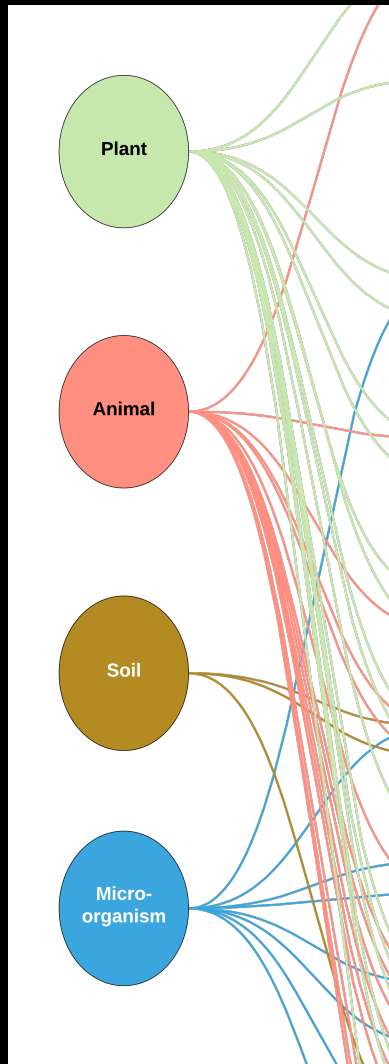
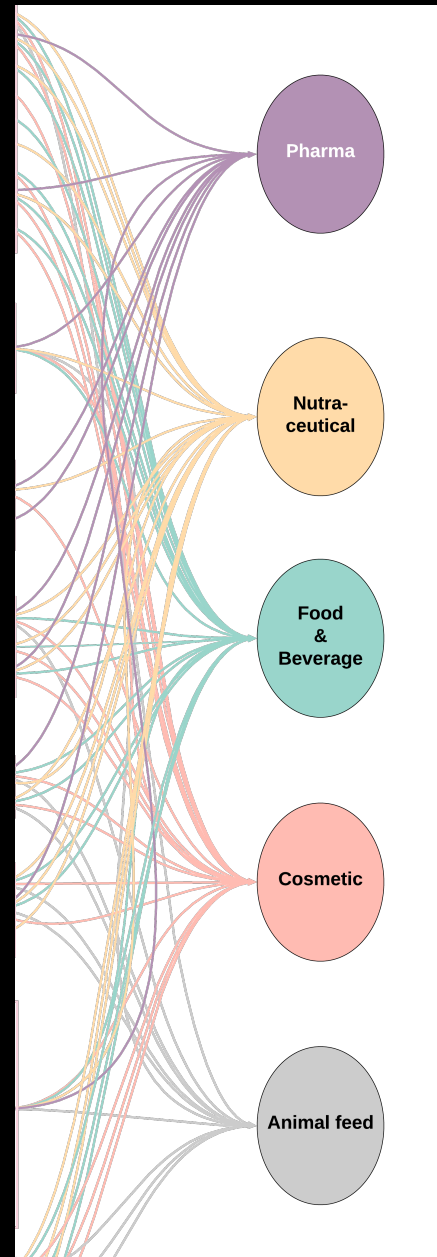


# Natural Ingredients Directory



Process	Ingredient
<b>Functional ingredients</b>	
Extraction, biochemical reaction	Colorant
Extraction, biochemical reaction	Emulsifier
Extraction, biochemical reaction	Flavoring
Extraction, biochemical reaction	Fragrance
Extraction, biochemical reaction	Lubricant
Extraction, biochemical reaction	Solubilizer
Extraction	Stabilizer
Extraction, biochemical reaction	Texturizer
Extraction	Thickener
<b>Extracts</b>	
Extraction, biochemical reaction	Botanical
Extraction, biochemical reaction, fermentation	Fruit
<b>Excipients</b>	
Extraction, biochemical reaction	Binder
Biochemical reaction	Carrier
<b>Carbohydrates</b>	
Extraction, biochemical reaction	Fiber
Extraction, biochemical reaction	Starch
Extraction, biochemical reaction	Sweetener
<b>Micronutrients</b>	
Extraction, biochemical reaction	Mineral
Extraction, biochemical reaction	Vitamin
<b>Gut microbiotics</b>	
Extraction	Prebiotic
Extraction, biochemical reaction, fermentation	Probiotic
Extraction, biochemical reaction	Synbiotic
<b>Protein derivatives</b>	
Extraction, biochemical reaction	Amino acid
Extraction, biochemical reaction	Collagen
Extraction, biochemical reaction	Enzyme
Extraction, biochemical reaction	Gelatin
Extraction, biochemical reaction	Peptide
Extraction, biochemical reaction	Other proteins (albumin, globulin, casein, whey etc.)
<b>Fatty acids</b>	
Extraction, biochemical reaction	Fat oil
Extraction, biochemical reaction	Omega-3
Extraction, biochemical reaction	Other fat (omega-6, omega-9 etc.)



**Natural ingredients opportunities classified according to the ThinkingLinking 5-dimensional taxonomy:**

**INGREDIENT**

**ORIGIN**

**PROCESS**

**VERTICAL MARKET**

**HEALTH BENEFIT**



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# Natural Ingredients Directory

## A 5D-taxonomy for the sector

Welcome to ThinkingLinking's Natural Ingredients Directory!

In linking natural ingredients companies, our M&A/JV/licensing advisory firm realized that partners care not just about the match on the ingredient dimension itself but many other factors as well. Not finding an existing useful taxonomy in the sector, we built our own around the key five considerations that kept on coming up in our work. This new taxonomy was initially for the 'ThinkingLinking Natural Ingredients Database', but we have decided to publish it, along with what we have been able to do with it in practice, so that clients can use it themselves and see the patterns it has revealed about the sector and the opportunity it provides to link partners more efficiently and successfully.

The taxonomy allows a product to be classified broadly enough to make strategic linking possible. Also, it allows the scale of the sector to be seen clearly in terms of its 'territory'. Finally, the relationships between the origins (or sub-origins), processes (including process combinations), vertical markets and health benefits for each ingredient can be plotted and quantified using the taxonomy as a 'backbone'. Health benefit is included as a dimension because of its importance, even though of course it doesn't apply to all products.

Finally, the taxonomy has been tested against our database of 300 companies and overlaid on 628 of their products to make it useful for 5D-linking purposes (see section 'The power of the database').

