



Beverage Flavor Pairing

The art of unexpected flavor

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= sensory property of food perceived by chemical senses



1

Aroma
(olfaction)

Aroma is the most contributor to flavor

e.g. floral, fruity,
woody, herbaceous



2

Taste
(gustation)

sweet, sour, salty,
bitter, and umami



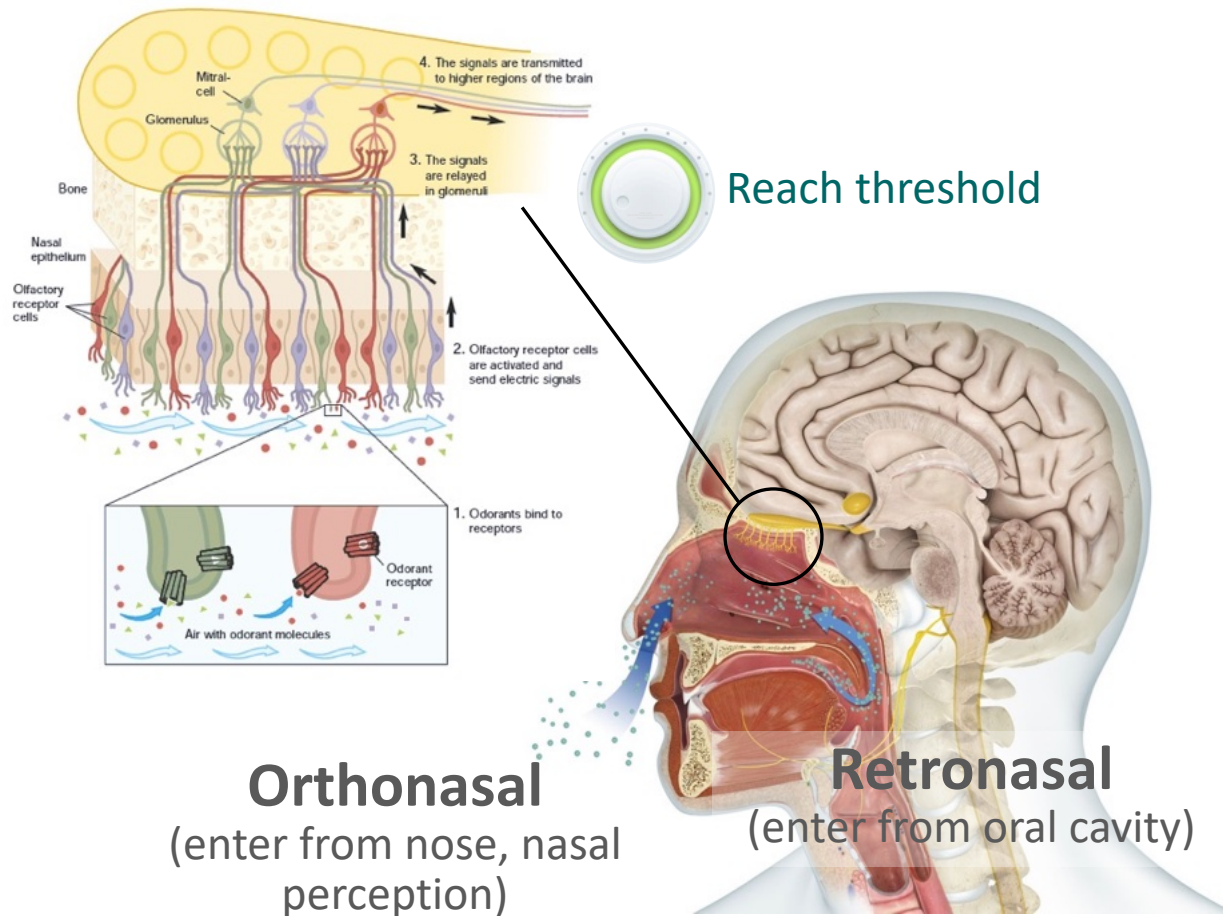
3

Chemical feeling
(chemesthesis)

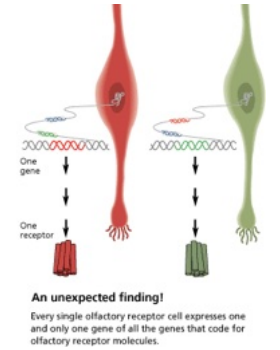
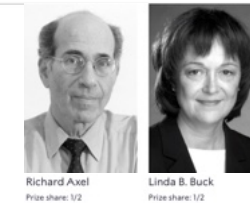
e.g. pungent, cooling,
astringent, tingling



