



„Chemically speaking,
chocolate really is the world's
perfect food.“

Michael Levine

Defining and Analyzing Quality

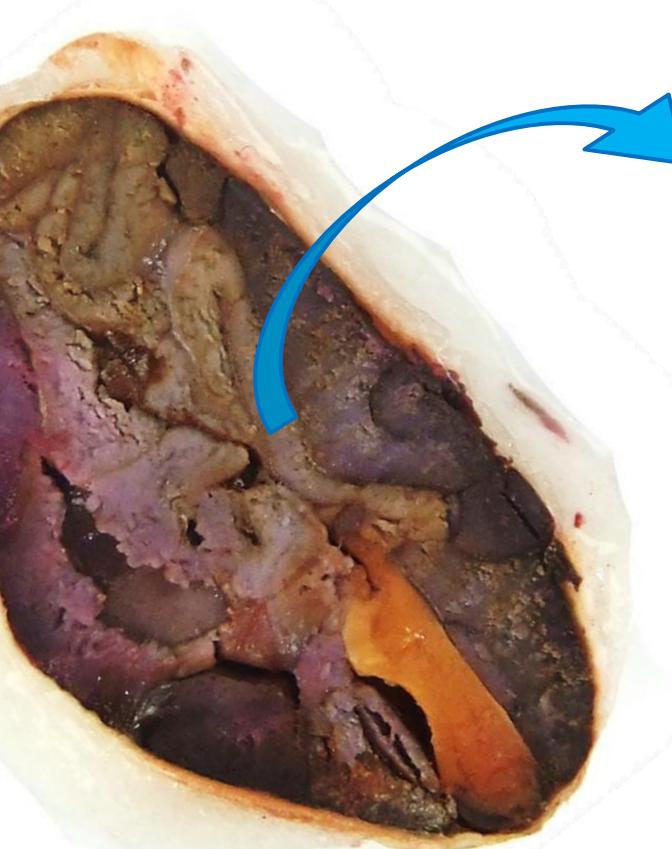
Biochemical and Sensory Attributes of Cocoa and Cocoa Liquors

Hamburg, May 12th 2017

Dr. Daniel Kadow



Ingredients in fresh seeds...



Cotyledon

- Fat
- Proteins
- Phenolics
- Alkaloids
- Carbohydrates
- Organic acids

And their impact on flavor...



Cotyledon

- Fat
- Proteins
- Phenolics
- Alkaloids
- Carbohydrates
- Organic acids

Bitter

flavan-3-ols

alkaloids

And their impact on flavor...



Cotyledon

Fat
Proteins
Phenolics
Alkaloids
Carbohydrates
Organic acids

Bitter

flavan-3-ols
alkaloids

Astringent

flavan-3-ols flavonols
cinnamic acid amides

And their impact on flavor...



Cotyledon

Fat
Proteins
Phenolics
Alkaloids
Carbohydrates
Organic acids

Bitter

flavan-3-ols

alkaloids

Astringent

flavan-3-ols

flavonols

cinnamic acid amides

Sour

citric acid

Ingredients of the fruit pulp...



Fruit pulp

Sugar
Organic acids
Mono-terpenes
Secondary alcohols
Esters

And their impact on flavor...



Fruit pulp
Sugar
Organic acids
Mono-terpenes
Secondary alcohols
Esters



Sour
citric acid
malic acid

And their impact on flavor...



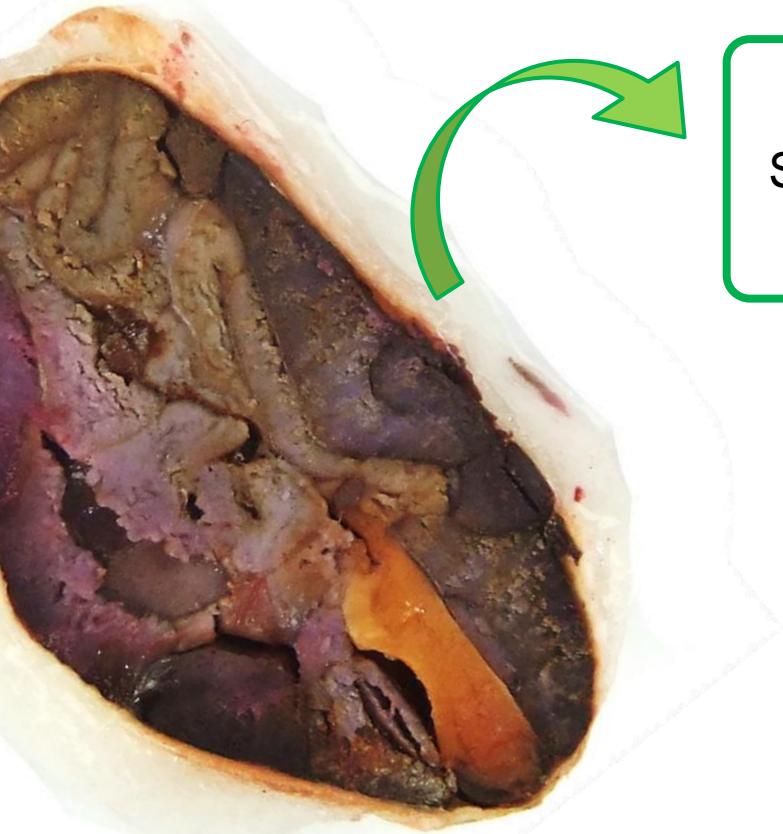
Fruit pulp
Sugar
Organic acids
Mono-terpenes
Secondary alcohols
Esters



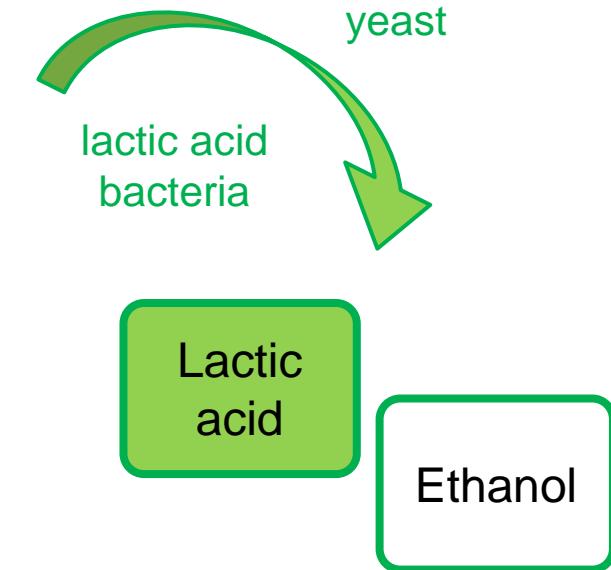
Sour
citric acid
malic acid



Changes during fermentation...



