Practical Formulation with Plant-Based Technologies

CuliNex

5.24.22

Innovation.
Naturally.

While maintaining our commitment to continuous learning, we exceed our client's business goals by developing **DELICIOUS, CLEAN LABEL FOODS** that create a better planet, healthier people and happier communities.

Since 2005 CuliNex has been the industry's premier clean label product development consultancy.

We serve ingredient supplier, boards & commissions, brand owners, food manufacturers, and retailers.

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NEXTY AWARDS

Award winners in 2010, 2011, 2020, 2021

Double Award winners in 2021

Agenda

Hype

Consumer Perception

New Ingredient Technology

Building Blocks
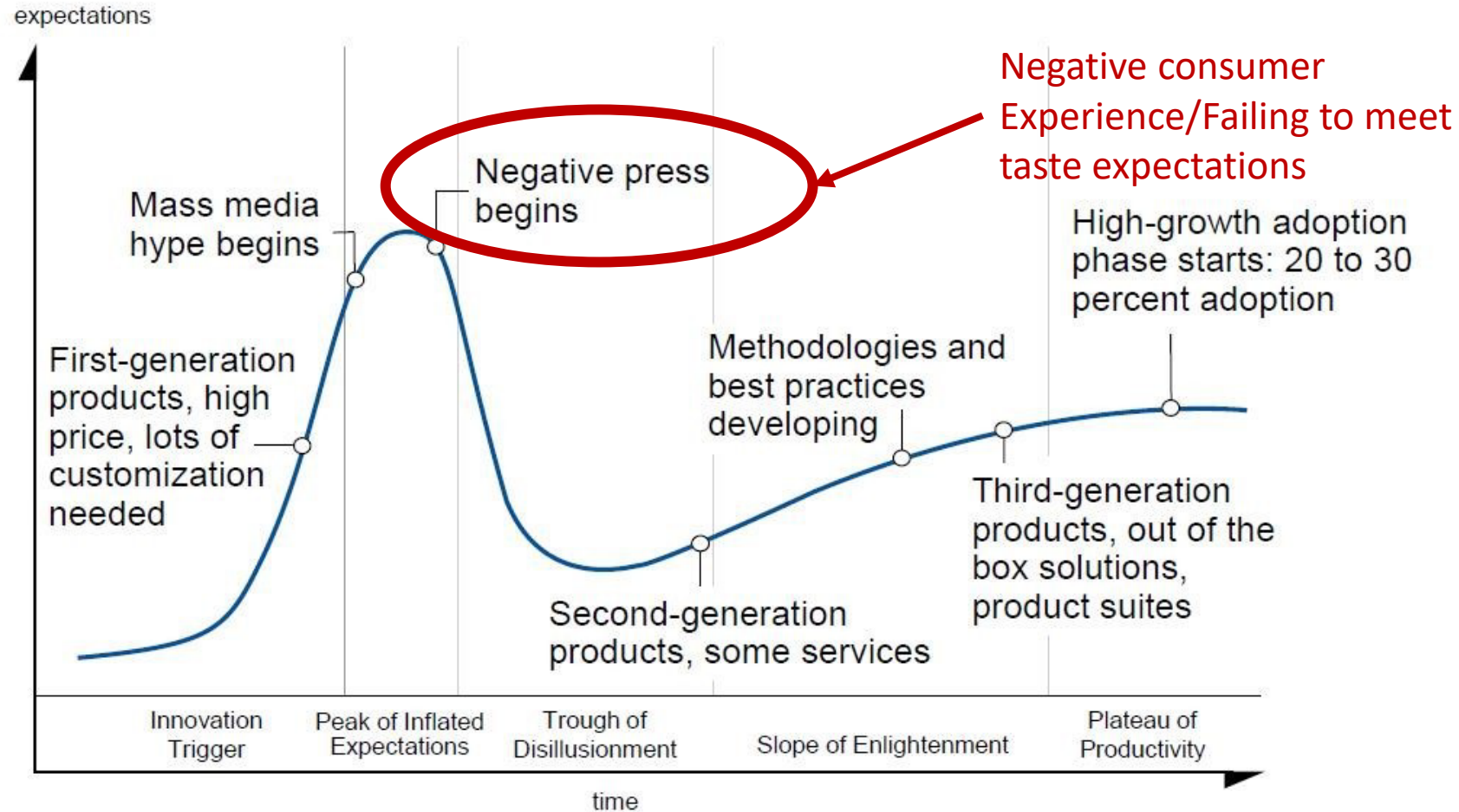
Protein

Fat

Flavor

Color

Functional Ingredients

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Hype and the Comedown

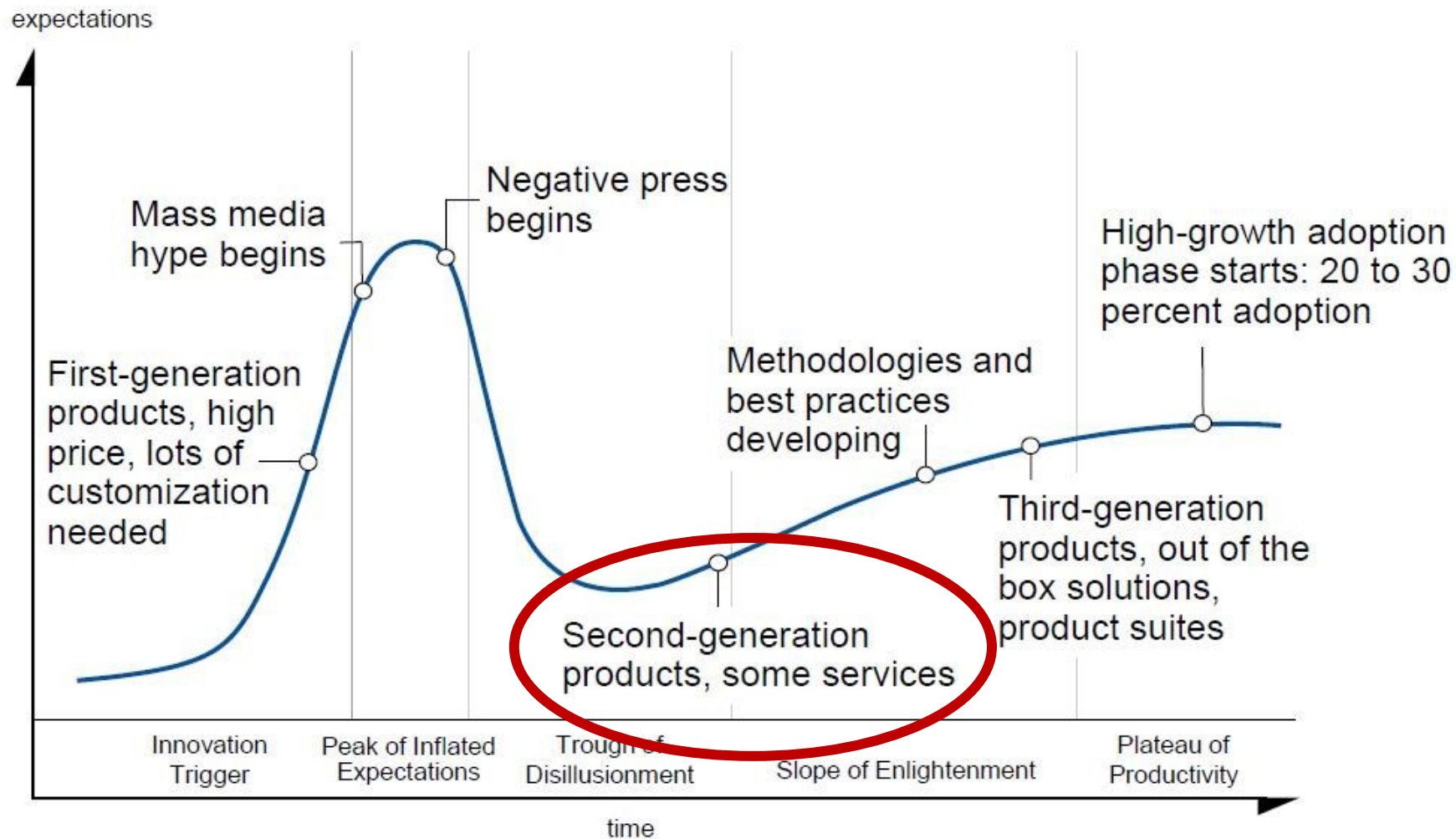**What is the disconnect between all the hype surrounding plant based meats and sales?**

"The ebbing of the sales surge is down to products which fail to meet taste expectations. 'There are a lot of people that have moved to plant-based because of sustainability issues, but yet they aren't really satisfied with what's out there. Price has also been an issue as plant-based meat makers have struggled to get repeat purchases from customers once the initial excitement has died down.'"

- Neil Rankin of Symplicity Foods in the Financial Times

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The Hype Cycle of Innovation

Negative consumer Experience/Failing to meet taste expectations

expectations

Mass media hype begins

Negative press begins

High-growth adoption phase starts: 20 to 30 percent adoption

First-generation products, high price, lots of customization needed

Methodologies and best practices developing

Third-generation products, out of the box solutions, product suites

Second-generation products, some services

| Innovation Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Gartner.

The Hype Cycle of Innovation

Gartner.