Olfaction



The Nobel Prize in Physiology or Medicine 2004



Odorant receptors	1	2	3	4	5	6	7	8	9	10	11	12	13	14	Description
A <chem>CCCC(=O)O</chem>					●										rancid, sour, goat-like
B <chem>CCCCCO</chem>		●				●									sweet, herbal, woody
C <chem>CCCC(=O)O</chem>	●			●	●		●			●	●				rancid, sour, sweaty
D <chem>CCCCCO</chem>		●			●	●									violet, sweet, woody
E <chem>CCCC(=O)O</chem>	●			●	●		●	●		●	●	●			rancid, sour, repulsive
F <chem>CCCCCO</chem>				●	●		●			●					sweet, orange, rose
G <chem>CCCC(=O)O</chem>	●			●	●		●	●		●		●			waxy, cheese, nut-like
H <chem>CCCCCO</chem>				●	●		●			●		●			fresh, rose, oily floral

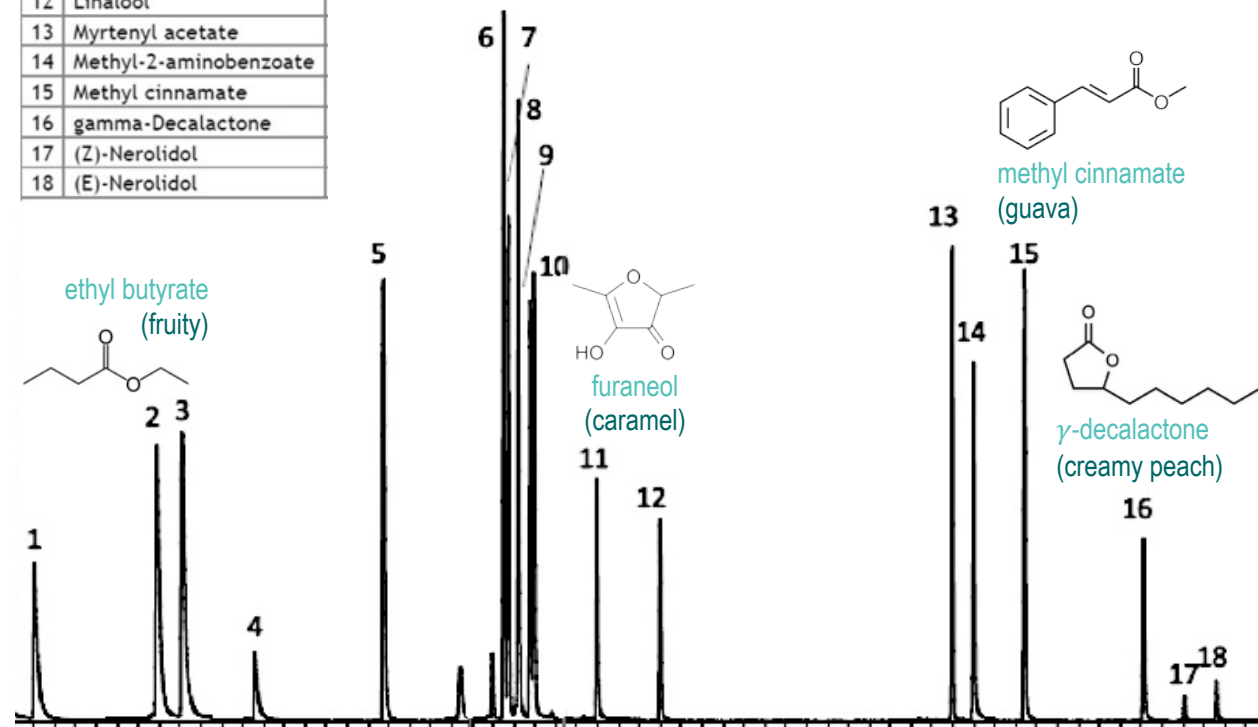
MODIFIED AFTER LINDA BUCK AND COLLEAGUES IN CELL VOL 96, MARCH 5, 1999

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<https://www.nobelprize.org/prizes/medicine/2004/7428-the-nobel-prize-in-physiology-or-medicine-2004-2004/>



Nº	Compound
1	Methyl butanoate
2	Ethyl butanoate
3	Butyl acetate
4	E-2-hexenal
5	Methyl hexanoate
6	butyl butanoate
7	Ethyl hexanoate
8	Z-3-hexenyl acetate
9	Hexyl acetate
10	E-2-hexenyl acetate
11	Mesifurane
12	Linalool
13	Myrtenyl acetate
14	Methyl-2-aminobenzoate
15	Methyl cinnamate
16	gamma-Decalactone
17	(Z)-Nerolidol
18	(E)-Nerolidol