### The elements of the 5 dimensions

Ingredients		Origins	Processes	Vertical Markets	Health Benefits
<b>Functional ingredients</b> Colorant Emulsifier Flavoring Fragrance Lubricant Solubilizer Stabilizer Texturizer Thickener	<b>Micronutrients</b> Mineral Vitamin  <b>Gut microbiotics</b> Prebiotic Probiotic Synbiotic  <b>Protein derivatives</b> Amino acid derivative Collagen Enzyme Gelatin Peptide Other protein	<b>Animal</b> Bovine Chicken Dairy Fish Larvae Porcine Sheep Shellfish Snail Other  <b>Microorganism</b> Bifidobacterium Lactobacillus Microalgae Yeast Other  <b>Plant</b> Ashwagandha Bark Berry Cereal Citrus Flower Garlic/Onion Ginger Green vegetable Hemp Herb Mushroom Olive Root Seaweed Tropical Fruit Other  <b>Soil</b>	<b>Extraction</b>  <b>Biochemical reaction</b>  <b>Fermentation</b>  <b>Extraction &amp; biochemical reaction</b>  <b>Extraction &amp; fermentation</b>  <b>Fermentation &amp; biochemical reaction</b>	<b>Pharmaceuticals</b>  <b>Nutraceuticals</b>  <b>Food &amp; beverage</b>  <b>Cosmetics</b>  <b>Animal feed</b>	<b>Blood</b>  <b>Bone/muscle/joint</b>  <b>Cardiovascular</b>  <b>Cognitive</b>  <b>Eye</b>  <b>Gastrointestinal</b>  <b>Hair and nail</b>  <b>Hormonal</b>  <b>Immunomodulatory</b>  <b>Infection-related</b>  <b>Lung</b>  <b>Metabolism</b>  <b>Nervous system-related</b>  <b>Skin</b>  <b>Urogenital</b>  <b>Wound</b>

**Note:**

"Functional ingredients": It is recognized that products can fall into an ingredient category as well as functional ingredients since the latter is in effect an additional dimension. However, taking into account ingredients companies often use the term "functional ingredients" in place of a technical ingredient category, we have included it as a category alongside the ingredient names and have generally classified products as the producer in question has. "Other Fat": This is an abbreviation for other saturated fatty acids. "Mushrooms": Mushrooms are included in the Plant origin category. "Microorganisms": Single-celled plants are excluded from the Plant origin category separated as Microorganisms. "Health benefits": The health benefits are as claimed by the producer and we are not offering any opinion on their validity.

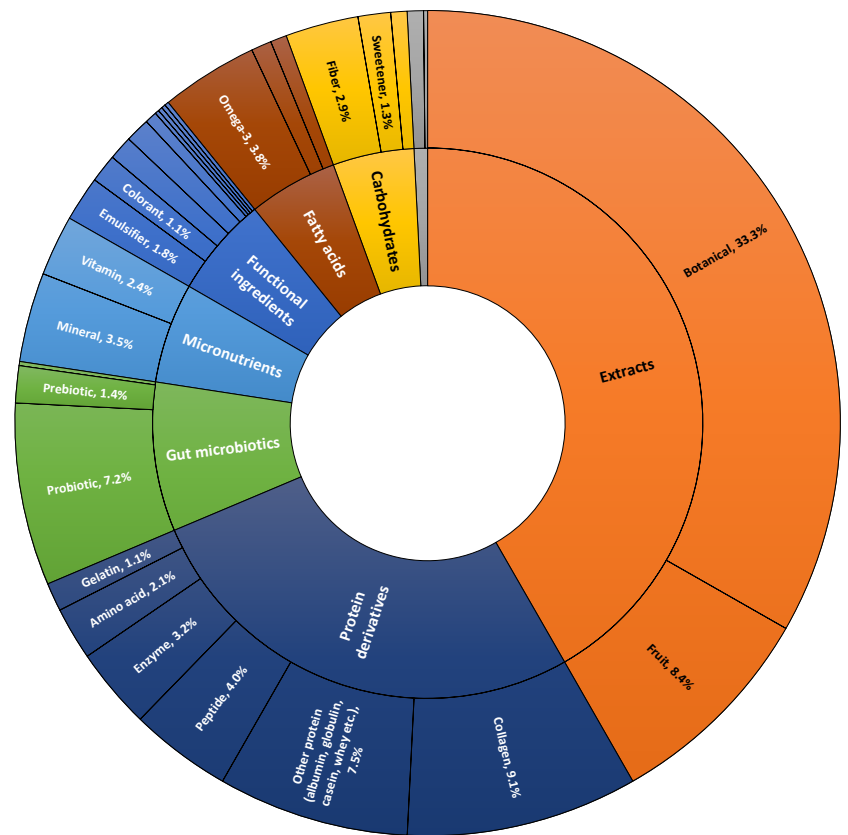
# Testing the taxonomy

Our taxonomy has been used to classify the entire ThinkingLinking Natural Ingredients Database which is a database of real world natural ingredients companies and their products. This process allowed us to ensure that it works in the sector. Moreover, we looked at the last 10% of the companies classified and found that they didn't require any new categories or present any classification contradictions.

