Beyond The Cup

What if Umami is more than a taste?

Exploring the connection between taste, memory and the coffee we love.



RESEARCH & INNOVATION COFFEE HUB

A COFFEE CHEMISTRY SERIES BY

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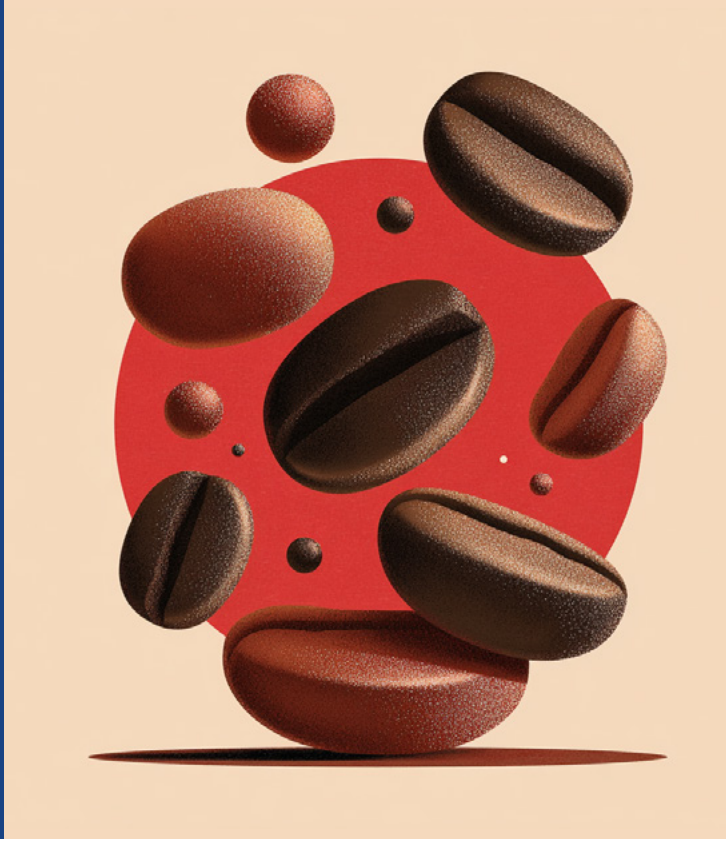
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PART 2

Decoding umami: the role of proteins and peptides in coffee's savory profile





From Bean Biology to Browning Reactions: Why do the Savory Notes Start Long Before the Brew

If Part 1 made you feel something, this part tells you why.

Behind every "brothy" "complete" or "round" coffee there is a cast of microscopic characters: proteins, amino acids and peptides.

Most people think of these as nutrients, but in coffee, they're flavor builders.