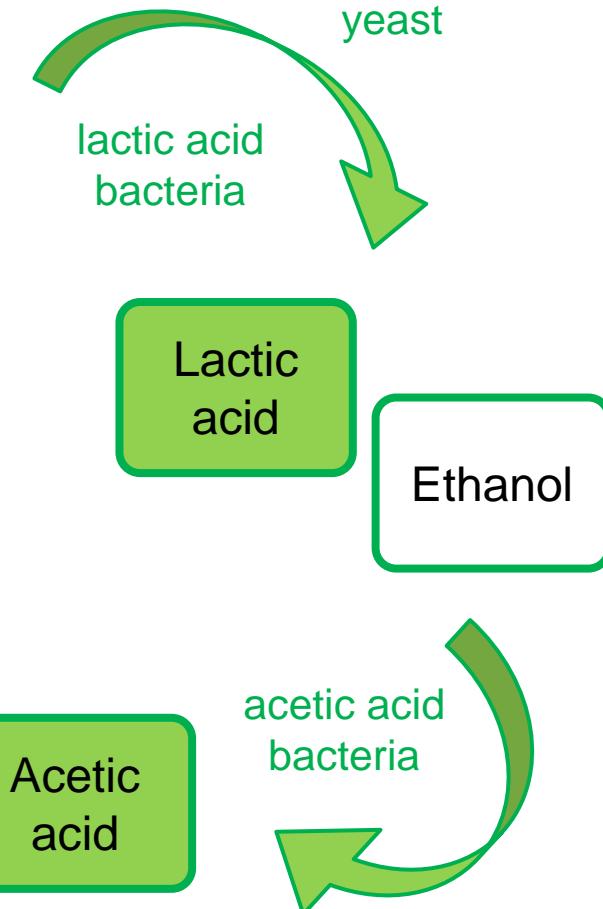
Fruit pulp
Sucrose, glucose,
fructose



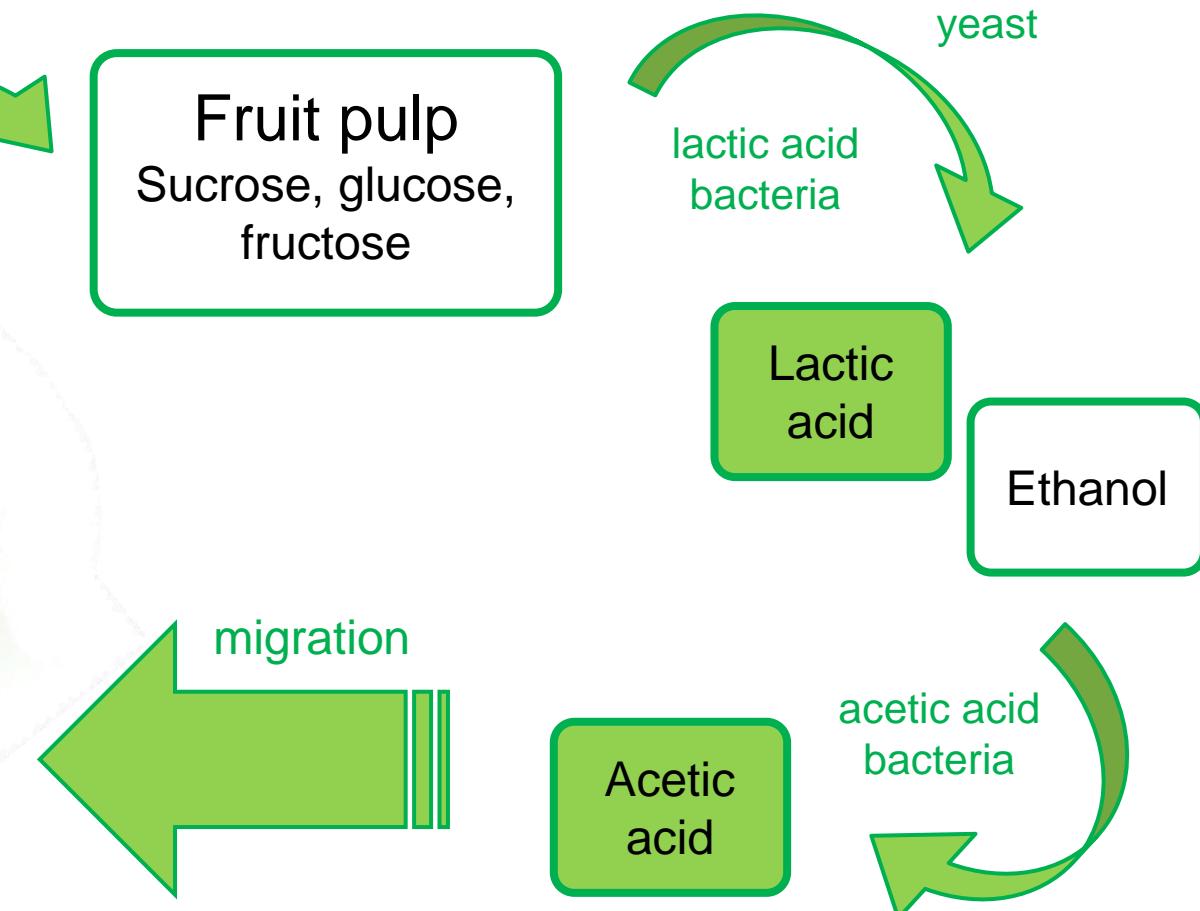
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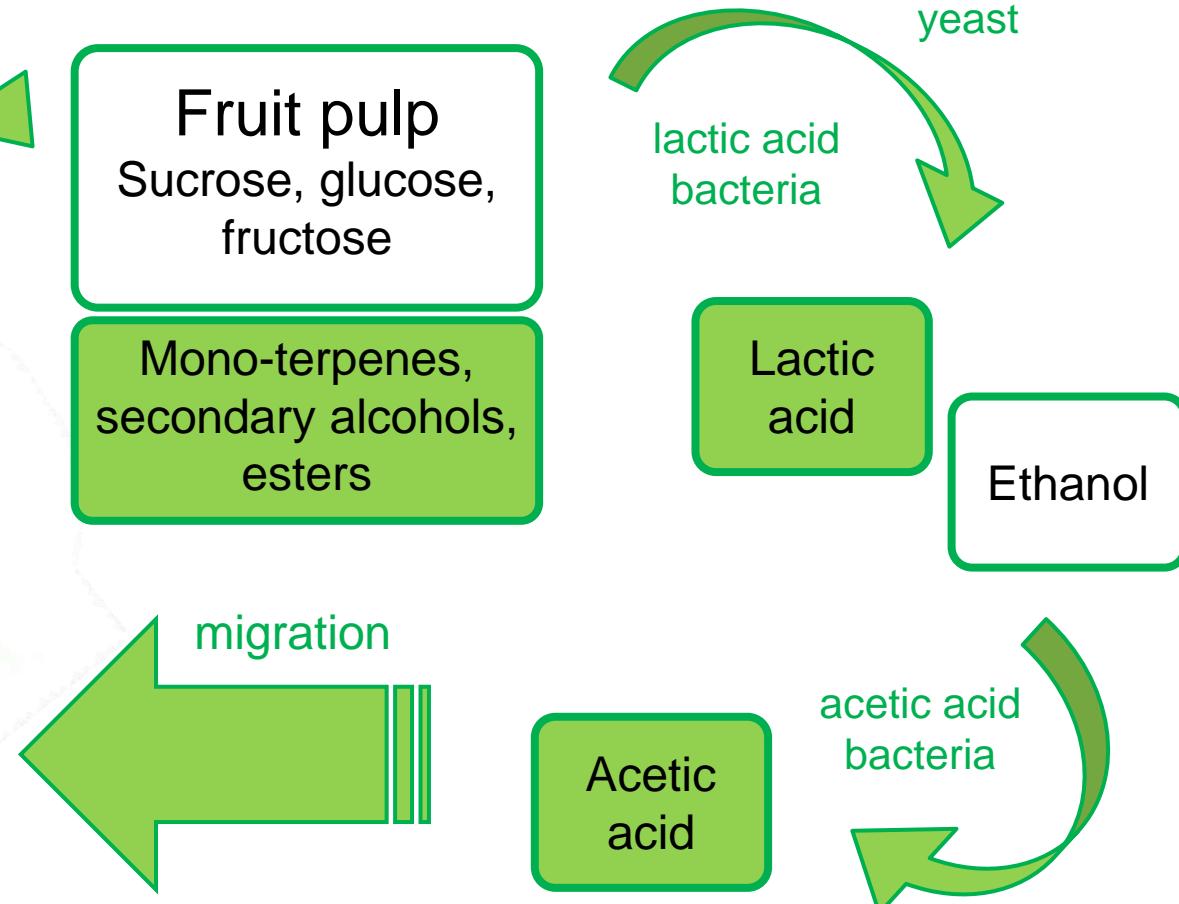
Fruit pulp
Sucrose, glucose,
fructose



