

Starch: A structural overview

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From molecules to granules

Molecular components



Starch granules

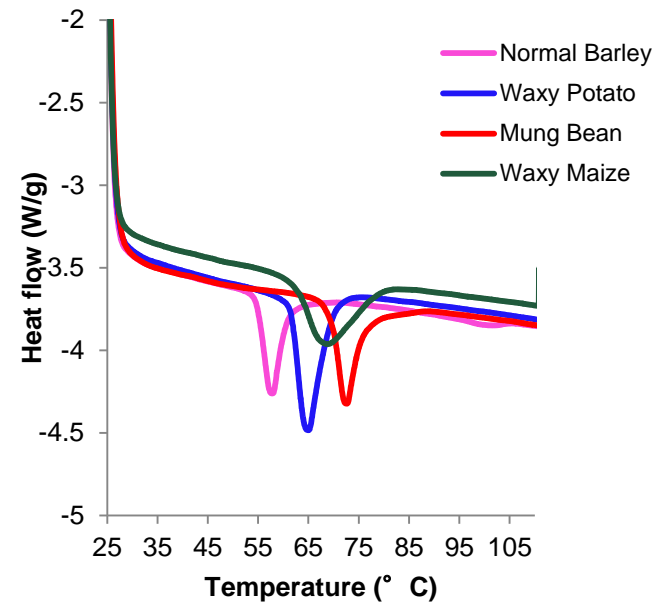
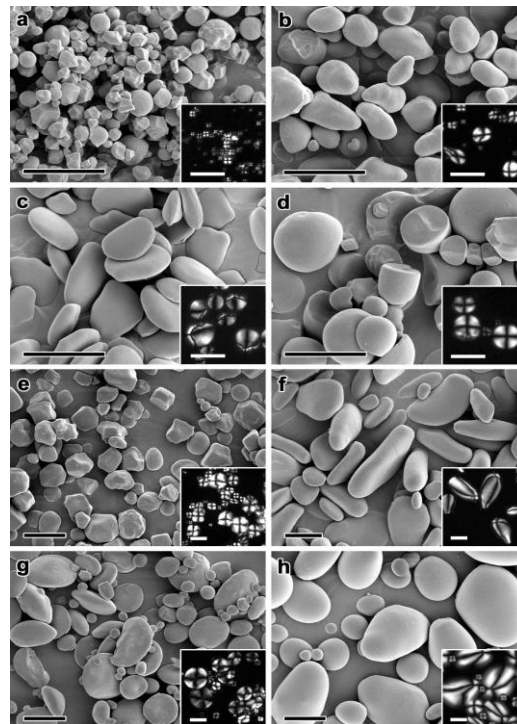
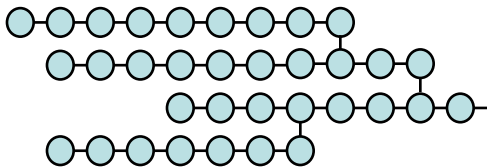


Different properties

Amylose



Amylopectin



Why is starch structure of interest?

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HOW IS STARCH SYNTHESIZED?

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Complex system of enzymes



STARCH GRANULES



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Different properties



NON-FOOD

- Paper manufacturing (coating, sizing)
- Textile manufacturing (coating, sizing)
- Encapsulation materials
(pharmaceuticals, pesticides, foods)
- Biodegradable materials (plastics)



**Create new structures
with unique functionality**

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STARCH GRANULES



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Create new structures
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FOOD

- Food additives
(instant foods, gellies, puddings,
frozen foods, low-calorie food, etc.)
- Impact on digestion
- Health and nutrition



Create added value
for consumers

Starch projects at the Food Science Department

INITIAL STARCH DEGRADATION IN THE PRE-GASTROINTESTINAL SYSTEM

The digestion of different food model systems by salivary amylases

Komeine Nantanga

STARCH STRUCTURE OF MILLETS

The structural basis of a natural source of slowly digestible starch

George Amponsah Annor / Varatharajan Vamadevan

CHEMICAL TOOLS FOR STRUCTURE ANALYSES OF STARCH

Methylation and acetylation analyses in combination with GC-MS as complement to enzymatic analysis of starch structure