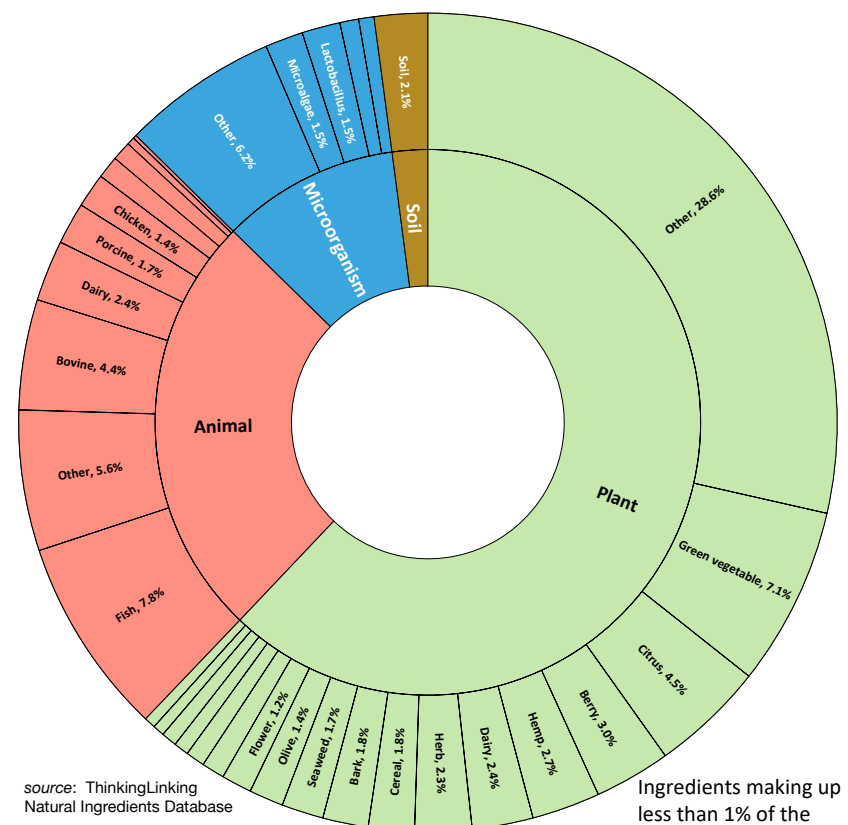
In total, 309 companies included in the database were put through the classification process. For each company, we selected the main products. In cases where products were similar and would yield an identical 5D-picture, we classified the group as one, since the information would be the same for strategic matching purposes. This process resulted in 628 classified products for potential linking. Since products can have multiple vertical markets and multiple claimed health benefits, the database has a total of 892 specific 'opportunities' when these additional vertical market relevancies are considered and 722 when the additional claimed health benefits are considered.

A multi-dimensional taxonomy can mathematically of course offer every permutation of its dimensions (in our case over 432,000 theoretical combinations). However, the real world permutations, which are limited by what is scientifically possible and further by what actually exists, number about 400. It is these 400 relationships that we have been able to present in this directory in visual form to describe the sector as it is. Future innovation of course can expand the number beyond 400 when a new product happens to make a different ingredient/sub-origin/process/vertical market/health benefit combination. It

## Ingredients & groupings



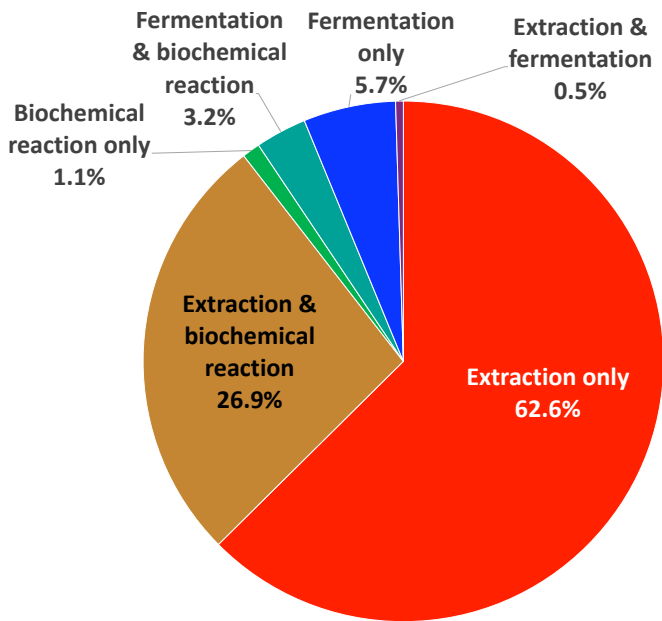
## Origins & Sub-origins



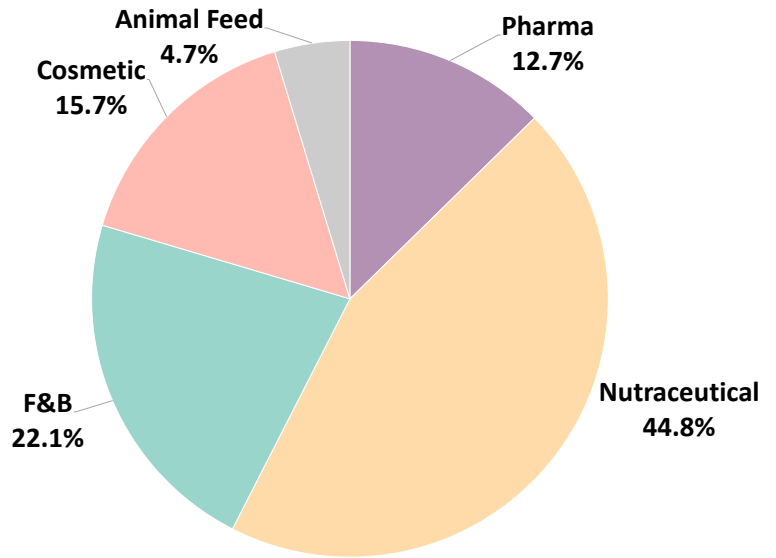
source: ThinkingLinking Natural Ingredients Database