Changes during fermentation...



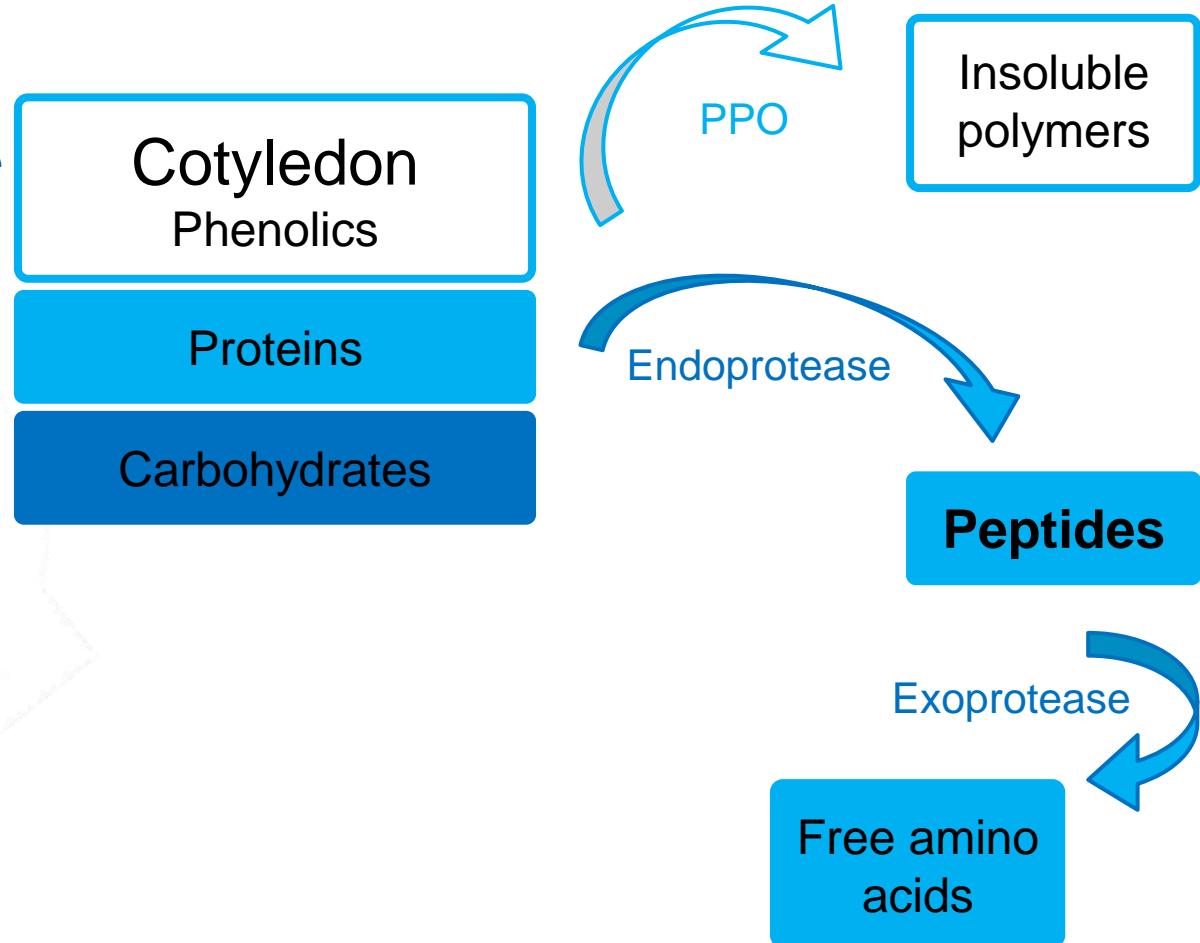
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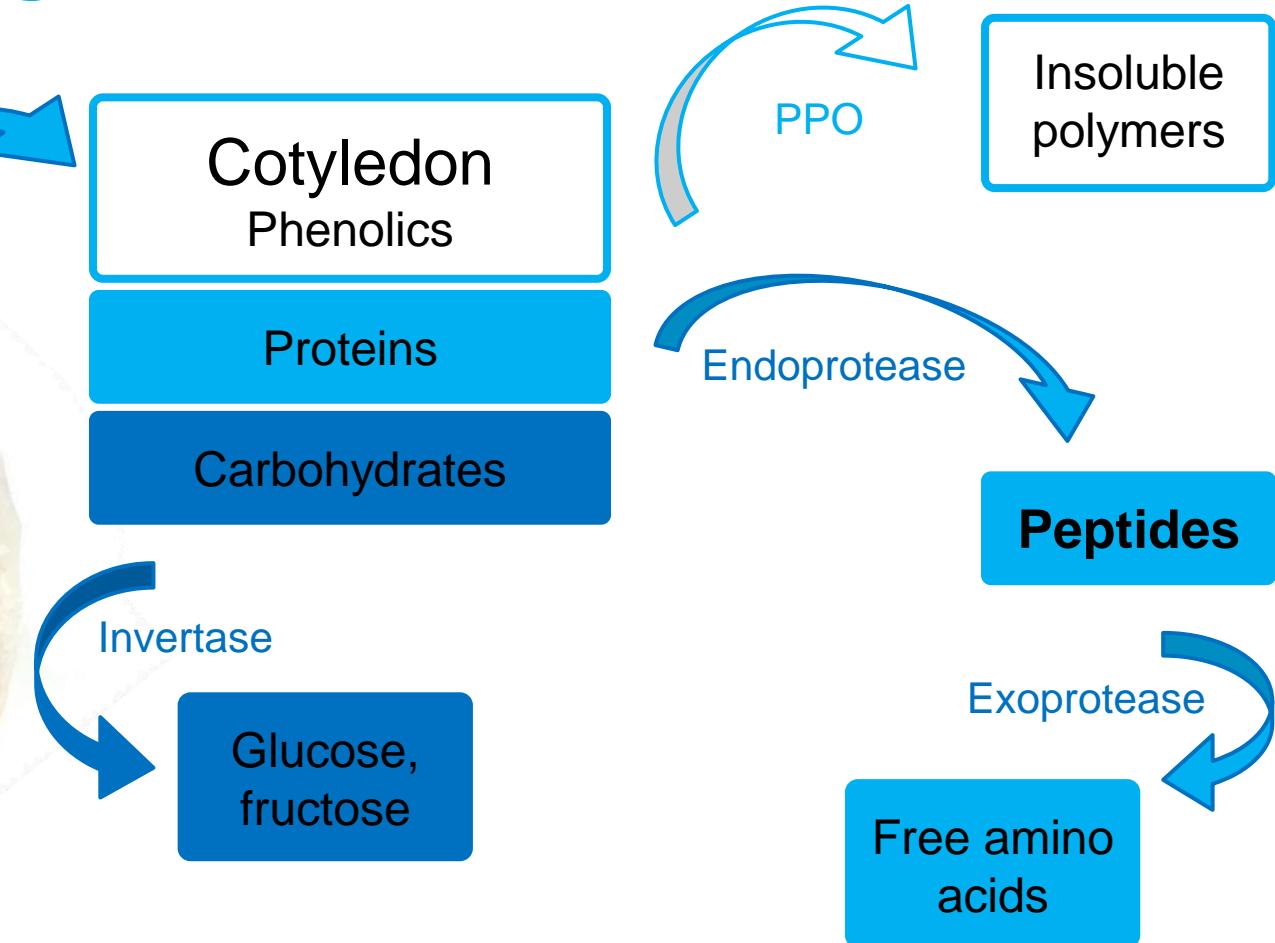