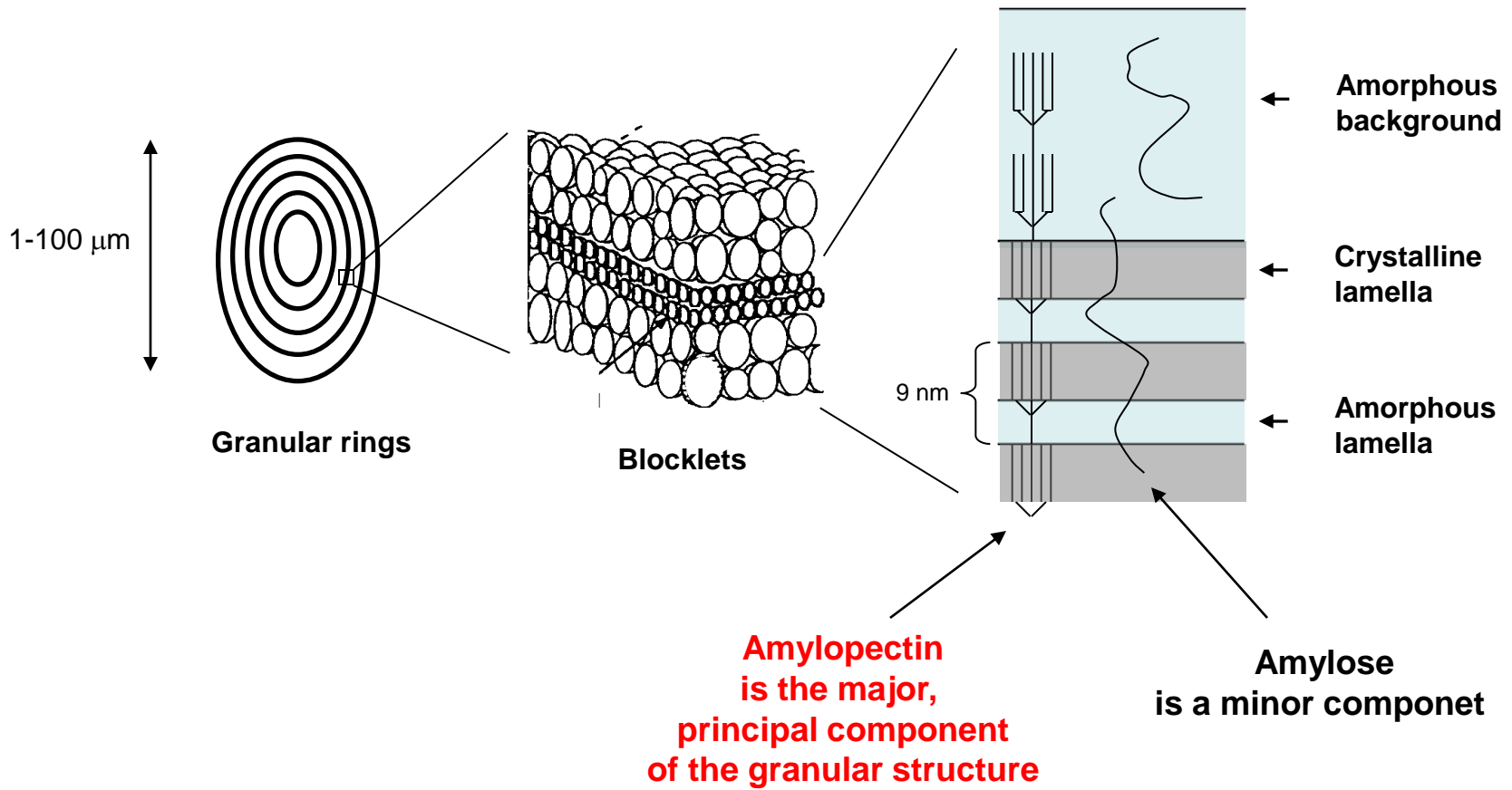
Bruce Manion

SYNTHESIS OF STARCH IN WHEAT

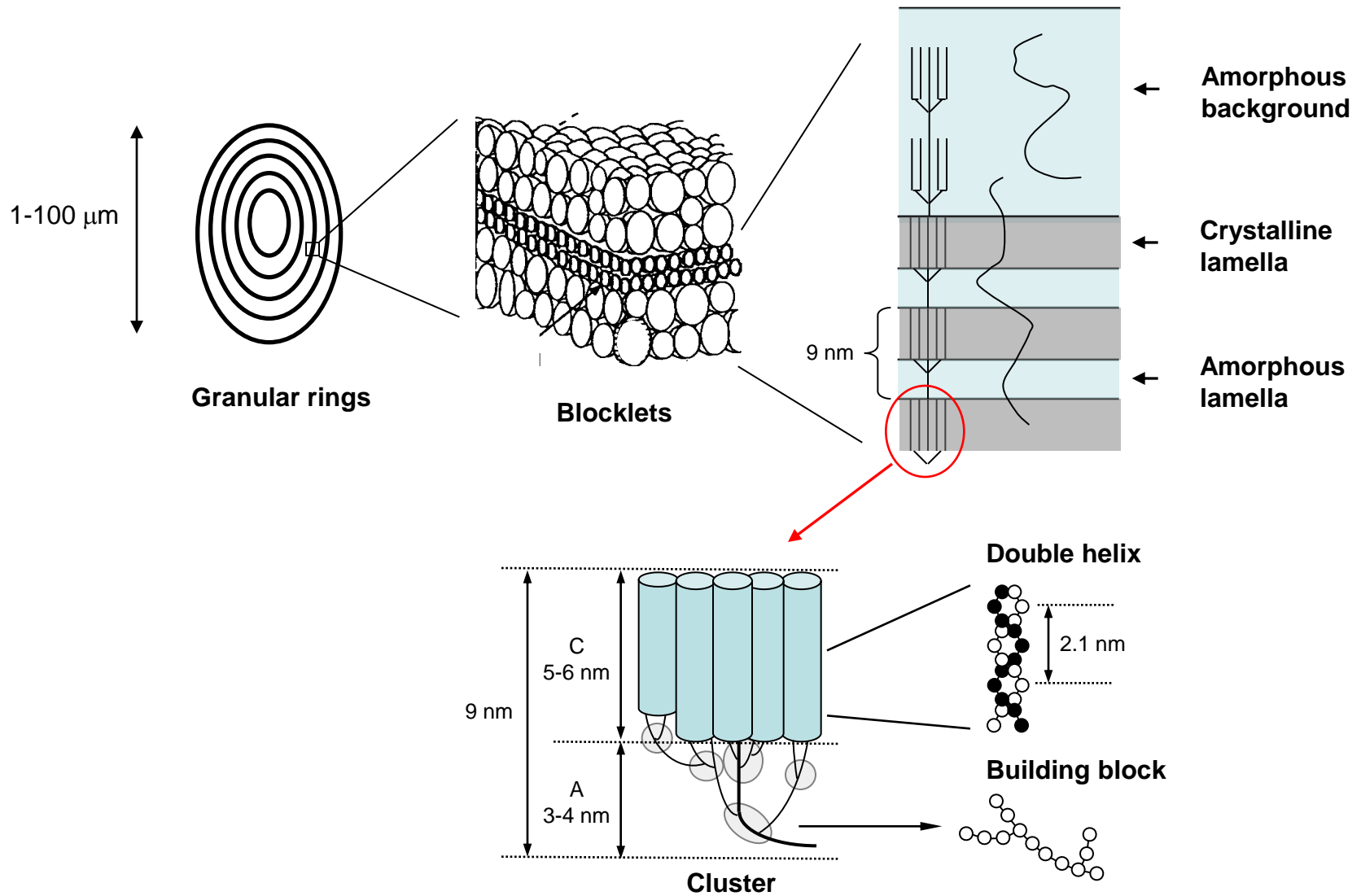
Development of starch granules in wheat endosperm during maturation