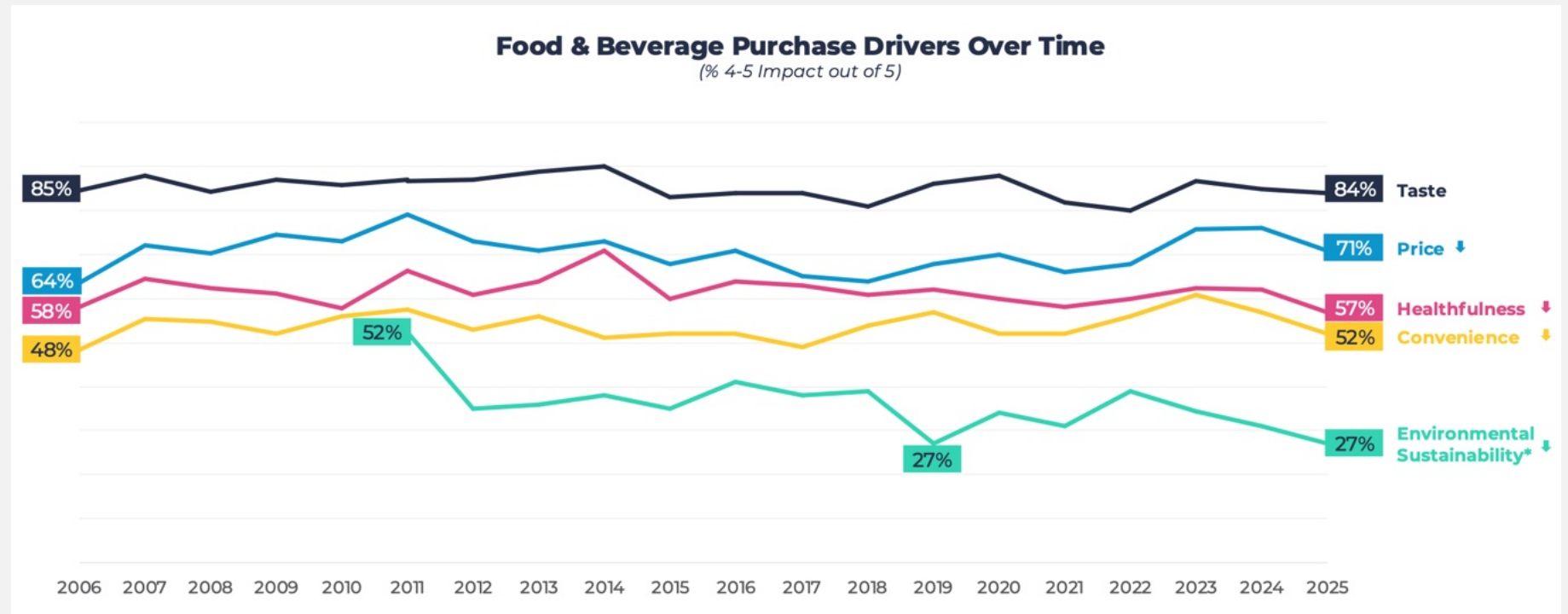
- All aroma compounds are **not equally contributed** to food flavor.
- Different **concentrations** of aromas result in different odor **characteristics**.



Sources:
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<https://www.washingtonpost.com/business/2019/11/04/inside-little-known-world-flavorists-who-are-trying-make-plant-based-meat-taste-like-real-thing/>
<https://www.flavornet.org/flavornet.html>

Flavor

The most important attribute in food selection and acceptance



Source: <https://ifc.org/wp-content/uploads/2025-IFIC-Food-Health-Survey-Full-Report.pdf>



Flavor Pairing

Chemical compatibility + Human perception = Maximizing satisfaction



Why does flavor pairing matter to the food industry?