# Creating The Next Generation Plant-Based

1. Ingredients need to be acceptable to consumers

   Using tools and research we can determine what ingredients consumers find acceptable and desirable

2. Need more realistic products

   Ingredients and processing techniques are being launched to help you create more realistic products

What can bring us closer to delivering on the benefits expected by consumers?

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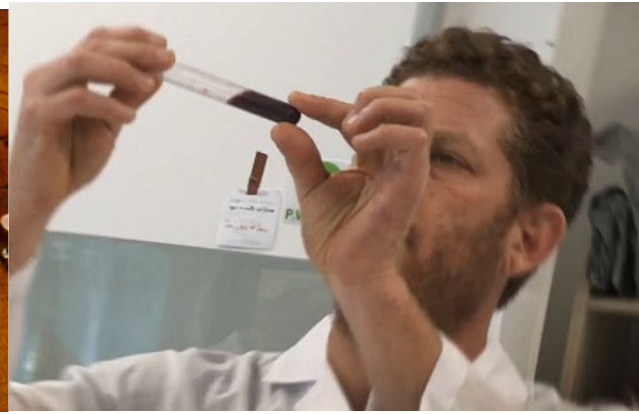
insightsNOW Clean Label Scores™

InsightsNow is a consumer research group that focuses on researching how consumers perceive ingredients and their benefits. The higher the score the more consumers associate an ingredient with a certain benefit or claim,

Scale	Description
100 95 90 85 80 75	**Strong positive association:** ingredient score of 75 or higher—a vast majority had a positive association.
70 65 60 55 50	**Positive association:** attribute score of 50-74.9—there were more people with positive associations than negative.
45 40 35 30	**Negative association:** attribute score of 25-49.9—there were more people with negative associations than positive.
25 20 15 10 5	**Strong negative association:** attribute score less than 25—a vast majority had a negative association.

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Protein Data

Food & Beverage Scores Powered by InsightsNow	Lunch/Dinner (Meat Alternatives)
Wheat Protein	87.77
Pea Protein	87.25
Lentil Protein	85.64
Rice Protein	84.50
Peanut Protein	84.04
Pumpkin Protein	83.51
Chickpea Protein	81.86
Soy Protein	78.19
Hemp protein	77.66
Potato protein	76.00
Algae Protein	75.00
Fava Bean Protein	70.05
Textured Pea Protein	66.51
Textured Vegetable Protein	65.09
Faba Protein	63.30
Hydrated Pea Protein	62.74
Canola Protein	62.23
Pea Protein Isolate	60.85
Mung Bean Protein	58.49
Soy Protein Concentrate	55.66
Hydrolyzed vegetable protein	50.94
Textured Soy Protein (Hexane Free)	44.81
Isolated Soy Protein	40.57
Soy Protein Isolate	40.38
Fermented Mushroom Protein	40.00
Fermented pea protein	37.67
Mycoprotein	34.91
Fermented Rice Protein	33.00
Hydrolyzed Pea Protein	31.17

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Protein Data

Qualifiers Make Consumers Nervous

Putting a descriptor in front of a protein gives the perception that it is more processed, leading to negative perceptions

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Protein Data

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Newer and Unfamiliar Proteins

As developers, we can think that some proteins may score better with consumers, but new and unfamiliar protein sources may require some consumer education to score higher.

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Whole Foods with Higher Protein

Making textured proteins from whole ground flours saves, energy, water, and increases yield of the crop.

<u>My Experience:</u> They hold water well and feel more natural on the palate
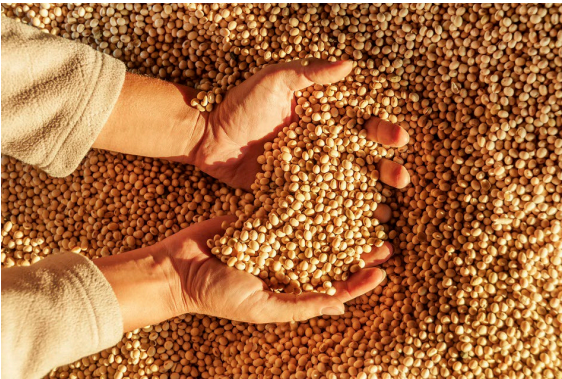
Novel Sources

Ingredient companies are launching proteins from plants that grow fast and use less inputs than the commonly used plants.

<u>Examples</u>: Algea, Duck Weed, Seaweed

Randomization

Animals are all different, Making plant-based meat look and feel randomized will make them more realistic. Having a perfectly distributed cut of meat will seem like fake food.