Renuka Waduge

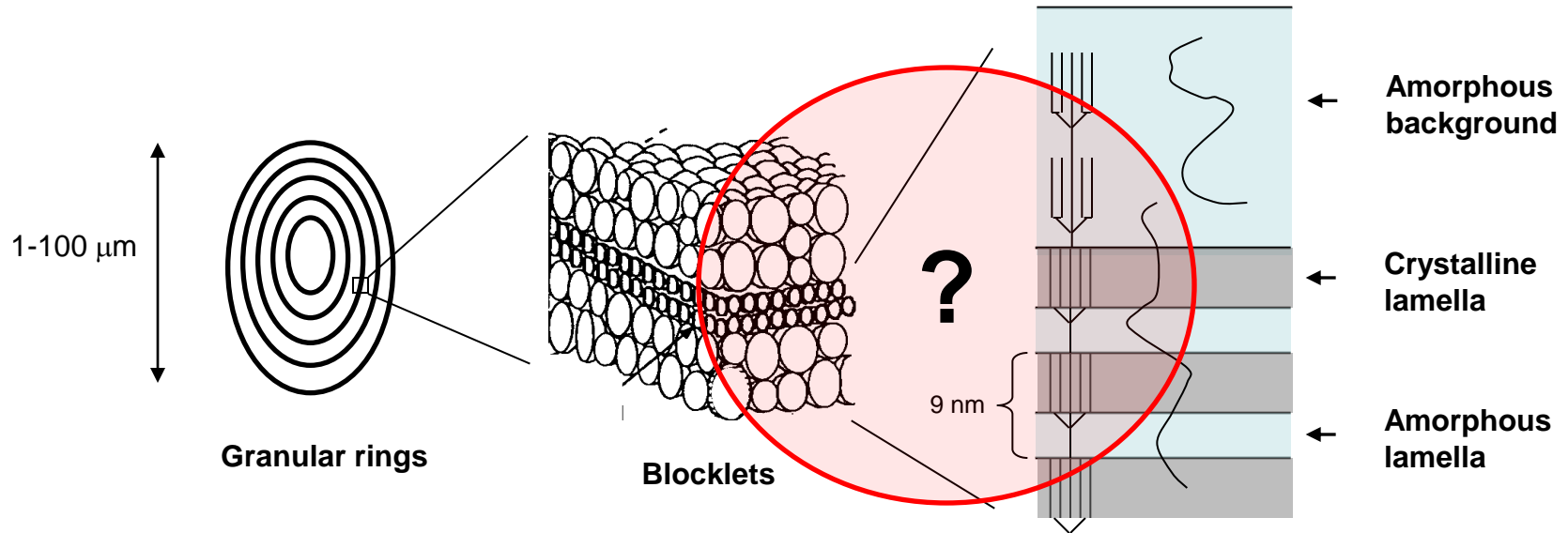
From starch granules to building blocks



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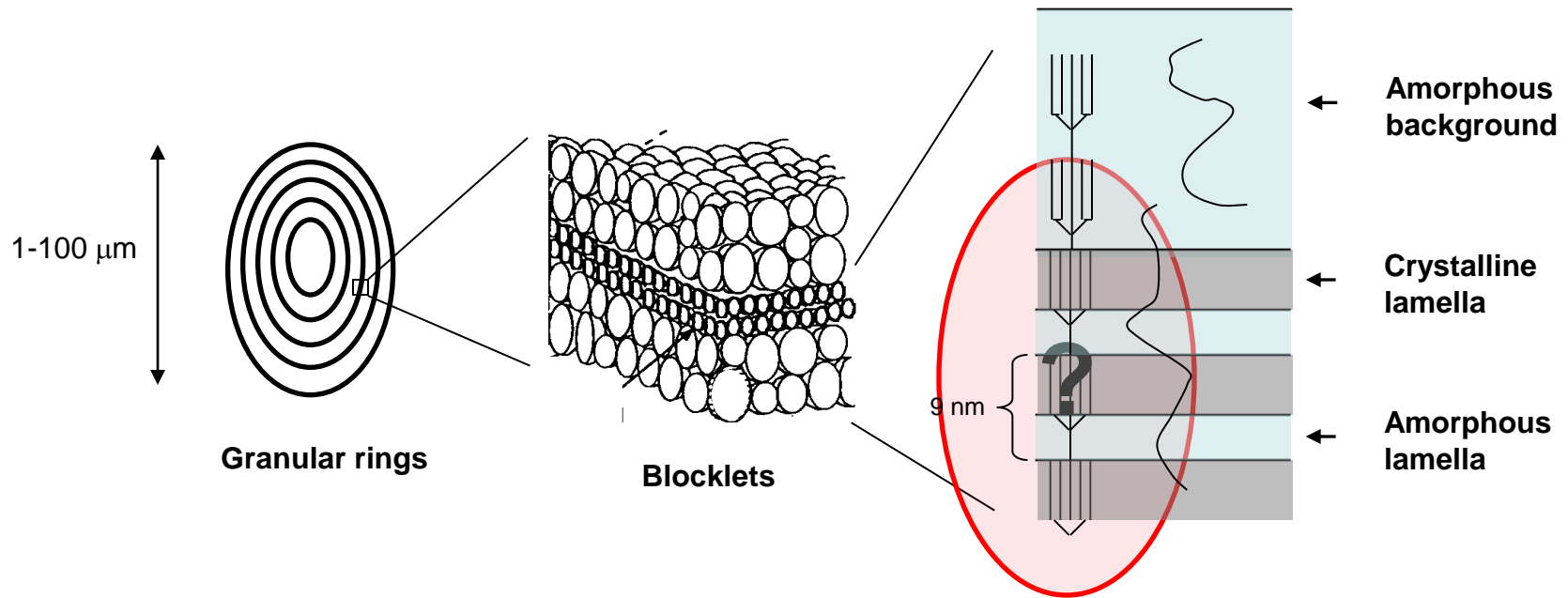