Ingredients making up less than 1% of the database not shown

## Processes



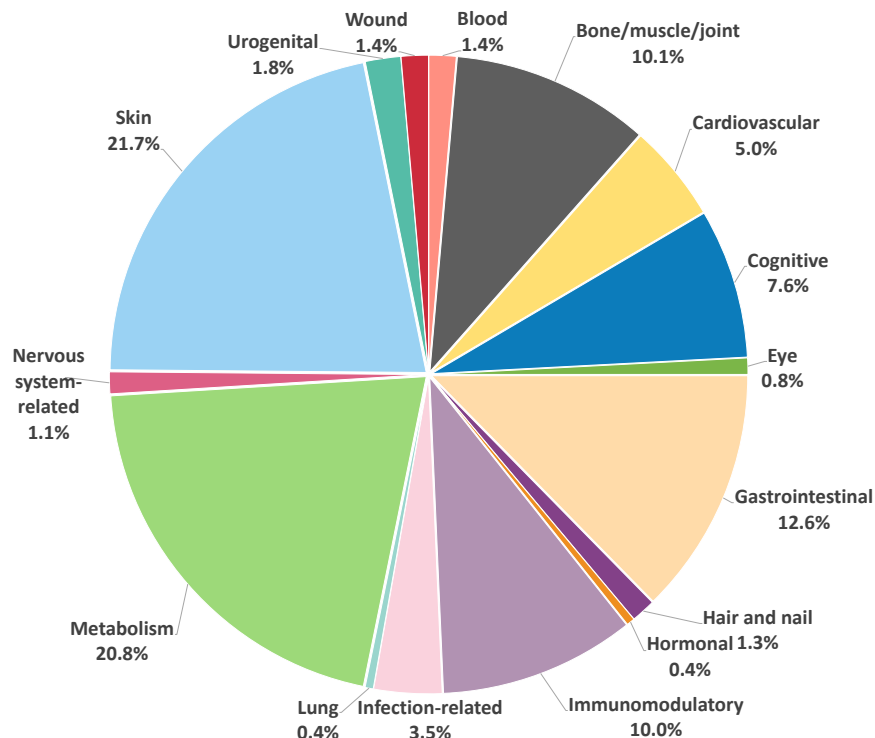
## Vertical Markets



should be noted, of course, that most innovation takes place within the existing configurations since the purpose of innovation is hardly to invent a new configuration.

The 'territory' of the sector and relationships between its five dimensions, as shown in the more complex charts later in the directory, are derived directly from the actual product classifications we have made as opposed to what is scientifically possible but which may not exist yet in the market. Put another way, every line in the link charts, or data represented in other charts, is backed up by a minimum of one actual product and its relationship picture as classified across the dimensions.

## Health Benefits



source: ThinkingLinking  
Natural Ingredients Database

# The power of the database

The resulting classified database allows a large number of opportunities to be quickly checked for their match with the 5D-criteria of any company, whether it is looking for M&A, licensing or other forms of alliance or joint venture.

For a 5D-match to result in a successful transaction, it must qualify against the criteria of both parties. To this end, the 5D-approach can be applied from both sides.

In practical terms, our database is focused on products of privately-held companies since they are generally more 'accessible' for linking through acquisition or investment, and are frequently also actively looking out for other types of partnering such as JVs, outlicensing or other alliances. Confidentiality of companies included in the directory is enhanced by the use of reference numbers, so that in essence each opportunity is described according to the five dimensions and their sub-dimensions.

It is our experience that a huge amount of time is wasted by companies in the early stages of looking for potential partners because of a sporadic or inefficient approach, because there has not been a way to instantly identify all counter-parties' products or product profiles against their 5D-wish list. This tool allows their time to be focused on exploring 5D-relevant opportunities at the more useful stages of science, market opportunity and the commercial terms of a potential transaction. This is how ThinkingLinking is taking advantage of our growing classified database of relationships in the sector to make useful links for our clients.

## Example of a matching search using the 5 dimensions

From a starting point of 628 products (and nearly 1,000 opportunities generated by multiple vertical markets and multiple health benefits)



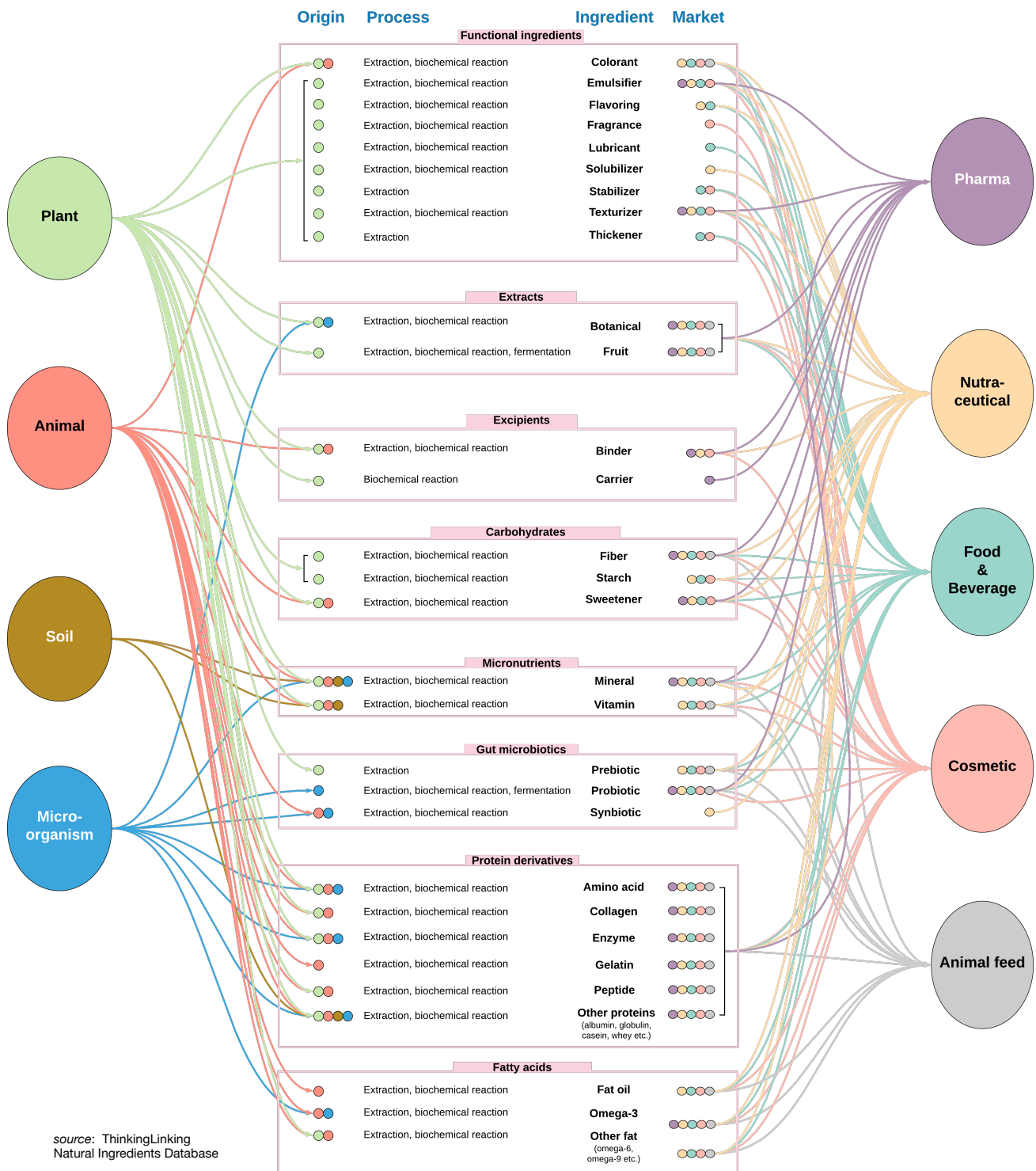
source: ThinkingLinking Natural Ingredients Database

# A complex picture

When we stand back from the natural ingredients sector, we can see the enormous 'cross over' between the different dimensions. Individual ingredients can come from many origins, they can be produced by more than one process and are used in multiple verticals. The point is that it is not just that the industry at large touches so many origins, processes and verticals, but each individual ingredient also does.