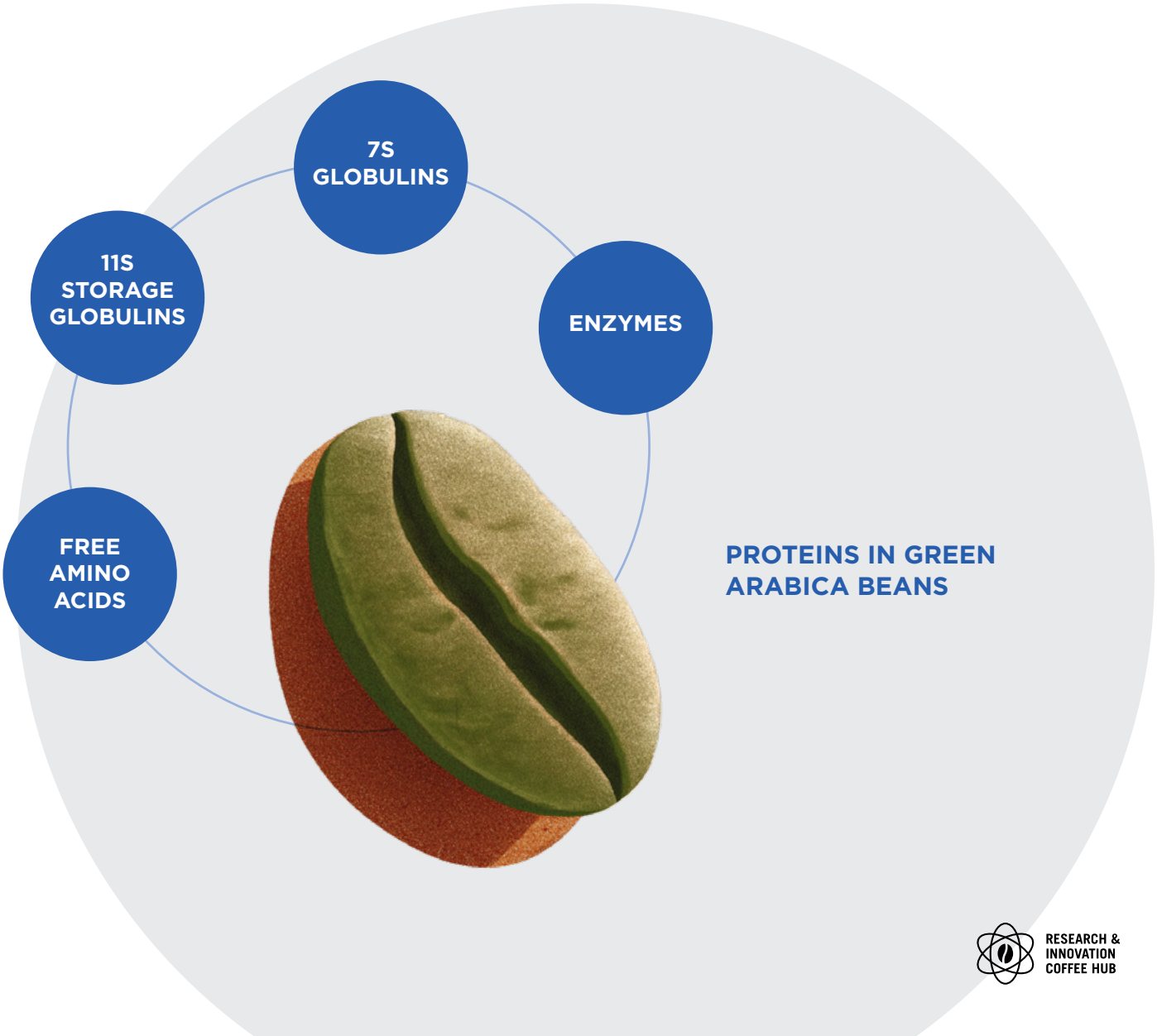
Bean Biology: Proteins and Amino Acids

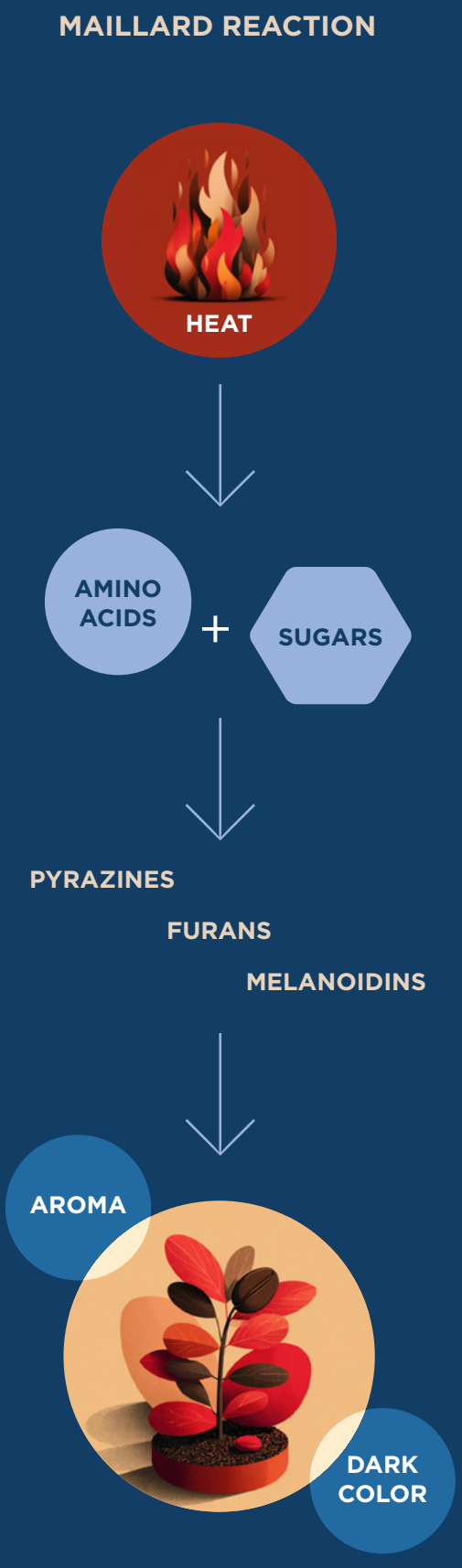
Proteins are like necklaces made of amino acid beads. In green coffee, these proteins are part of the bean's internal structure.
They help the seed to store nitrogen, to build enzymes and to survive until germination.