From starch granules to building blocks



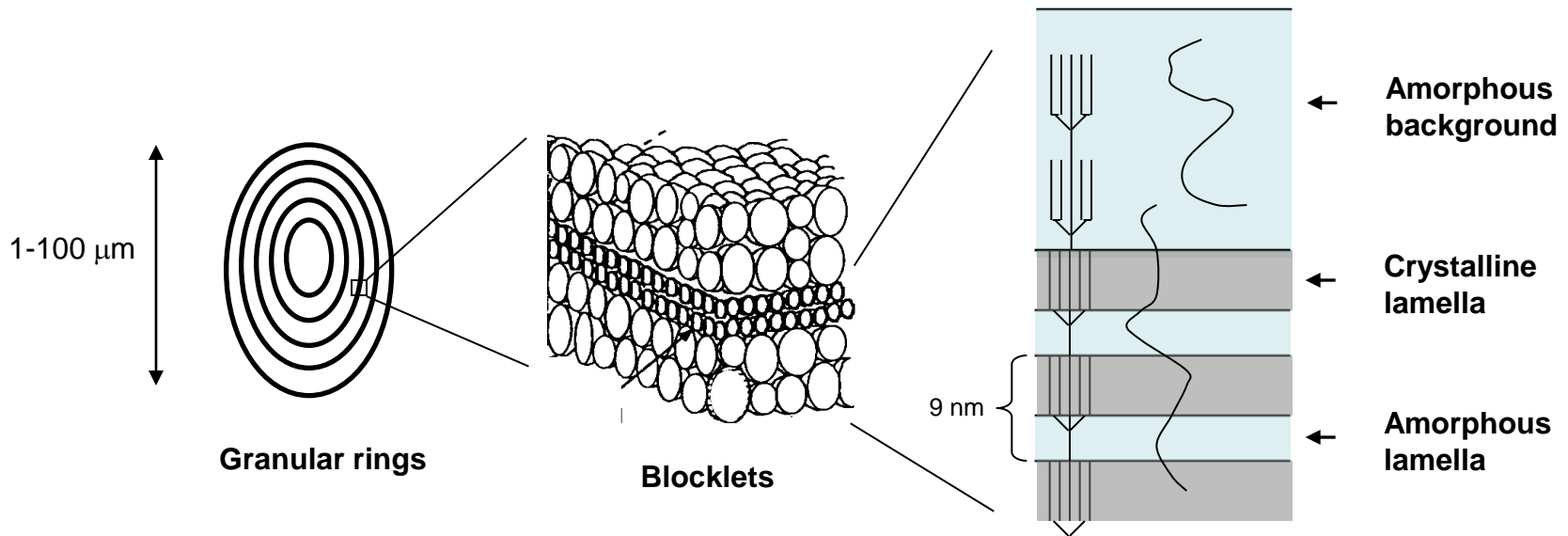
1. What is the structural relation between blocklets and the semi-crystalline organization of the granules?

From starch granules to building blocks



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2. How does amylopectin build up the semi-crystalline lamellae?

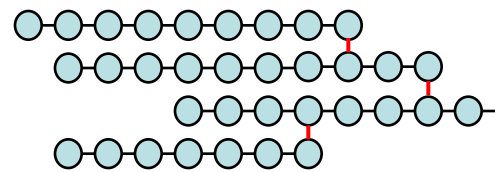
From starch granules to building blocks



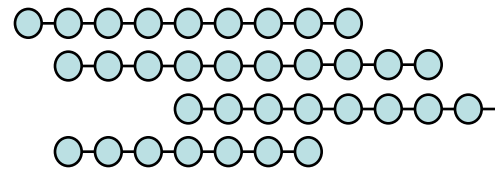
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Analysis of the structure of amylopectin

Composition of unit chains

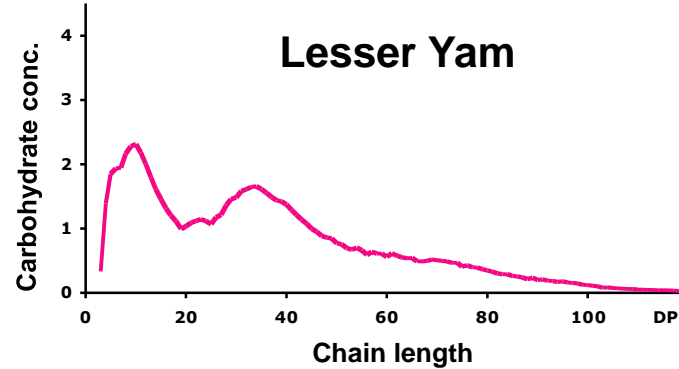
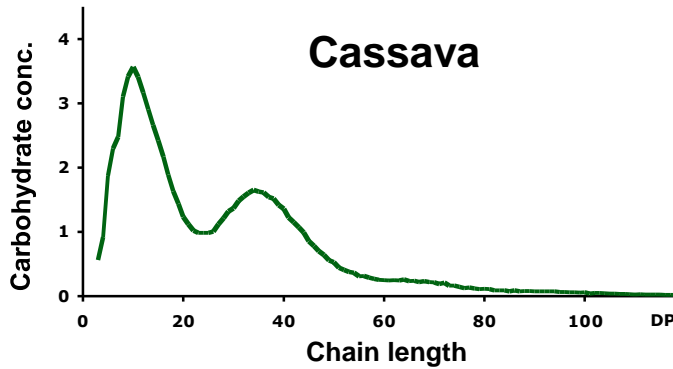
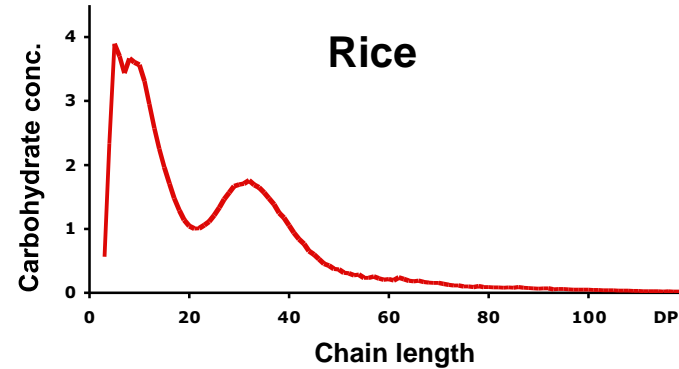
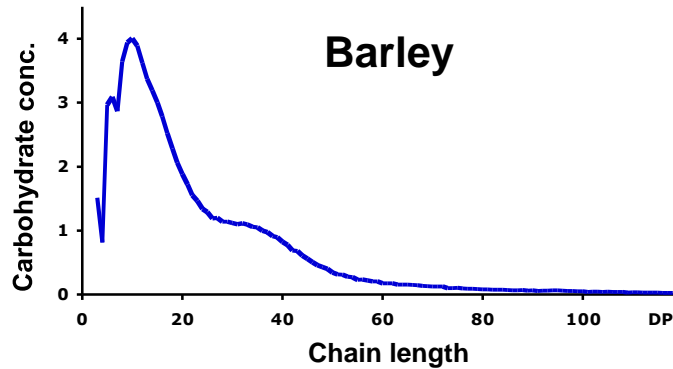