## In a snapshot – the natural ingredients sector

The origins, processes and markets for each ingredient type



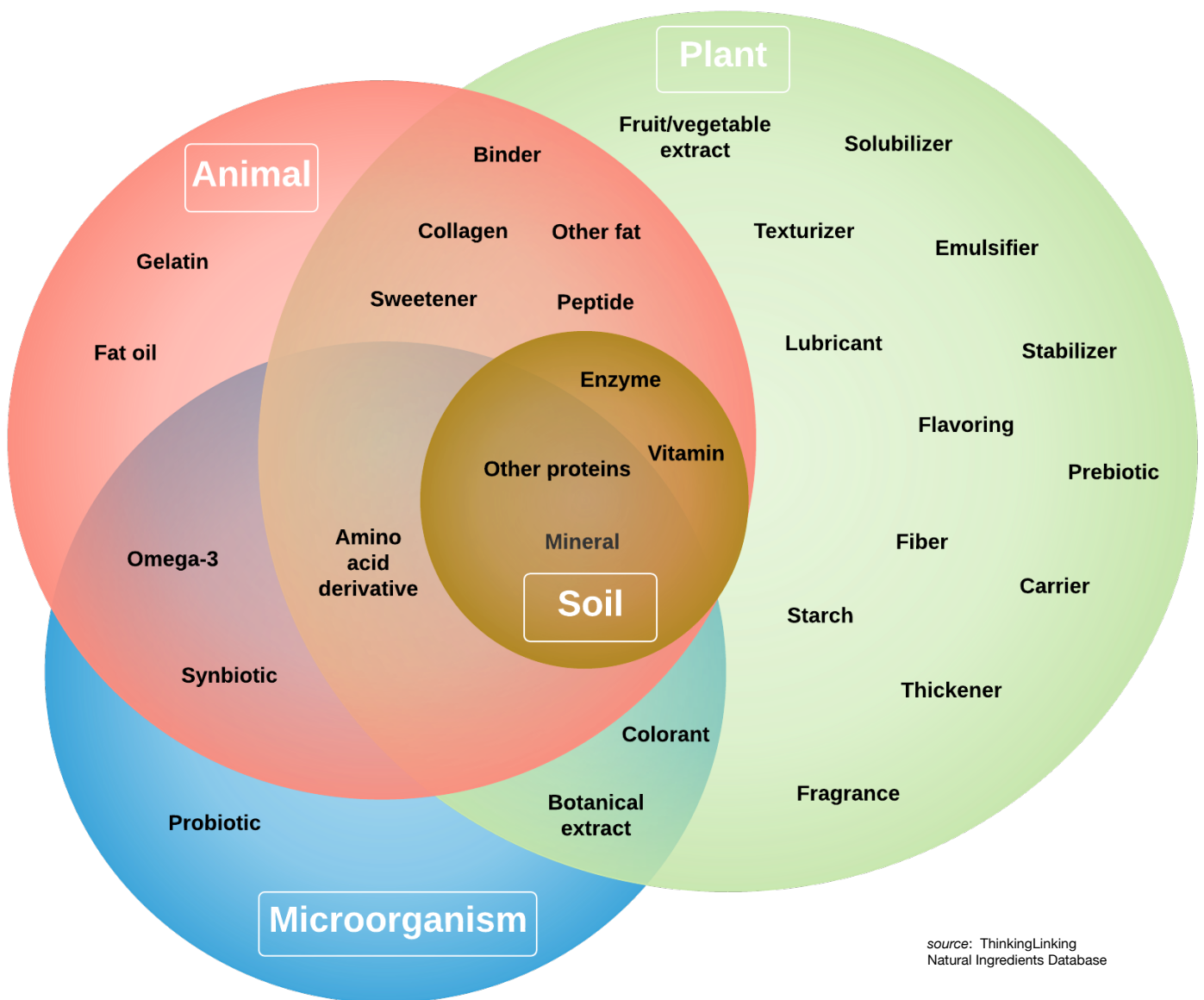
source: ThinkingLinking  
Natural Ingredients Database

# Origins

About half the ingredient types can be produced using only one of the four principle origins: plant, animal, microorganism or soil. If we were to go down to the sub-origin level, 'origin flexibility' – the number of possible origins for an ingredient – becomes even greater. For example, we can easily see how the vegan trend can be accommodated in many ingredient categories by changing the biomass.