Green *Arabica* beans contain **8.5 - 12% protein** by dry weight, mainly in the form of **11S storage globulins** and **7S globulins**, with some albumins and enzymes mixed in.

Only about **0.3 - 0.6%** of the bean is made of free amino acids, but among these are key molecules like:

- **Glutamic acid**: classic umami contributor
- **Aspartic acid**: similar effect, slightly sharper
- **Alanine, glycine**: soft, sweet notes
- **GABA**: a non-protein amino acid associated with calming effects in nutritional contexts, also contributing to the overall flavor profile.





Roasting Chemistry: Controlled Chaos

Roasting is a form of controlled chaos. Proteins denature, degrade and rearrange. Some break into amino acids and peptides, while others become part of **melanoidins** - brown, complex molecules formed through the Maillard reaction.

- **Amino acid degradation**: Asparagine → Acrylamide (potentially risk);
- **Amino acids (incl. glutamate) + reducing sugars** → roasting chemistry (Maillard/Strecker) → aroma-active volatiles (pyrazines, furans, Strecker aldehydes);
- **Peptides + sugars** → Strecker aldehydes, furans, pyrazines → Roasty, savory, meaty notes.

The **Maillard reaction** is also why dark-roasted beans smell like toast, meat or pretzels.
And it's the same chemistry that gives onion soup its aroma.

Brewing and Extraction

Only about 20% of a coffee bean is extracted during brewing, but this includes key flavor-active peptides, amino acids, and melanoidin fragments.

- **Espresso and French press:** higher extraction of peptides, more mouthfeel
- **Pour-over:** cleaner, more acidic, fewer heavy molecules

Anaerobic fermentation has been shown to increase free amino acids in green beans, meaning that the protein "fuel" for umami is already there before roasting even begins.

Why does it matter

Think of these molecules as the secret spices of coffee. You don't see them, but they play an important role in:

- Creating savory and sweet notes
- Enhancing body and balance
- Providing precursors to aroma

Later in Part 3, we'll see how they don't just impact taste but also how coffee makes us feel.

Key Takeaway:

During roasting, **Maillard reactions** between amino acids and reducing sugars form flavor-active peptides and **Strecker aldehydes**, such as methional and pyrazines.
These compounds contribute to **brothy and roasted aromas** and are commonly associated with medium-to-dark roast profiles and anaerobically processed beans, depending on roasting conditions.

Umami is not just about free amino acids. Advances in coffee science suggest that **fermentation-driven peptide and metabolite formation**, combined with **brewing methods and roasting chemistry**, all contribute to the sensory architecture of umami in coffee.

What's Next

PART 3

Umami beyond taste: the metabolic and health impact of coffee's molecules

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