Debranching

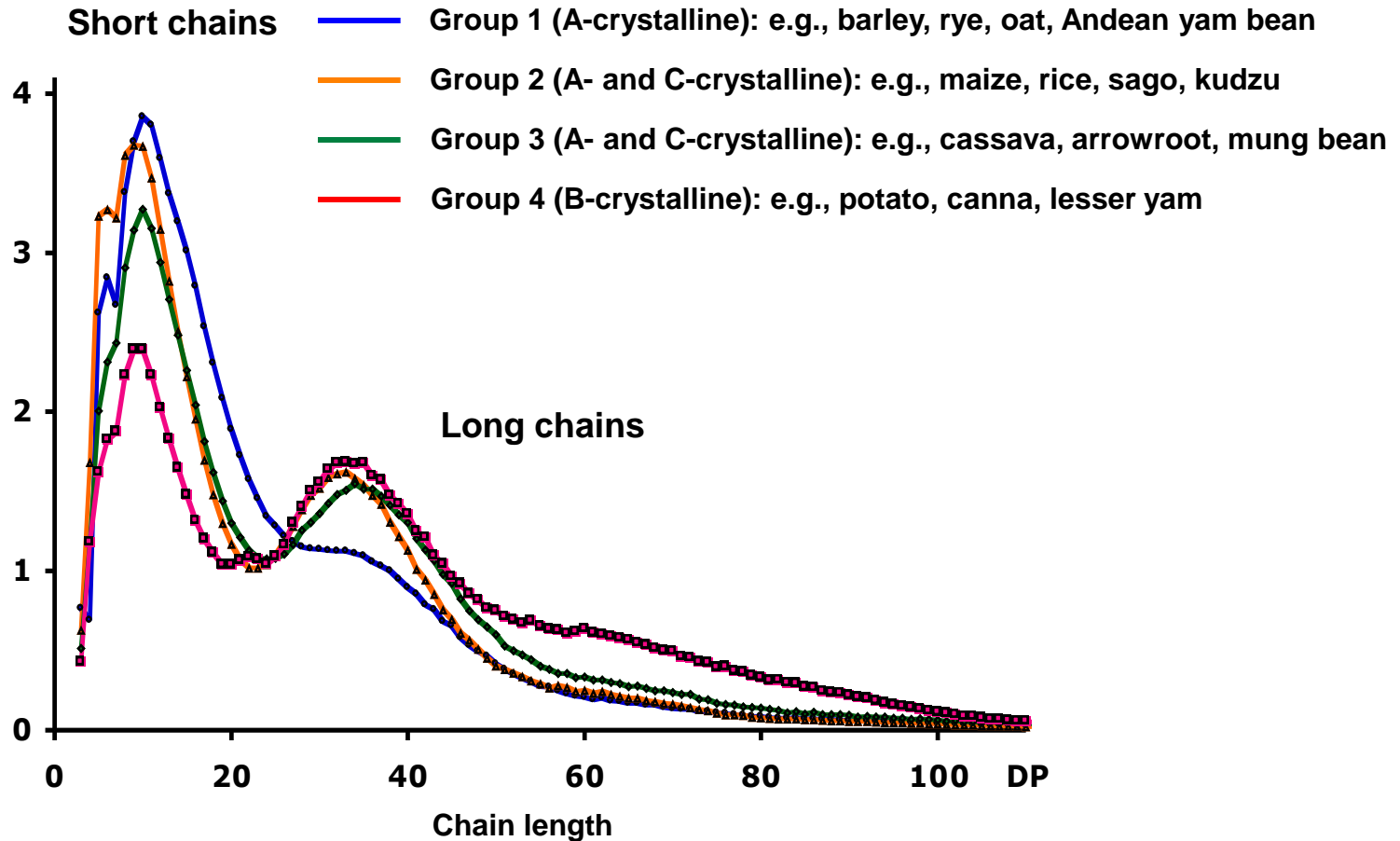


The molecular structure of amylopectin

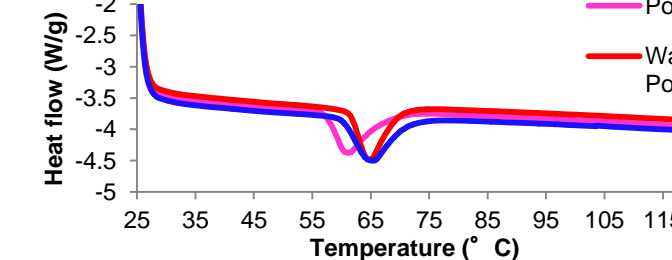
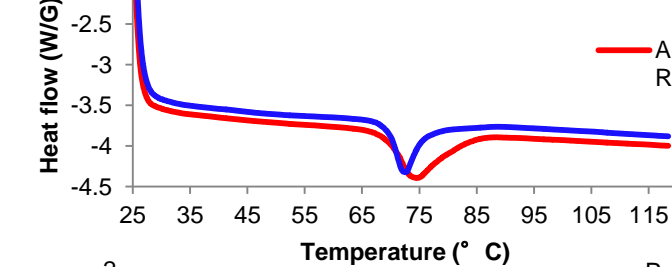
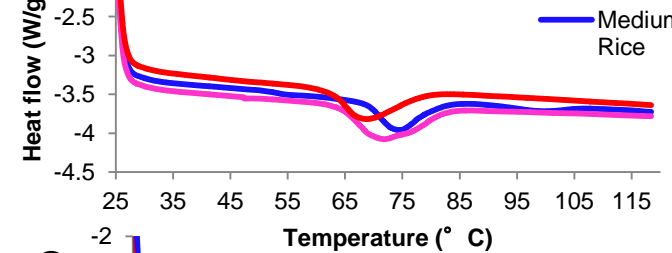
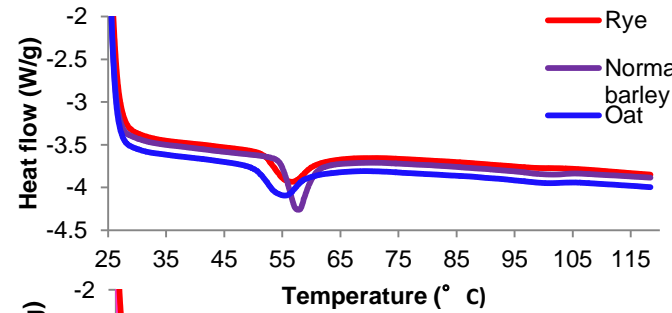