- Sensory value
- Health value
- Sustainability value
- Business value
- Scientific value



にんじん・りんご・パインアップル・レモン・マンゴーたち*を
超絶妙に混ぜ合わせた、野菜・果実100%ジュースです。

*クエン酸・香料・ビタミンCを含む



カゴメのブレンド技術で
あのオレンジ味を
実現しました。

※画像はイメージです。

KAGOME
Beyond

オレンジを使っていない* オレンジ味の100%ジュース

野菜・果実100%



*オレンジアレルギーの方に対応したものではありません。



File 04

カゴメ社員も驚いた！

ついに完成した試作品。目隠しで飲んでもらった、「この味でまさかオレンジを使っていないなんて！*」「他の野菜・果実でここまでできるのか」という驚きの声が続出。その驚きが後押しになり、異例のスピードで商品化が決まりました。

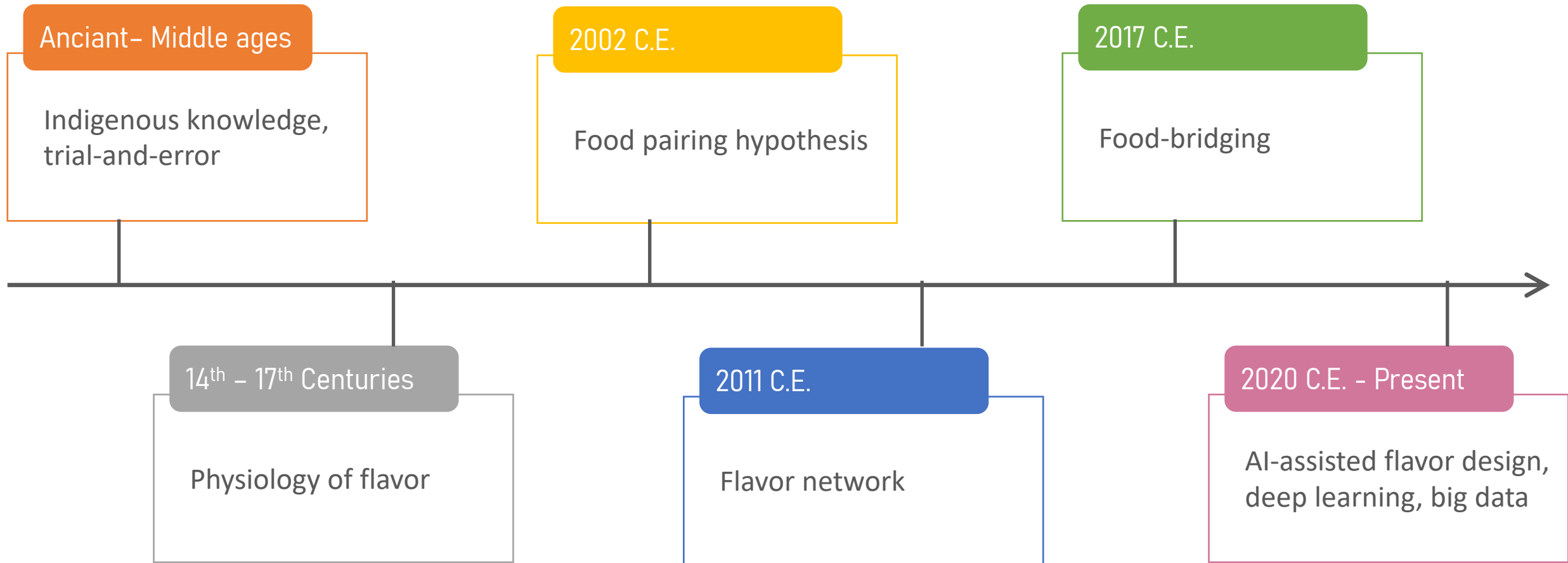
*オレンジアレルギーの方に対応したものではありません



※画像はイメージです

Source: <https://www.kagome.co.jp/products/brand/beyond/>

Evolution of Flavor Pairing



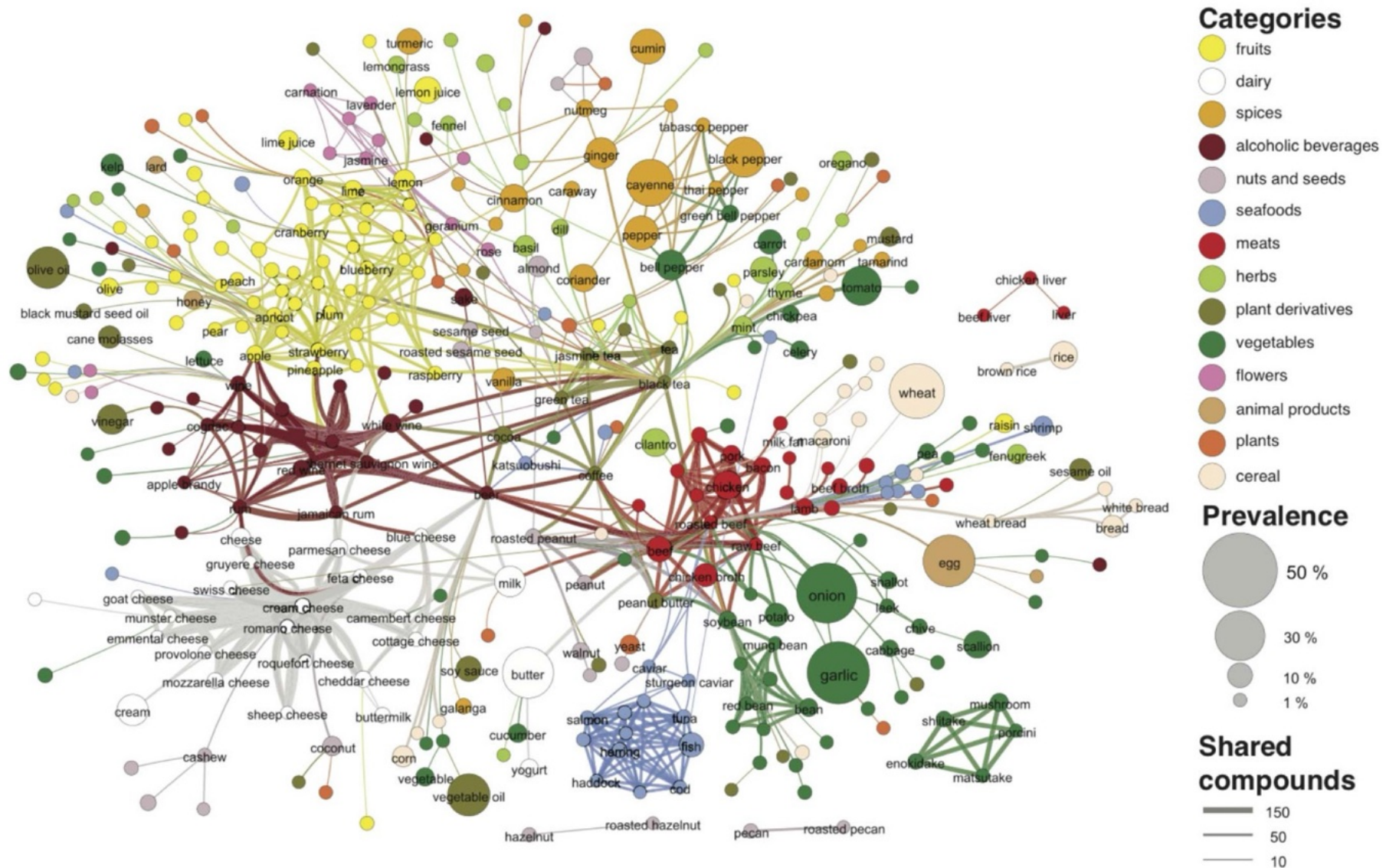


Figure 2 | The backbone of the flavor network. Each node denotes an ingredient, the node color indicates food category, and node size reflects the ingredient prevalence in recipes. Two ingredients are connected if they share a significant number of flavor compounds, link thickness representing the number of shared compounds between the two ingredients. Adjacent links are bundled to reduce the clutter. Note that the map shows only the statistically significant links, as identified by the algorithm of Refs.^{28,29} for p -value 0.04. A drawing of the full network is too dense to be informative. We use, however, the full network in our subsequent measurements.

THE SCIENCE BEHIND GREAT INGREDIENT PAIRINGS

Step 1: Determining an ingredient's aromatic profile

At Foodpairing® we begin by determining an ingredient's aromatic profile using gas chromatography coupled mass spectrometry (GC-MS). A single ingredient such as ginger may contain several dozens of different aroma molecules, though in reality, only the most dominant compounds are actually responsible for its signature scent.