## Unique or multiple sources

The one or more origins of each ingredient type



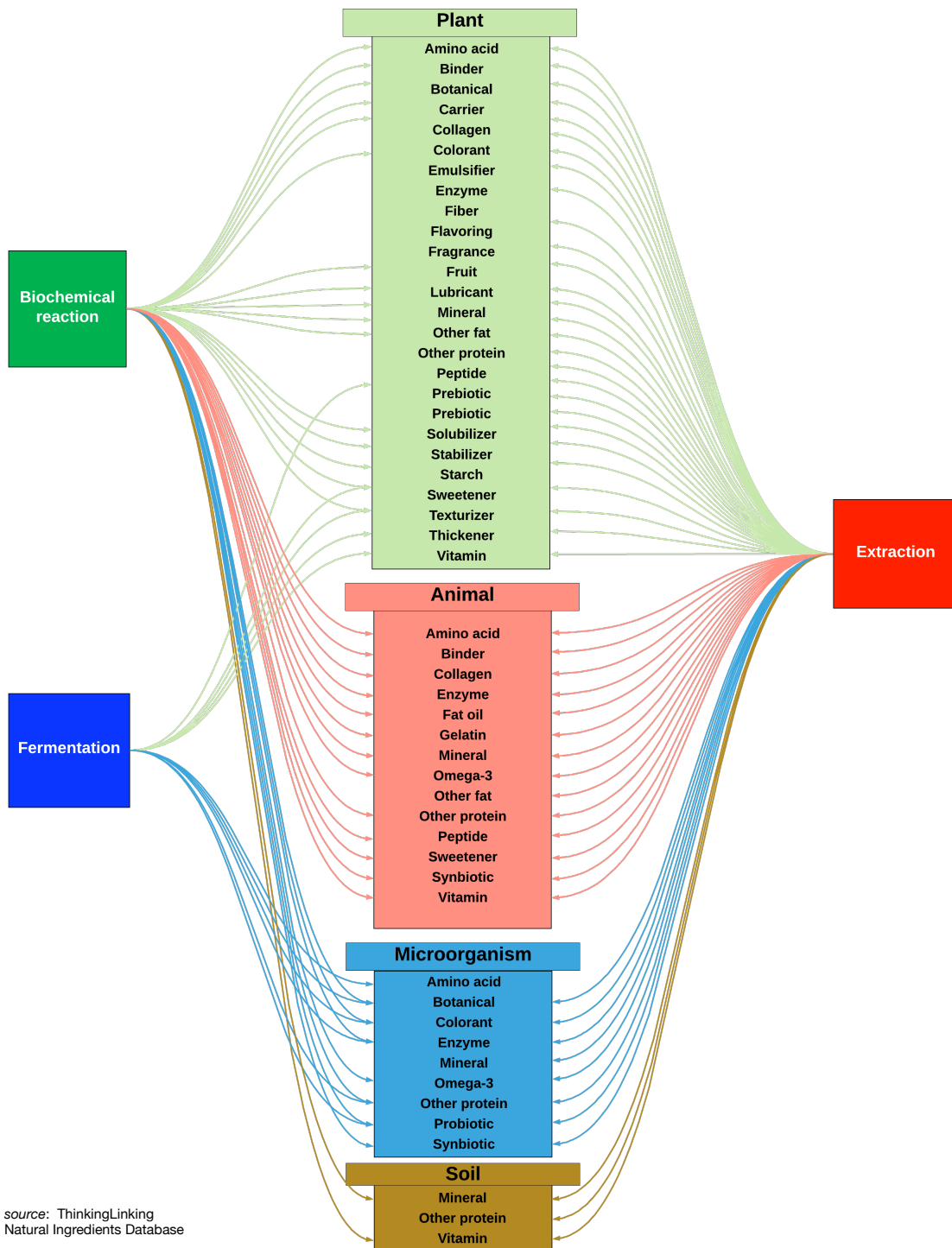


# Production process

We see that the three principal production processes of the natural ingredients sector can be used across all four principle origins, plant, animal, microorganism and soil. For example, we see that plant origins are used in all processes, not just extraction; and extraction itself is deployed across all four categories of biomass. We also see that ingredient types often repeat in different origin categories.

## Minimal correlation between process and origin

Almost every origin is relevant to every process



source: ThinkingLinking  
Natural Ingredients Database

# Combination processes

There are in fact six processes at work in the natural ingredients sector, the three basic ones, extraction, fermentation and biochemical reaction, plus the pairing of each of them. Ingredient types are plotted to show which of these six can be used to produce the particular ingredient. Of course, though an ingredient type has many options, individual companies tend to use only one. The overall picture is that there is a lot of choice in production method for most ingredients. Only three ingredient types have a single production method option. Many have at least three options and, at the extreme, probiotics has four. These options of course result in an ingredient having different product qualities and economics at different production levels.

## Processes and their combinations

The complex relationship between ingredients and their process options



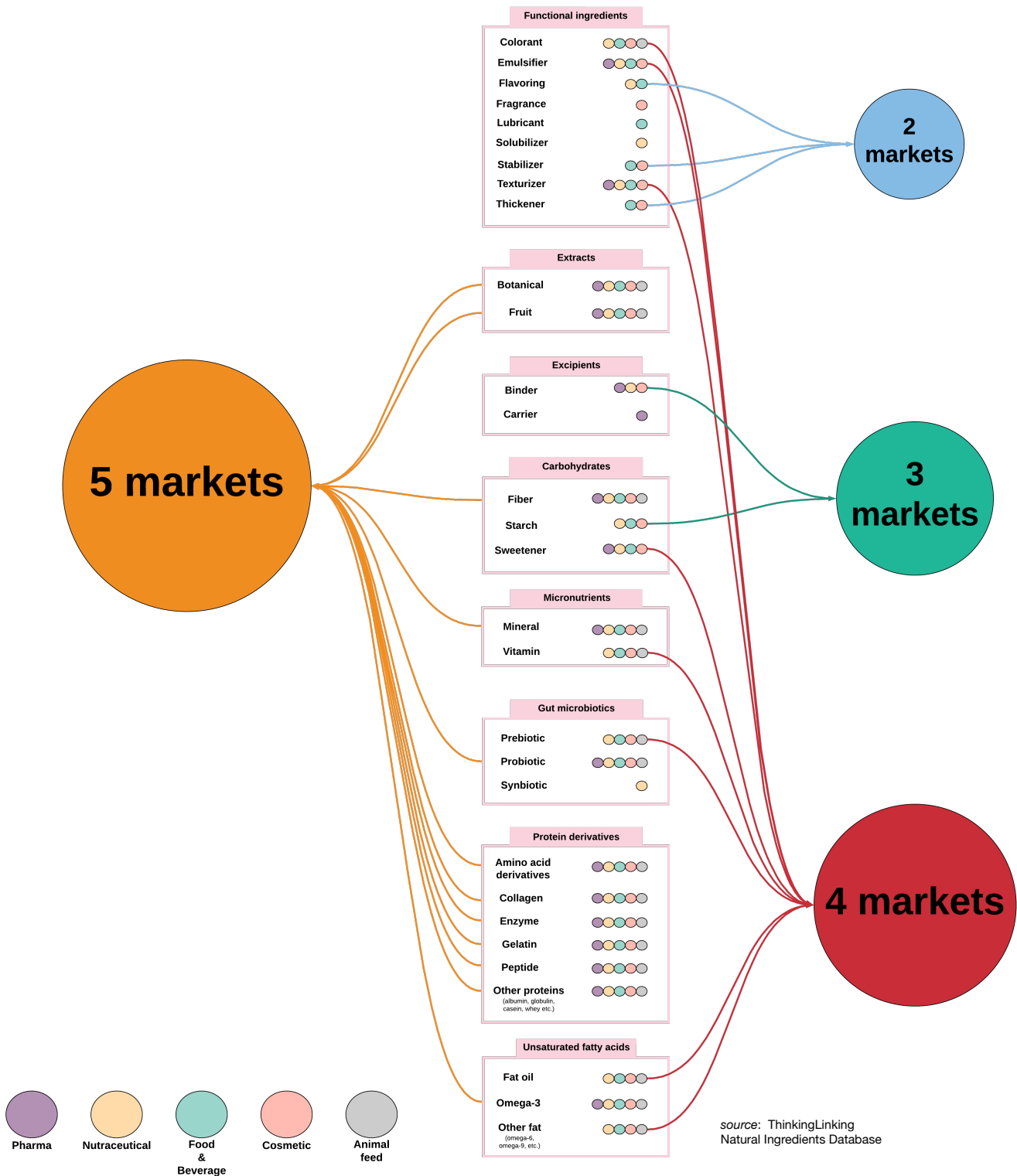
source: ThinkingLinking  
Natural Ingredients Database