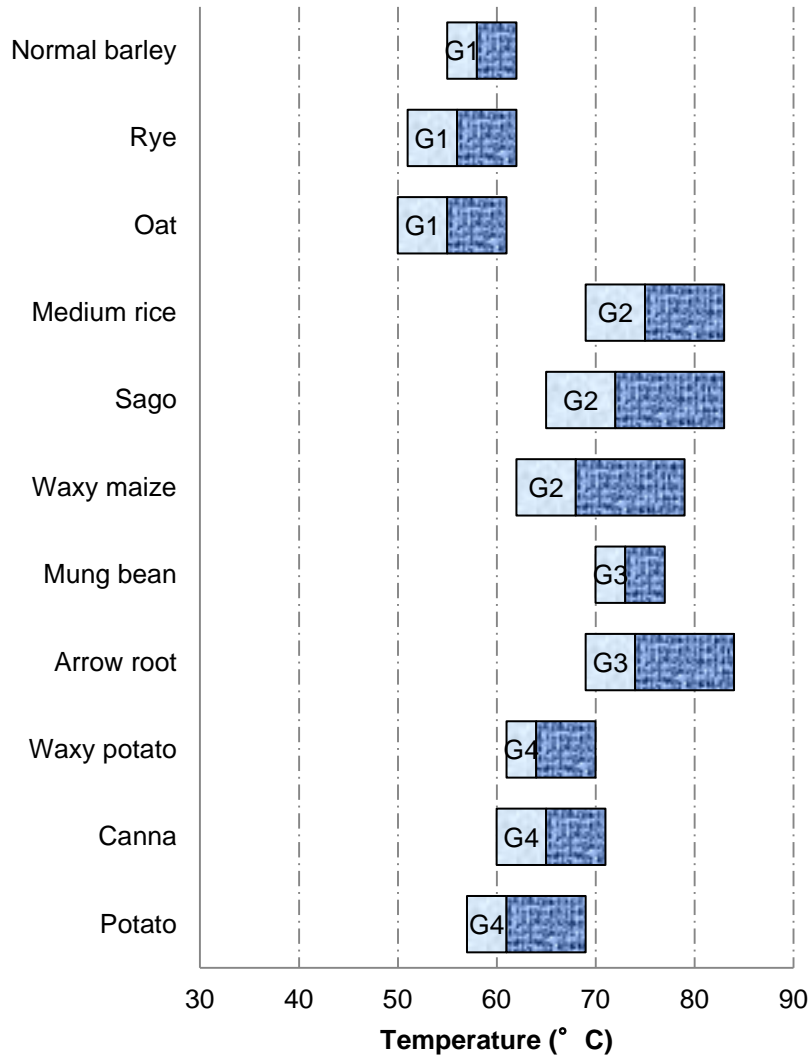
The unit chain profile is obtained by enzymatic debranching and analysis by HPAEC



Amylopectins from different plants can be organized into 4 groups based on their unit chain profiles