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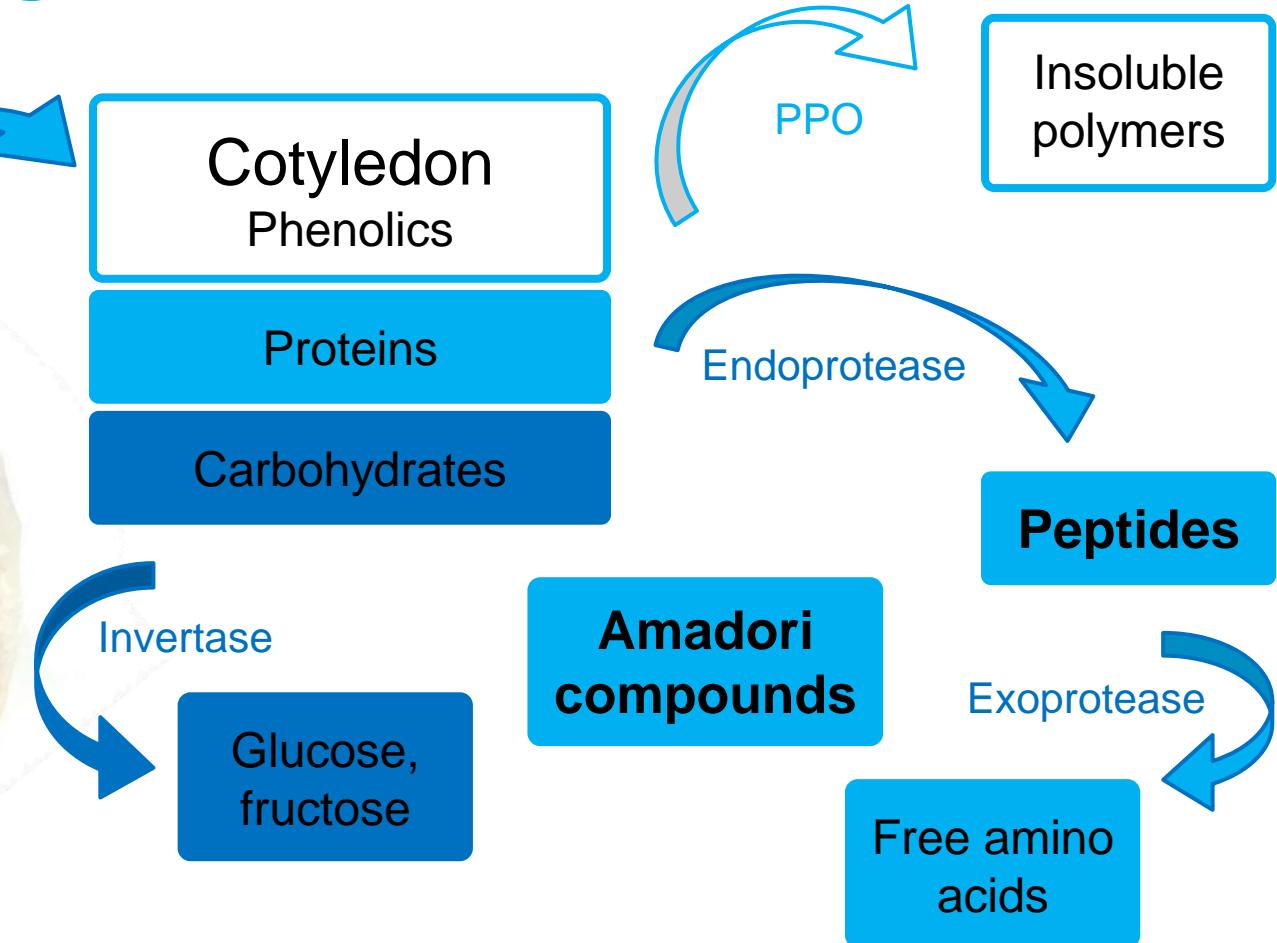
Changes during fermentation...



