followed by M3, while M2 had the lowest luminosity. M1's pH was also the lowest (5,623 ± 0,025), contributing to better microbiological stability. M1 was preferred by consumers in sensory evaluation.

This study clarified that matcha can exhibit significant flavor differences between brands and provided a theoretical basis for the selection and application of matcha in tea products.

# From Dish to Memory: Understanding Flavor in Mole Poblano Through Different Disciplines.

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**Abstract:**

This interdisciplinary reflection explores how flavor is formed in a traditional dish like mole poblano. It focuses on thermal processes such as amino-carbonyl reactions, caramelization, and lipid oxidation, which generate important volatile compounds (Campos-Montiel *et al.*, 2022). These reactions play a key role in the development of odor and taste during cooking.

However, flavor is not only a chemical process. We propose a multidisciplinary approach that includes chemistry, sensory analysis, anthropology, and heritage studies (Auvray and Spence, 2008; Mintz and Du Bois, 2002; Sammells, 2014). From this perspective, flavor can be understood both as a molecular phenomenon and as a cultural experience shaped by history and shared knowledge.

The preparation of the dish called *mole poblano* activates not only volatile compounds but also memory, identity, and tradition. Cooking becomes a space where chemical reactions and cultural meaning come together. In this way, science helps us understand and give context to culinary traditions. Flavor can be seen as a meeting point where molecules, perception, and cultural meaning interact, offering new insights for global food research.

**References:**

Auvray, M., & Spence, C. (2008). The multisensory perception of flavor. Consciousness and Cognition, 17(3), 1016–1031. https://doi.org/10.1016/j.concog.2007.06.005

Campos-Montiel, R. G., Reyes-Vega, M. L., & Contreras-López, E. (2022). Volatile compounds and sensory profile in traditional Mexican sauces: A focus on mole. Journal of Food Composition and Analysis, 103, 104201. https://doi.org/10.1016/j.jfca.2021.104201

Mintz, S. W., & Du Bois, C. M. (2002). The anthropology of food and eating. Annual Review of Anthropology, 31, 99–119. https://doi.org/10.1146/annurev.anthro.32.032702.131011

Sammells, C. A. (2014). Haunted by the taste of home: Food, memory, and identity in Mexico. University of Texas Press.

# Development and registration of extraction methods for odorant and tast compounds for use in the food Industry, using the mexican dish *birria* as a research matrix

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This research project arises from the idea of bringing to the food industry flavors and odorant profiles that evoke and form part of Mexican identity, as well as recreating this experience with multiple cultural identities and having the capacity to share them among one another. Simultaneously, it considers a series of real regulatory constraints that follow 2010, NOM-051-SCFI/SSA1-2010 and COFEPRIS guidelines that have progressively advanced towards stricter regulation of synthetic additives, as well as towards more rigorous labeling requirements. It is a reality that the world is changing and, with it, the population has developed greater awareness regarding what we consume. For this reason, the current market seeks flavors whose origin lies in primary and natural products, rather than synthetic additives.
Based on these two axes, the idea emerges regarding the extraction of complex odorant profiles and flavors directly from preparations made in traditional kitchens. To achieve this, techniques from molecular gastronomy are employed such as the use of agar-agar for clarification and extraction of odorant and complex profiles.
It is essential to clarify that obtaining odorant profiles requires, as a fundamental stage, the precise identification of the compounds responsible for their sensory characteristics.
Traditionally, this objective has been addressed through analytical techniques such as solvent extraction or steam distillation. However, solid-phase microextraction (SPME) has become established as a reference method for the analysis of volatile compounds, owing to its high sensitivity, low sample consumption, and direct compatibility with gas chromatography–mass spectrometry systems. Nevertheless,

this work proposes an accessible and low-cost alternative, inspired by molecular cuisine, suggesting the use of agar-agar subjected to controlled thermal treatments to generate gelation of our study medium, which is the *birria* recipe of cook Margarita García Juárez. In this manner, the process focuses on performing a differential separation of odorant fractions based on their volatility and affinity for the gelled agar matrix.

However, this work proposes to set precedents in the extraction of odorant and sapid compounds for the development of seasonings in the food industry. As previously stated, our model system, *birria*, was selected due to its high odorant complexity derived from chemical processes such as intense thermal treatments, amino-carbonyl reactions, lipid oxidation, and the interaction of compounds originating from spices. An initial analytical test will be conducted to record its odorant compounds and flavor profiles, in order to compare them subsequently with the filtrate obtained after freezing at -18 °C and cold filtration at 4 °C. In this way, said matrix allows evaluation of the method's capacity to discriminate key odorant compounds in systems of high cultural and culinary relevance, capable of evoking specific moments for entire populations.

Nevertheless, we acknowledge that the operational simplicity of the method based on agar-agar gels and its minimal infrastructure requirements make it a viable option for screening studies in resource-limited settings, as well as an excellent method for preliminary stages of product development, including the formulation of snacks with defined sensory profiles.