# Vertical markets

It's well-known that individual ingredients have wide use across different vertical markets but the scale of this phenomenon can now be appreciated. Indeed, 85% of ingredient types have between four and five vertical market uses.

## Multi-market picture

The vast range of sectors ingredients serve



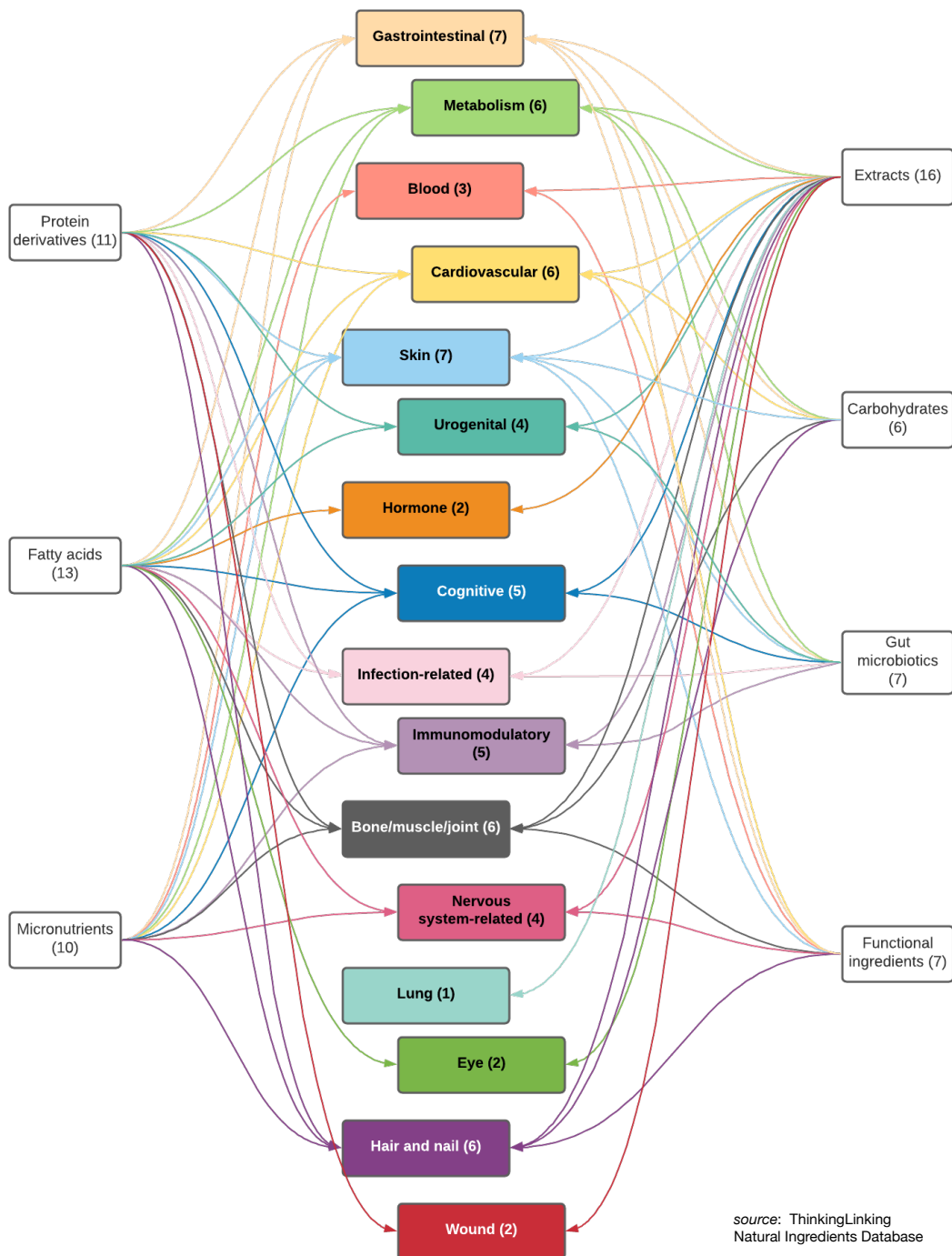
# Health benefits

We found that 83% of products in our opportunities database have a health benefit claim. In this sense, the health benefits dimension of course cannot be considered a universal one for the sector, unlike ingredient, origin, process and vertical market. Nevertheless, it's majority relevance makes it critical to the sector.

We can see that some natural ingredient groupings have a very wide impact across the health spectrum and also some therapeutic areas likewise can be addressed by multiple natural ingredients groupings.