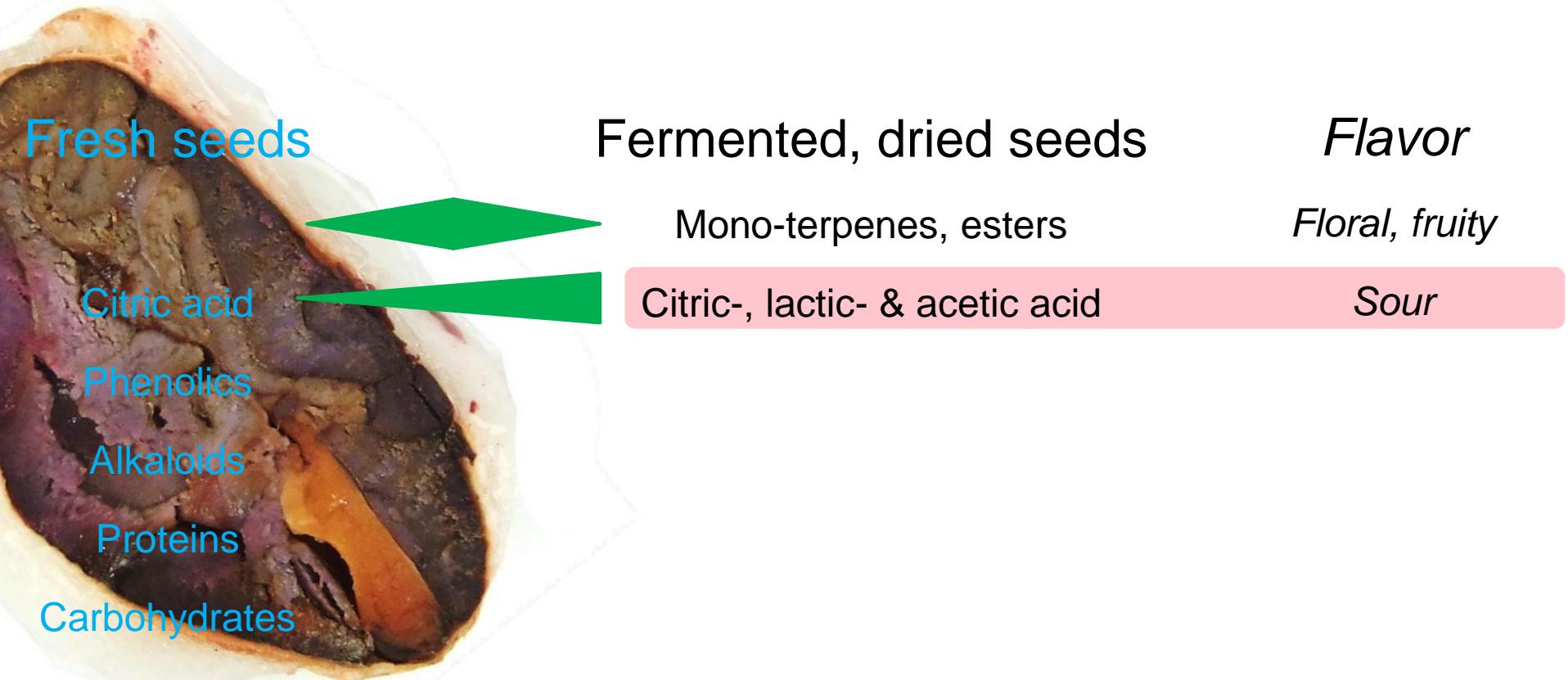
Changes during fermentation...