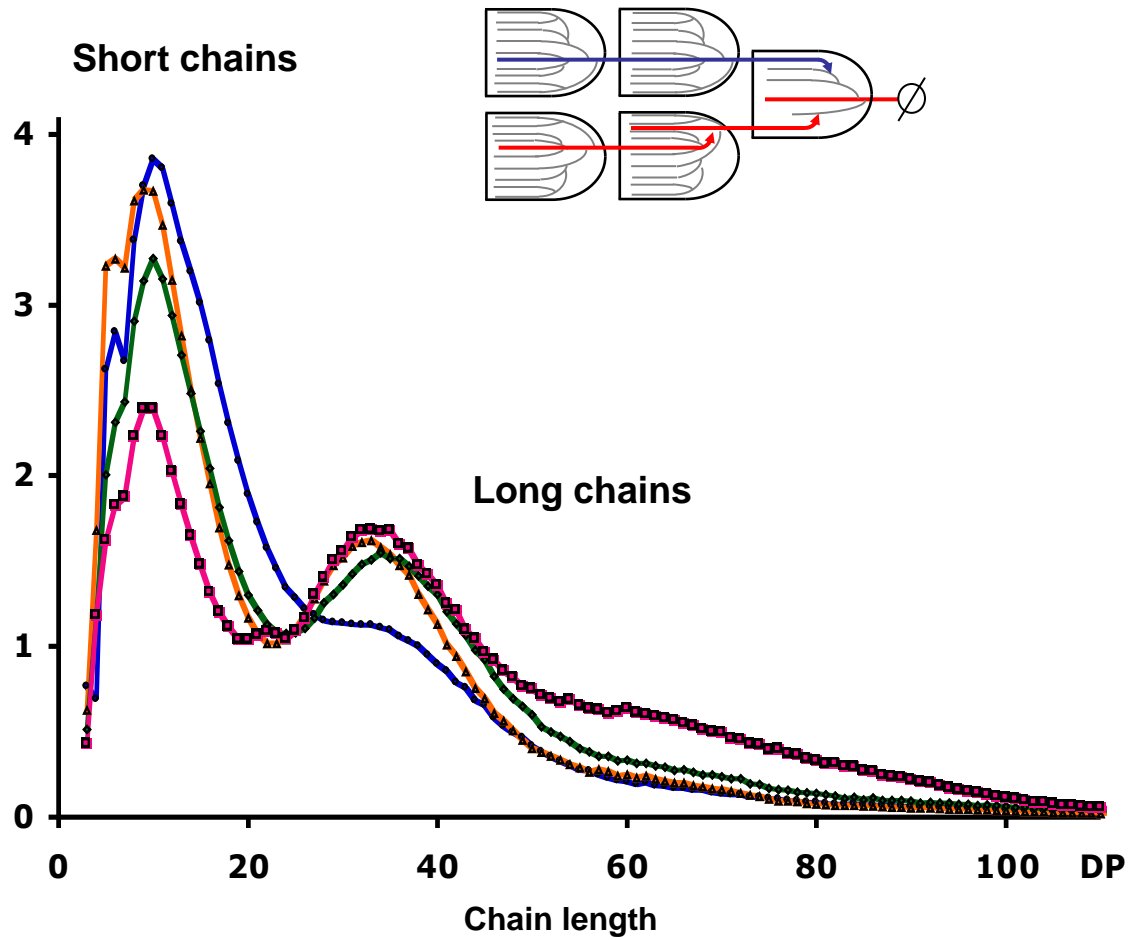
Molecular structure – properties



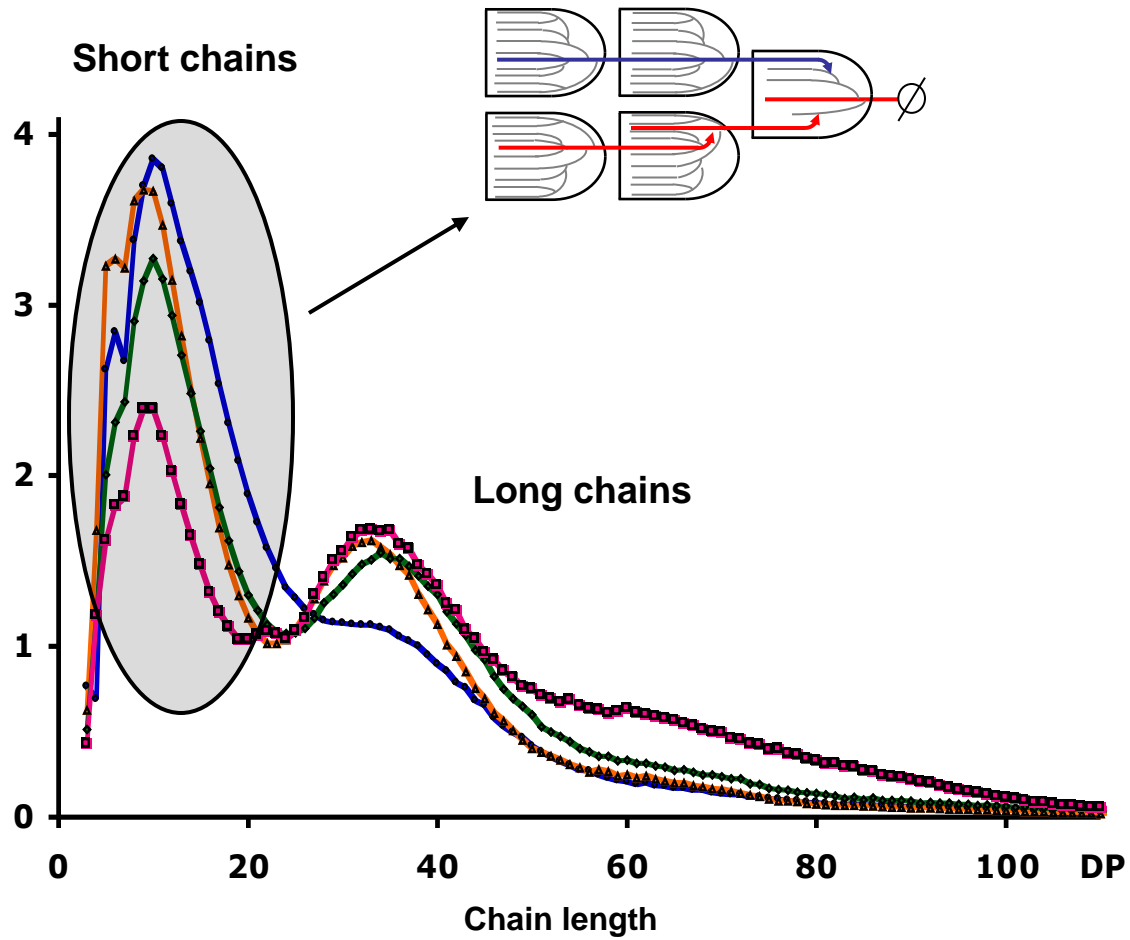
Bars indicating the temperature range of gelatinization (To-Tc) & border verifies the position of Tp

DSC thermograms of group 1, 2, 3, 4 starches

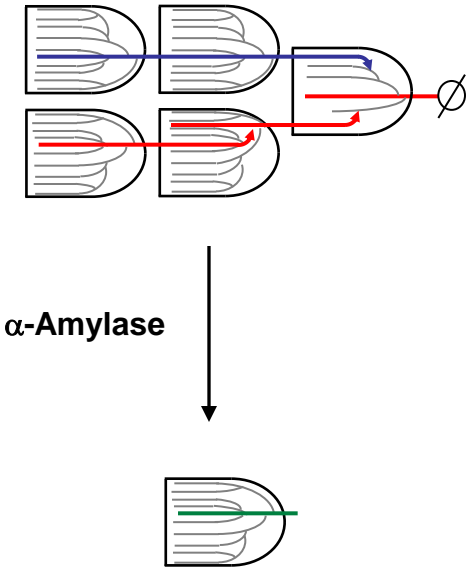
The unit chains are organized into clusters