## Ingredient Power

The therapeutic areas claimed by each ingredient

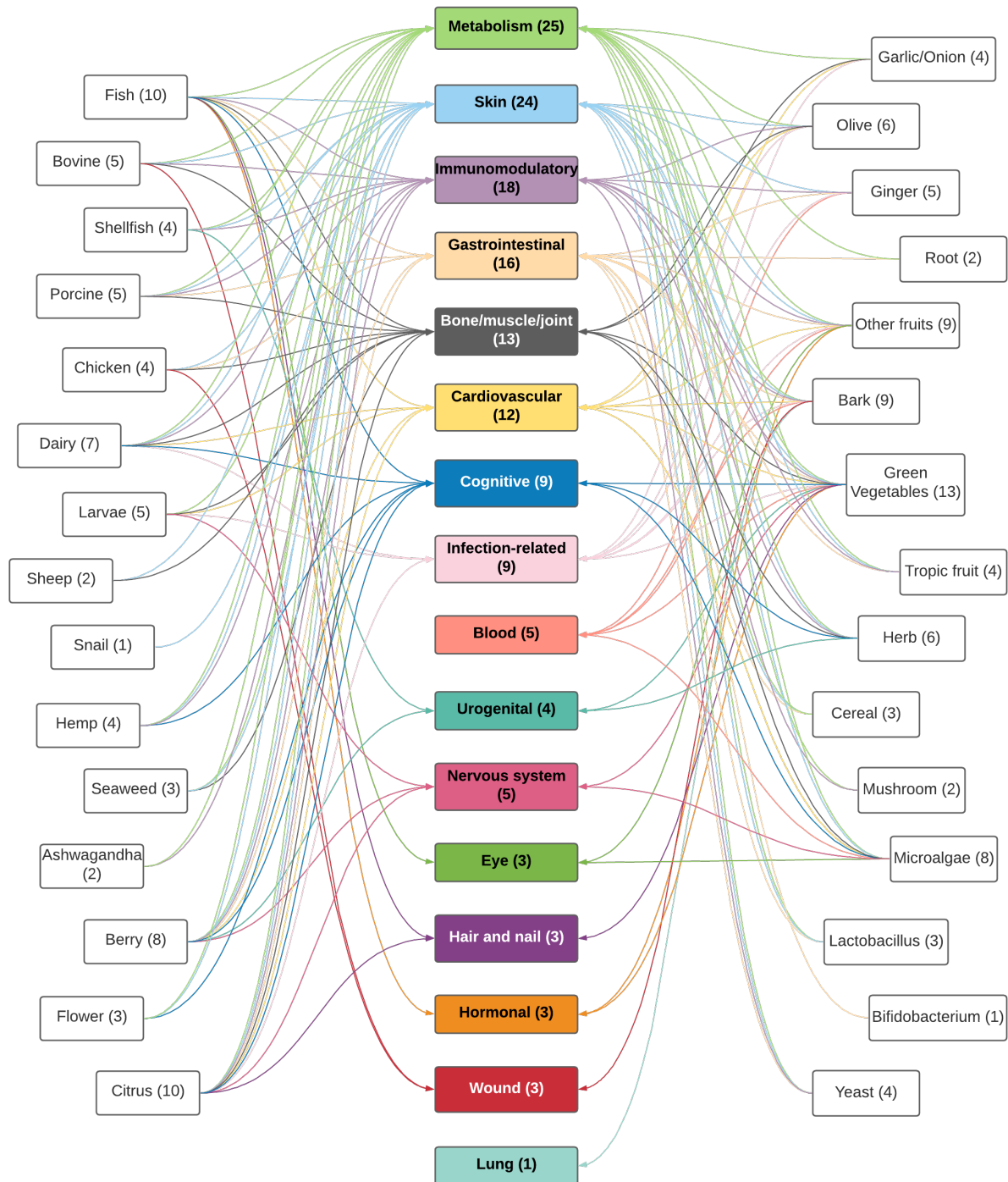


The data also shows that many sub-origins have wide healthcare uses and similarly many of the therapeutic and wellness categories can be addressed by multiple sub-origins.

This scale of ingredient and sub-origin choice for health and vice versa goes some way to explain the complexity of the sector and decisions facing the pharma and nutraceutical sectors, and indeed their consumers, when considering the choices they have from the natural ingredients sector.

## Origin Power

The therapeutic areas claimed from each sub-origin



source: ThinkingLinking  
Natural Ingredients Database

Our focus is to be a link between strategic investors and owners of proprietary natural ingredients businesses in the extraction, fermentation or biochemical reaction or combination, of plant, animal, microorganism or soil sources, for the pharma, nutraceutical, F&B, cosmetic, or animal feed verticals, across all health benefits. We cover all categories of natural ingredients: functional, extracts, excipients, carbohydrates, micronutrients, gut microbiotics, protein derivatives, and unsaturated fatty acids.

ThinkingLinking operates cross-border from London, New York, Paris, Milan, Wroclaw and Beijing, and has completed over 80 transactions in 25 countries.

Our primary two services are:

- Representing private owners of proprietary businesses: to maximise their valuation by introducing strategically-committed partners, and then creating an auction dynamic where these counter-parties are managed in a competitive process to ensure the owner gets a fair transaction.
- Representing acquirers and investors: to expand their range of opportunities of primarily private companies to build 1-on-1 relationships focused on strategic fit, with the goal of completing transactions outside an auction environment.

We are active also in joint ventures, alliances, licensing agreements and other transactions where the focus is on introducing optimal partners who can therefore do more together than other alternatives and fairly share the upside.

## INLINKING TEAM

The InLinking team represents ThinkingLinking's experts active in the natural ingredients sector:

Melis Uzmay	Senior Thinker, Ingredients Lead
Lee Bridgett	Senior Linker, Ingredients / USA Lead
Francesco Ceretti	Senior Linker, Ingredients / Italy Lead
Ling Liu	Senior Thinker, Macro & Micro Algae / China Lead
Bo Tandrup	Senior Linker, Ingredients & Pharma

Sylvia Li PhD	Research, NID taxonomy & classification
Félicie Mason	NID production
Hasan Mussa	Research, Head of Statistics & Data
Yufei Zhou	Research

Yekcan Arslan	ThinkingLinking Publications Coordinator
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Mark Dixon	Chief Thinking Officer
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**THINKING  
LINKING**  
The clearinghouse for  
natural ingredients opportunities

ThinkingLinking's 'InLinking' team has assembled knowledge and relationships with the primary acquirers and investors in the natural ingredients sector and 350 of the most innovative privately-owned companies with the commitment to be the clearinghouse for 'win-win' transactions between these two communities.

Our position at the epicentre of investment opportunities allows us to make M&A, licensing and alliance matches based on a combination of strategic fit and 'timing fit' based upon knowing the transaction needs of both investors and owners.

As part of this commitment to the sector, we have developed a 5-dimensional taxonomy and classified the sector's current opportunities in order to create a uniform 'language of strategic fit' between counter-parties who we then introduce.

**“Link with the optimal partner through ThinkingLinking”**