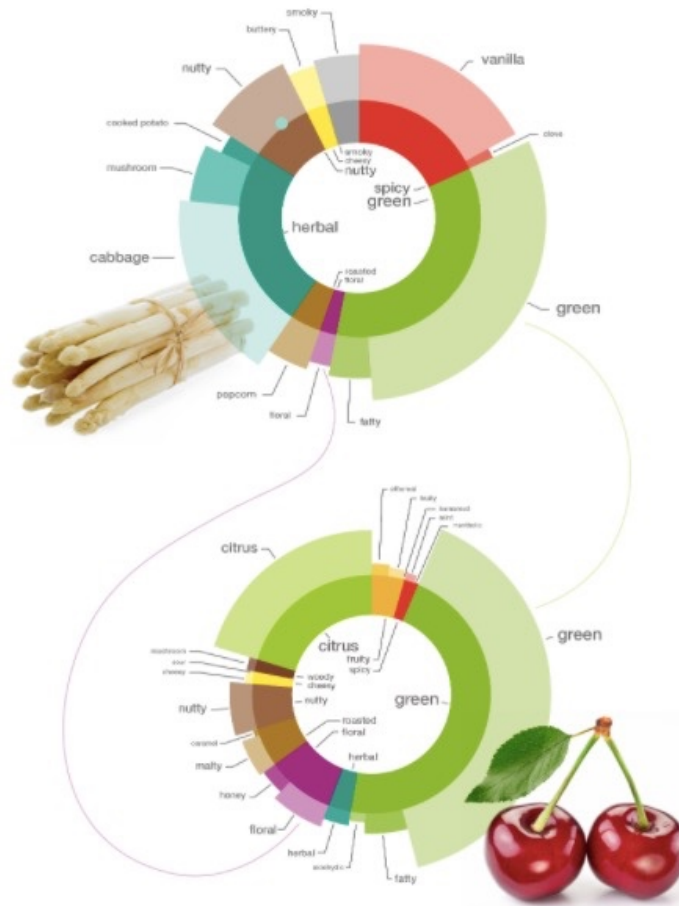
Step 2: Calculating pairings

From these results, our scientists then isolate the aroma data relevant to our sense of smell. Our team has developed algorithms that calculate the compatibility of different ingredients based on their aromatic profiles. **Cherry and asparagus**, for example, are a perfect pairing because they both share similar floral and green aromas.

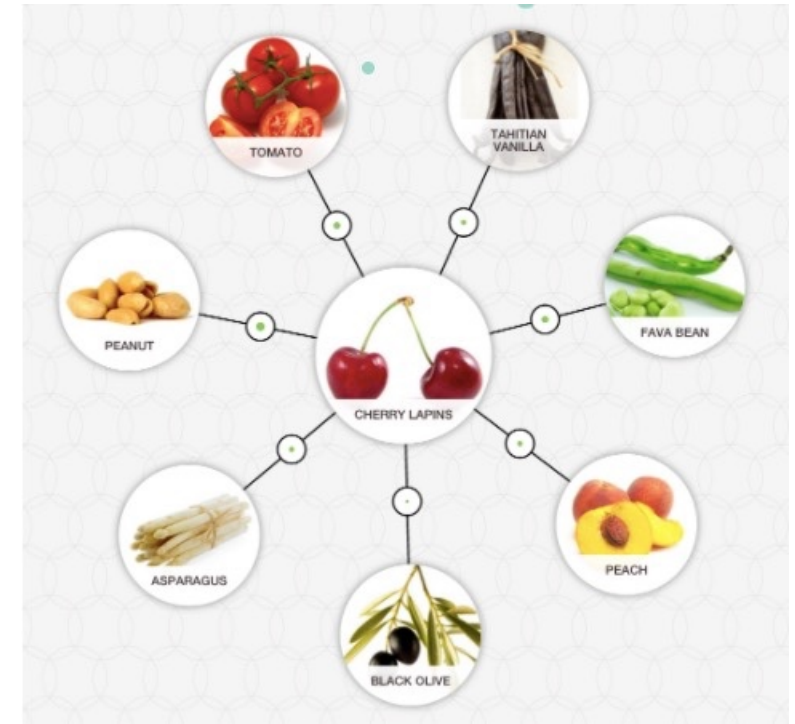
Step 3: Adding the data & algorithms to the database

Each time you select an ingredient our algorithms calculate possible aromatic matches. Remember that the greater the 'aromatic match,' the more likely it is that different ingredients will combine well in a recipe. Use our tool to find complementary pairings, while you as a chef create the perfect balance between Taste and Texture.

FOODPAIRING® aroma connections
asparagus + cherry



Ingredient Pairing



Source: <https://www.foodpairing.com/the-science-behind-great-ingredient-pairings/>

Theoretical Strategy



1

Intellectual / Cognitive approach

1) Conventional pairing



Geographical



Traditional

Photo credits:
<https://www.matchingfoodandwine.com/news/wine-basics/wine-and-cheese-a-basic-guide-for-beginners/>
<https://www.eddiemerlots.com/wine-and-steak-pairings-guide/>

2) Complexity pairing



Crossover

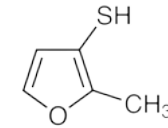
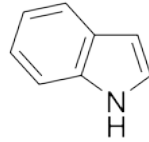
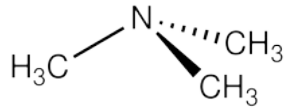
2) Complexity pairing...



Fluency

Photo credits:
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2) Complexity pairing...