New sources of protein and processing techniques

Food & Beverage Scores Powered by InsightsNow	Lunch/Dinner (Meat Alternatives)
Coconut Oil	83.65
Oat Fiber	78.62
Wheat Fiber	78.30
Beet Juice Extract (For Color)	76.42
Beet Powder (Color)	76.42
Potato protein	76.00
Natural Flavor	74.06
Potato Starch	73.11
Citrus Fiber	72.64
Cocoa Butter	70.75
Natural Flavors (From Plant Sources)	69.81
Grill Flavor [From Sunflower Oil]	62.74
Vegetable Oil	62.23
Sunflower Lecithin	62.02
Bamboo Fiber	61.56
Canola Oil	61.32
Natural Red Color	60.85
Cornstarch	60.58
Hickory Smoke Flavor	58.96
Rice Flour	57.00
Naturally Flavored Yeast Extract	56.60
Enzymes	52.83
Soy Lecithin	45.67
Psyllium Husk	44.34
Palm Oil	43.50
Maltodextrin	35.85
Autolyzed Yeast	35.11
Methylcellulose	25.00
Soy Leghemoglobin	23.11

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Functional Ingredients

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Functional Ingredients

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Coconut Oil Scores Higher Than Palm

Consumers still have a health halo around coconut oil, while palm oil remains with a very low score

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Encapsulated Fat

- Controlling the interface between water and fat, the size of the fat droplets, the texture and melting point of the fat can be balanced
- This can create a spongy bouncy fat that remains in the product and does not melt out
- Adds juiciness from oil and water

Picture Source: Food Navigator

Cultivated Fat

- This included cell cultured and bacteria derived fats
- Cell cultures is animal fat without the animal (Vegan?)
- Bacteria-based fat is animal-like fat produced by bacterial fermentation

Picture Source: Food Business News

New sources of protein and processing techniques

Functional Ingredients

![insightsNOW logo]

Natural Flavors on the Cusp of consumers having a negative perception, while other flavor ingredients such as yeast and soy leghemoglobin have very low scores

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Cystine

- Used to create a Maillard reaction to give a well-rounded umami that isn't spiky.

- Cysteine amino acid is an essential ingredient in the Maillard reaction

- Need heat and reducing sugar
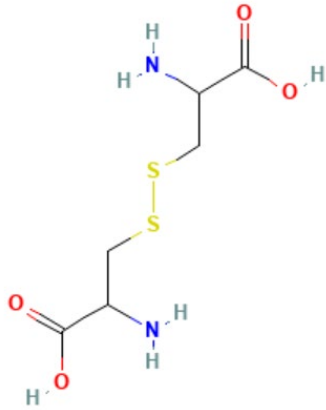
Picture Source: PubChem

Mono and Disaccharides

- Can be labeled as natural flavor

- Different kinds give umami at different points in the eating experience

- A background note, not a flavor added on top


New Methods for Natural Flavors

Functional Ingredients

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Methylcellulose is Unwanted and Hard to Replace due to its functionality, but emerging solutions do score higher

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Potato Protein and Citrus Fiber

- Clean Label

- Creates an irreversible gel

- Will turn white when used in emulsion

- Looks like milky gel when cooked

- May need different binder for uncooked processing
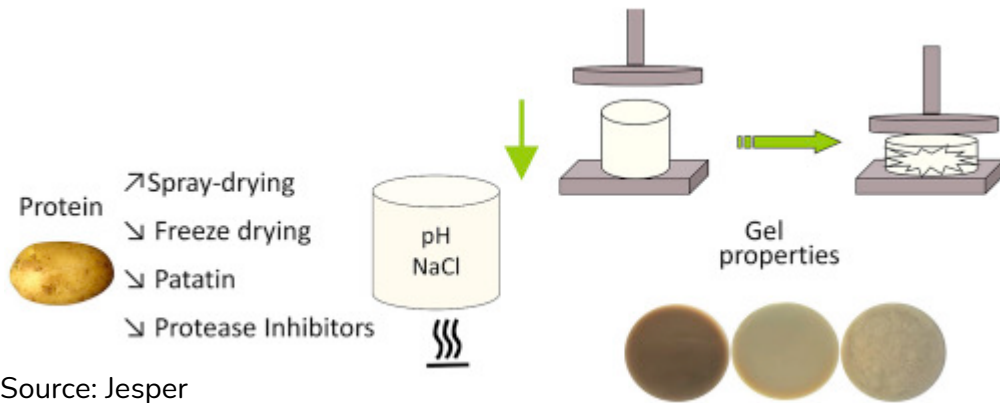
Picture Source: Jesper

Red Algea

- Liquid binder derived from red algae

- Gels when heated like blood

- Creates a meat-like color and flavor

- May still need a binder for processing

New sources for clean label binders

Questions?

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