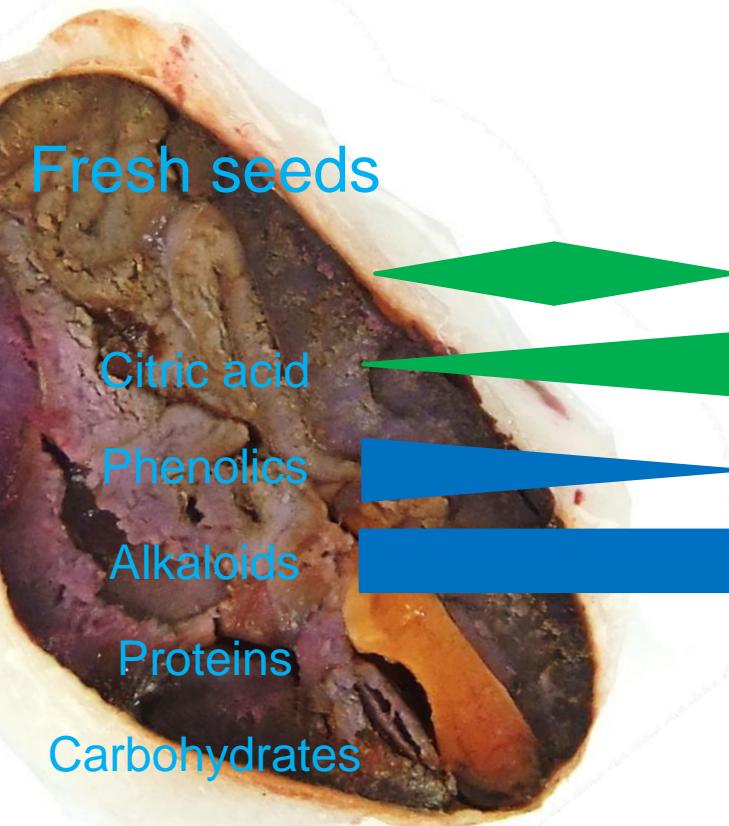
Changes during fermentation...



Changes during fermentation...



Changes during fermentation...



Fresh seeds

Fermented, dried seeds

Flavor

Citric acid

Mono-terpenes, esters

Floral, fruity

Phenolics

Citric-, lactic- & acetic acid

Sour

Alkaloids

Phenolic substances

Astringent, bitter

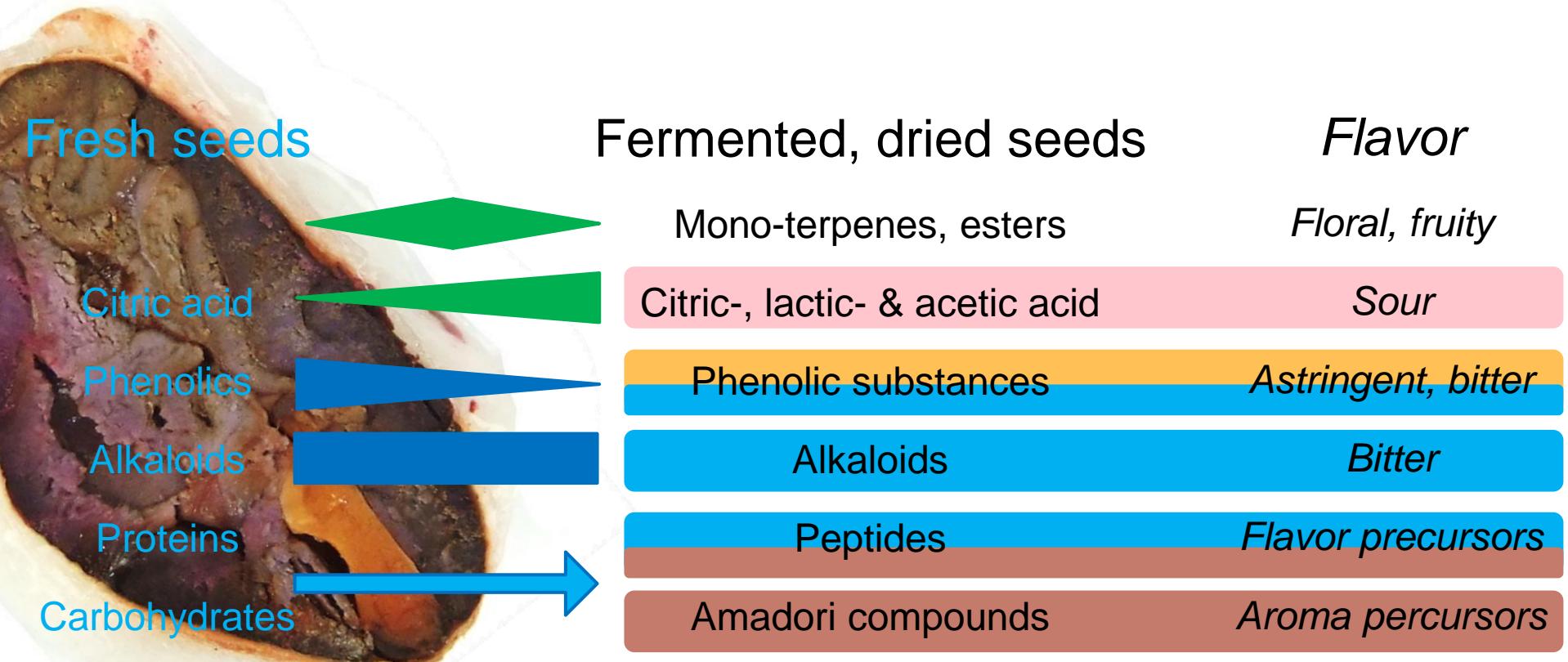
Proteins

Alkaloids

Bitter

Carbohydrates

Changes during fermentation...



And secondary post-harvest processing...

Fermented, dried seeds

Peptides

Liquor

Flavor

Diketopiperazines

Bitter



And secondary post-harvest processing...

Fermented, dried seeds

Peptides



Liquor

Diketopiperazines

Flavor

Bitter

Amadori compounds



Strecker aldehydes

Cocoa aroma

And secondary post-harvest processing...