Molecular conceptual (shared volatile compounds)

Photo credits:
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<https://temeculablogs.com/pork-liver/>
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2 Perceptual approach



Similarity



Contrast



Harmony

Photo credits:
<https://sweetpeaskitchen.com/triple-berry-cocktail/>
<https://www.texaner.in.com/honey-sweetened-lemonade/>
<https://www.thenerdiebaker.com/recipes/sea-salt-cold-foam-iced-coffee>

2 Perceptual approach...



Emergence



Modulation (enhancement)



Modulation (suppression)

Photo credits:
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Practical Framework

1. Consumer insight
2. Sensory target
3. Flavor driver analysis
4. Pairing strategy selection
5. Prototype development
6. Sensory & Consumer test
7. Commercialization



Beverage Flavor Pairing Worldwide



Function
not option



Fusion
without border



Fulfilled
in faith



Futuristic
wild card

Function not option



➤ Botanical / Flower



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➤ Exotic fruit



e.g.

- Mango
- Passionfruit
- Guava
- Pineapple

Source: <https://athome.starbucks.com/refreshers-concentrate/starbucks-refreshers-concentrate-mango-dragonfruit>



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➤ Aromatic citrus



Source: <https://www.bevindustry.com/articles/96377-sanpellegrino-zero-grams-added-sugar-italian-sparkling-drinks>

➤ Refresher



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➤ Creamy



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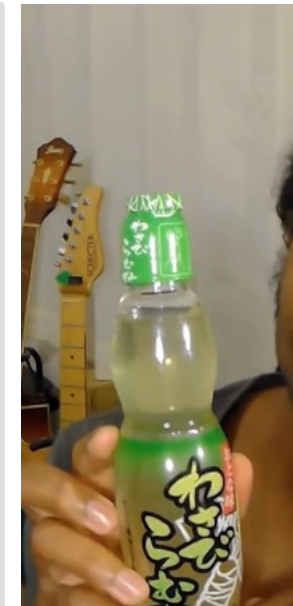
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➤ Herb & Spice





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Fusion without border



➤ Cross culture

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➤ Global influence



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*J*offee = juice + coffee



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➤ Heritage



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Fulfilled in faith



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Futuristic wild card



- **Swicy** (sweet + spicy) / **Fricy** (fruity + spicy)



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➤ Swangy (sweet + spicy + tangy)



INGWER SHOT CRANBERRY HORSERADISH

—
WURZELPOWER²



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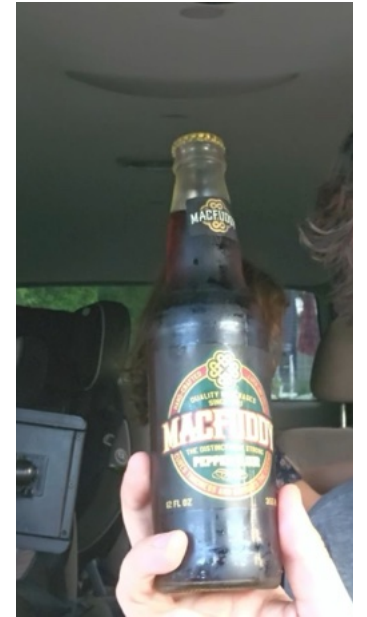
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➤ **Swavory** (sweet + savory)



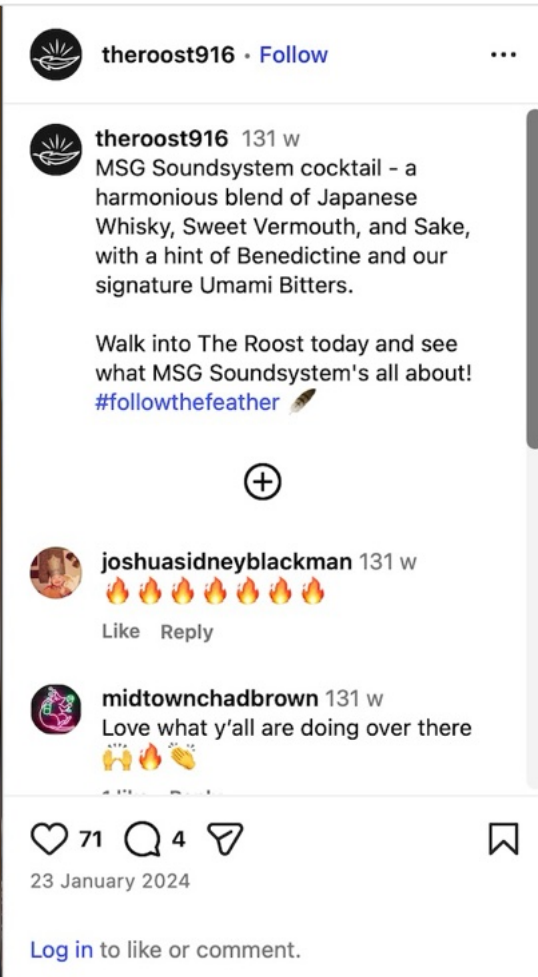
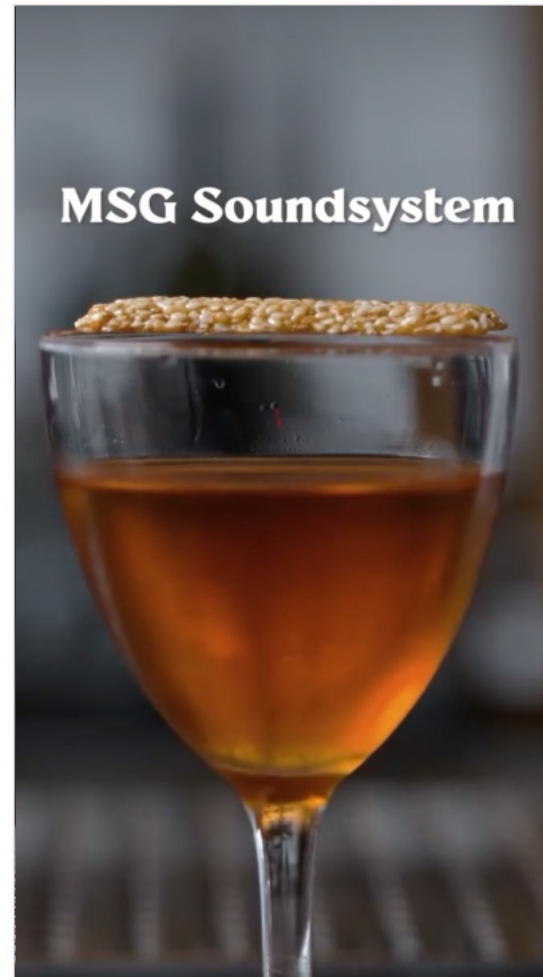
Source: <https://www.thespicychefs.com/food-culture/the-20-weirdest-soda-flavors-across-the-world/3>

➤ Sweet + Spicy + Savory



Source: <https://www.thespicychefs.com/food-culture/the-20-weirdest-soda-flavors-across-the-world/3>

➤ Umami synergy



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Where Calmness Meets Flavor

Strawberry Lavender

Sweet calm at sunset — ripe strawberry softened by lavender's floral stillness, a moment of evening balance.

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➤ DIY



7-ELEVEN
FAMOUS DRINK COMBINATIONS

TOIDA
Japan Travel

- Calpis Soda + Frozen Fruits + Ice Cup = Calpis Fruits Soda
- Strawberry Milk + Vanilla Coolish + Ice Cup = Strawberry Milk Shake
- Matcha Latte + Coffee Jelly + Ice Cup = Matcha Coffee Jelly Drink
- Pocari Sweat + Lemon Ice Bar + Ice Cup = Lemon Pocari Cooler



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➤ Multisensory experience



Source:
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<https://creativepool.com/kaz-tsuburaku/projects/xin-cafe-sonic-sweetener>

Triggered 4 MILLION conversations around the world.

SONIC SWEETENER

— CO-PRODUCED BY UNIVERSITY OF OXFORD —

AN EXTRAORDINARY MELODY TO REDUCE SUGAR CONSUMPTION

Sugar overconsumption is a global issue. But in China, many are ignoring the warning signs of it. Xin Café – a health conscious café – wanted people to be more conscious about their sugar intake.

Scientific research indicates that listening to distinctively higher-pitched sounds can alter people's senses towards food to be sweeter. So we created Sonic Sweetener, an extraordinary melody that reduces sugar consumption. We installed a cup-shaped device powered by Sonic Sweetener to help people focus on the sweetness of the beverage, without the need to add more sugar.

XIN CAFE



BOBA BY JARRITOS POPPING BOBA BY JARRITOS POPPING BOBA BY



Source:
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Key takeaway

- One size does not fit all
- Flavor is dynamic system
- Don't be overwhelming
- Aroma is linked to memory
- Dare to fail, dare to try
- Always validate with consumer testing

「**Flavor** is king,
Balance is key,
Pairing Makes it Possible.」



THANK YOU

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