Fermented, dried seeds

Peptides



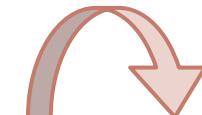
Liquor

Diketopiperazines

Flavor

Bitter

Amadori compounds



Strecker aldehydes



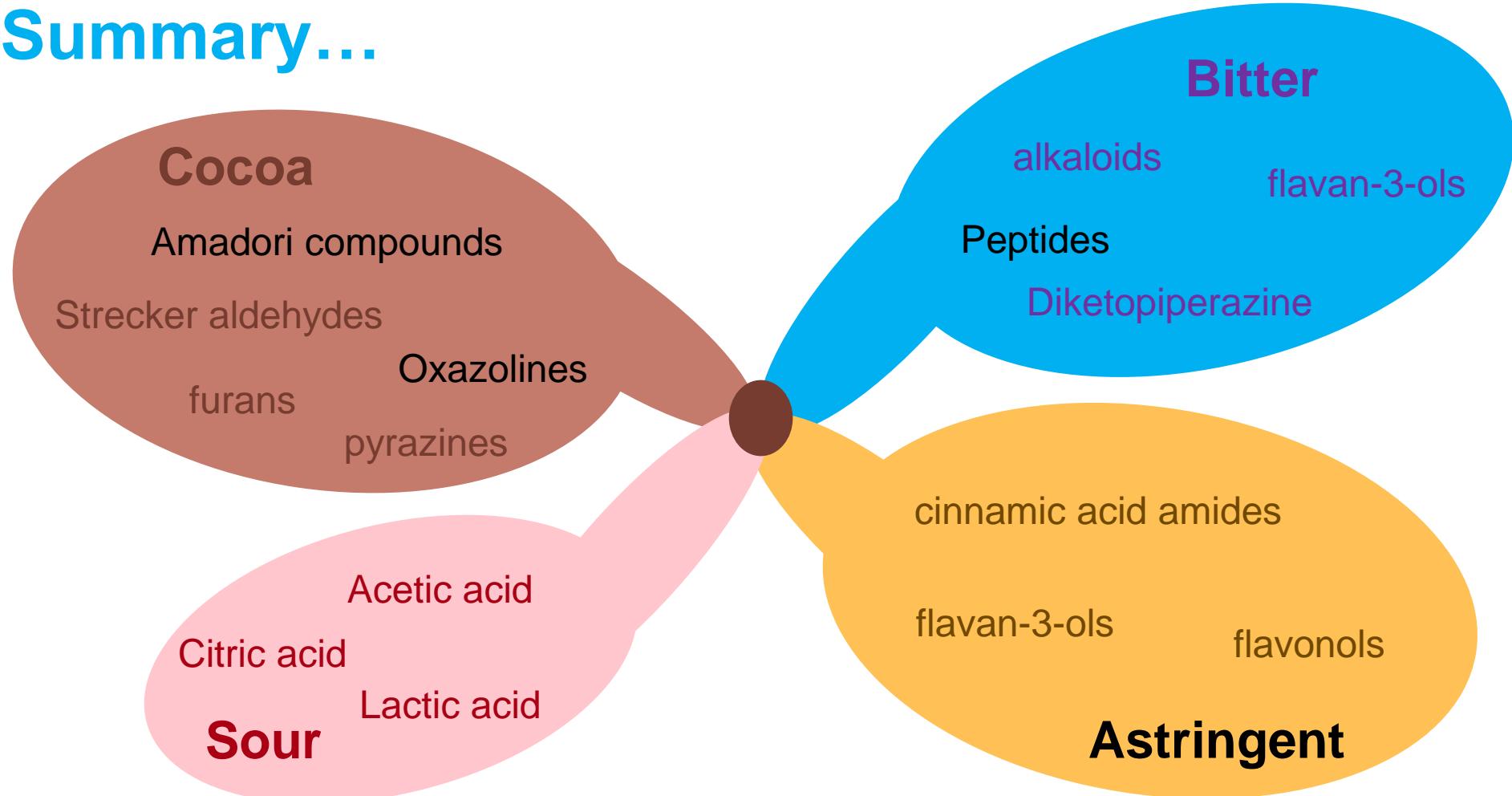
Oxazolines



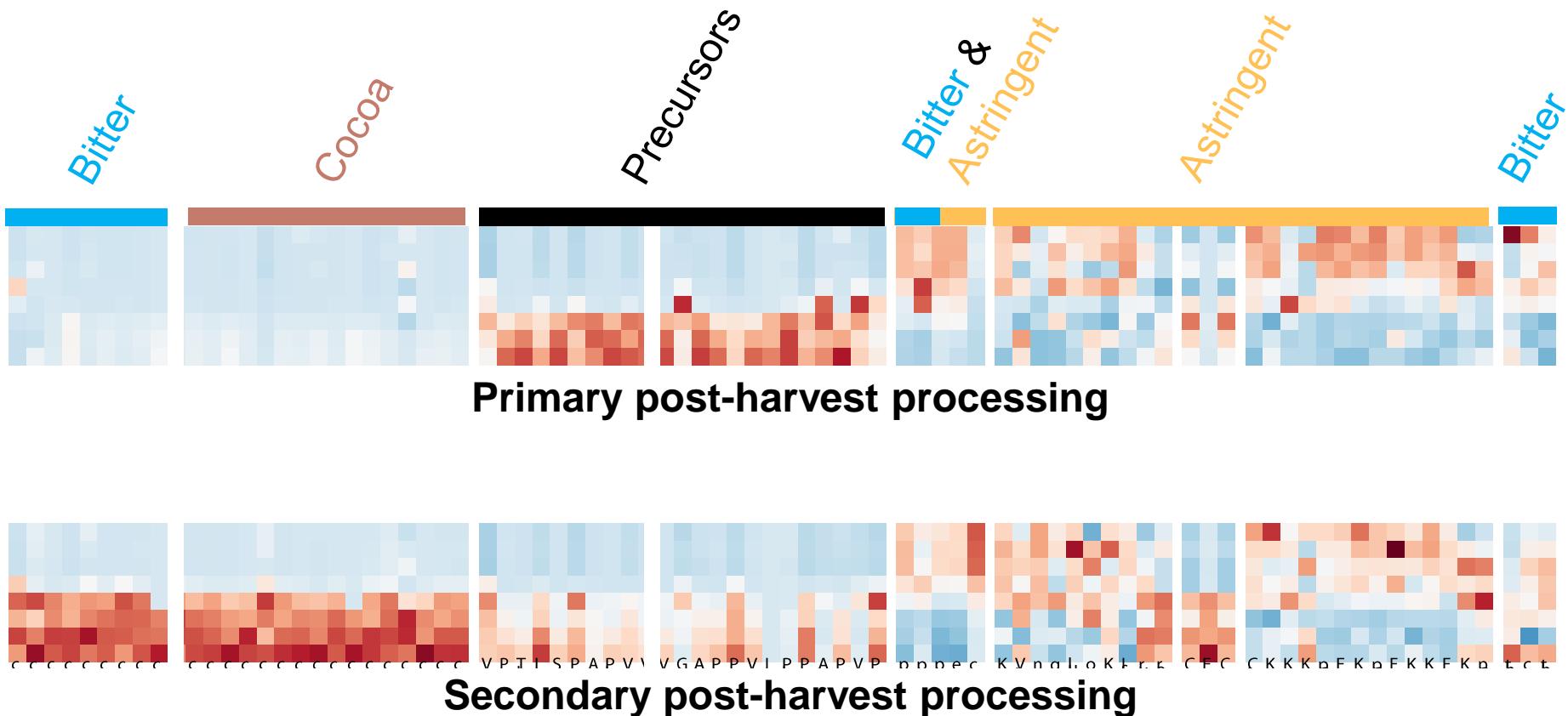
Cocoa aroma

Cocoa aroma precursors

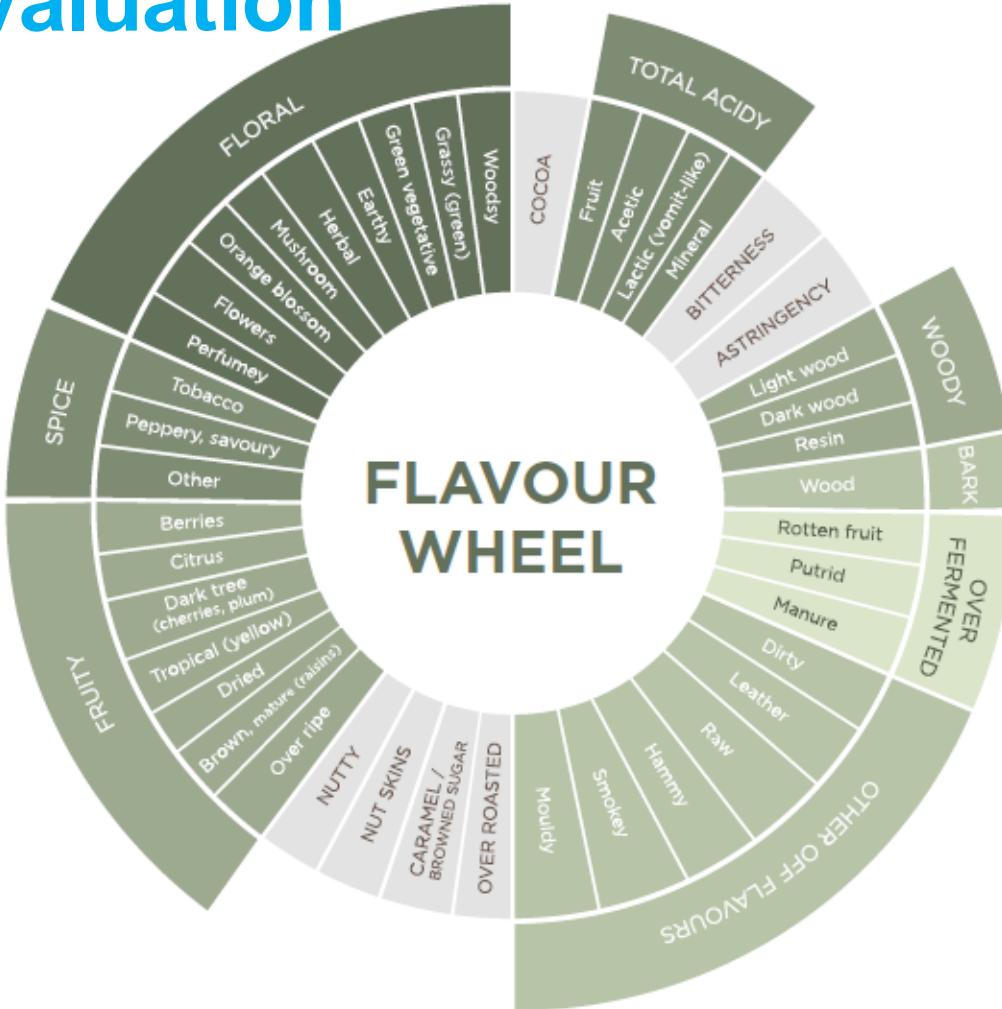
Summary...



Holistic quality monitoring



Sensory evaluation



Standardized training liquors





RUNDER TISCH KAKAO

HAMBURG



22. - 23. Juni 2017

Kakaoqualität – wohin führt der Weg?
Perspektiven bis 2020.

Ein Vortrag von Dr. Daniel Kadow

10:00 Untersuchungen zur Kakaofermentation im Labormassstab – eine praxisorientierte Forschungsreihe



Prof. Dr.
Jörg Stender
Hochschule
Ostwestfalen-Lippe

10:50 Vergleichende chemische Analyse roher und fermentierter Kakaobohnen



Prof. Dr.
Nikolai Kuhnert
Jacobs University
Bremen

11:40 Von chemosensorischen Codes zur umfassenden Flavor-Quantifizierung in Lebensmitteln



Prof. Dr.
Thomas Hofmann
Technische
Universität
München

13:30 Molekularsensorische Charakterisierung des Aromas von Nacional-Kakao – Unterschiede zu CCN-51



Dr.
Martin Steinhaus
Deutsche
Forschungsanstalt
für Lebensmittel-
chemie
Freising

14:20 Poster
Fermentation und Flavor

15:40 Nachhaltige Verpackungen auf Basis von Kakaoschalen, Beeren- und Apfelfetrester



Dr.
Stefan Hanstein
Fraunhofer-Institut
für Silicatforschung
ISC
Alzenau

09:00 Agroforst versus
Monokultur – Stärken
und Schwächen
der Anbausysteme



Monika Schneider
Forschungsinstitut
für biologischen
Landbau (FiBL)
Frick/Schweiz

09:50 Think Big:
Nachhaltige
Planung großer
Kakaoplantagen



**Dr.
Silke Elwers**
ForestFinest
Consulting
Bonn/Hamburg

10:40 Poster
Anbausysteme und Nutzung von
Nebenprodukten

12:00 Mitigation of
Cadmium Bioaccu-
mulation in
Theobroma cacao L.



Prof. Dr.
Pathmanathan
Umaharan

Internationaler
Gastredner

Cocoa Research
Center
Trinidad/Tobago

12:50 Mittagspause

13:50 Innovative Methoden
zur Früherkennung
möglicher Fehlaromen
in Rohkakao und Halb-
fabrikaten



Dr.
Wolfgang Weber

Institut für
Produktqualität
Berlin

An aerial photograph of a large shipping port at night. The foreground and middle ground are filled with thousands of shipping containers stacked in organized rows. The containers are a vibrant mix of colors, including red, blue, green, and yellow. In the background, a long bridge stretches across the horizon under a dark sky. The port is brightly lit by numerous lights from the buildings and equipment, creating a glowing effect against the night.

Thank you!