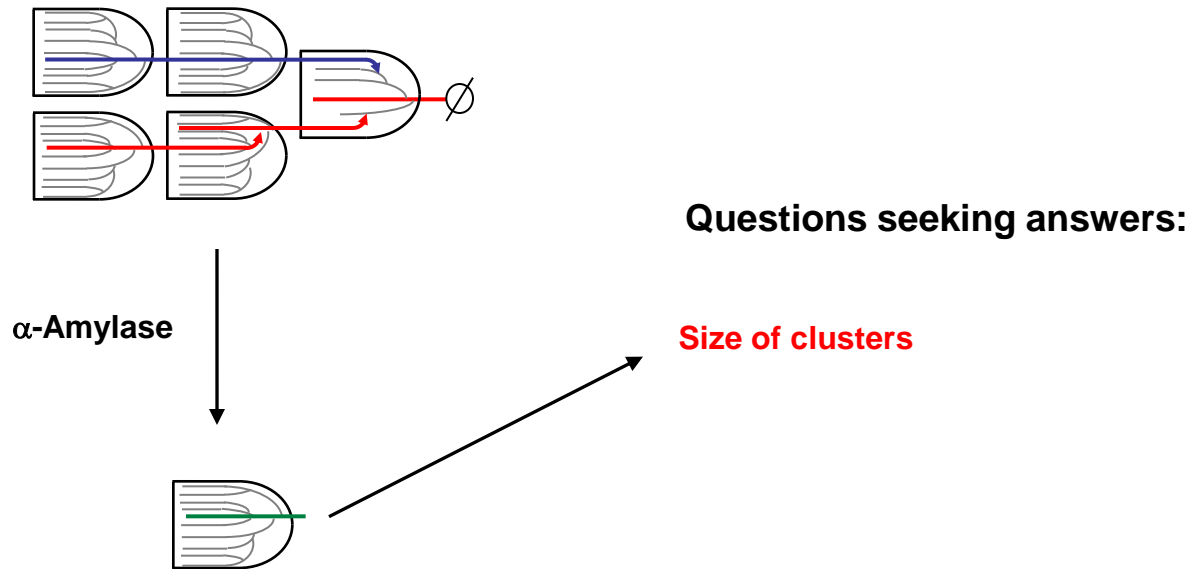
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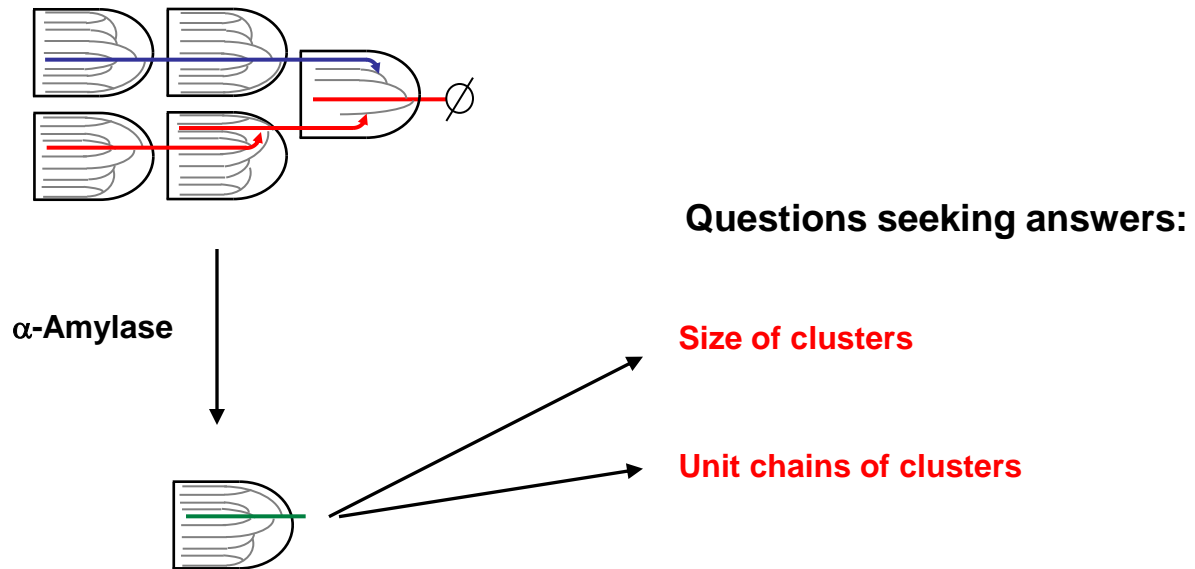
Principle analysis of cluster structure



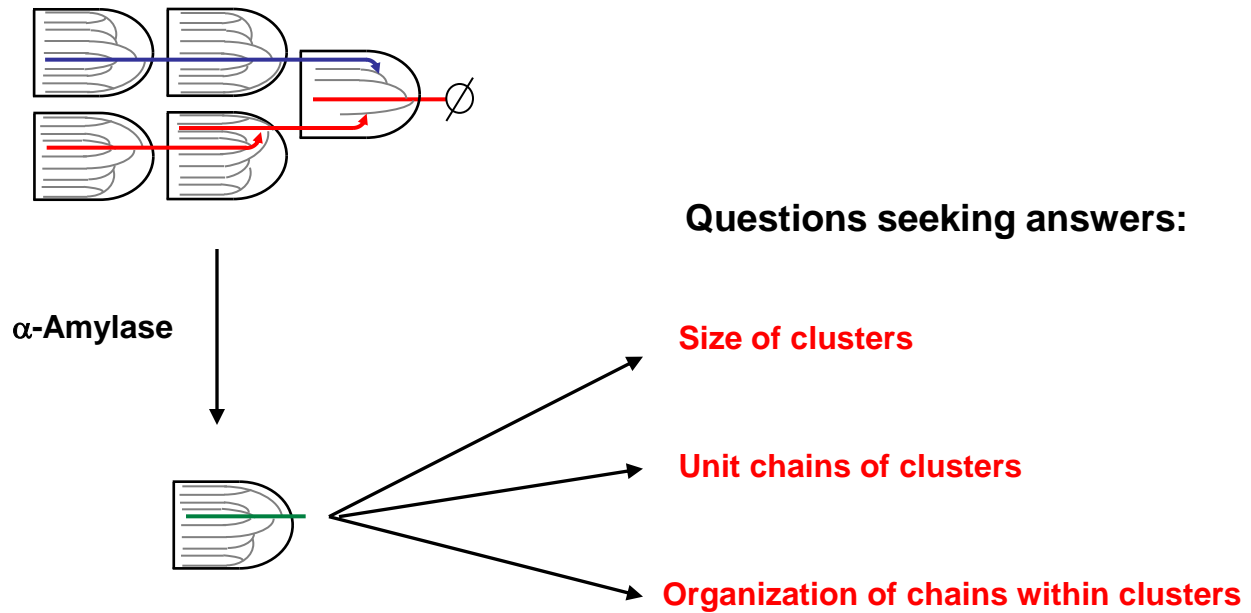
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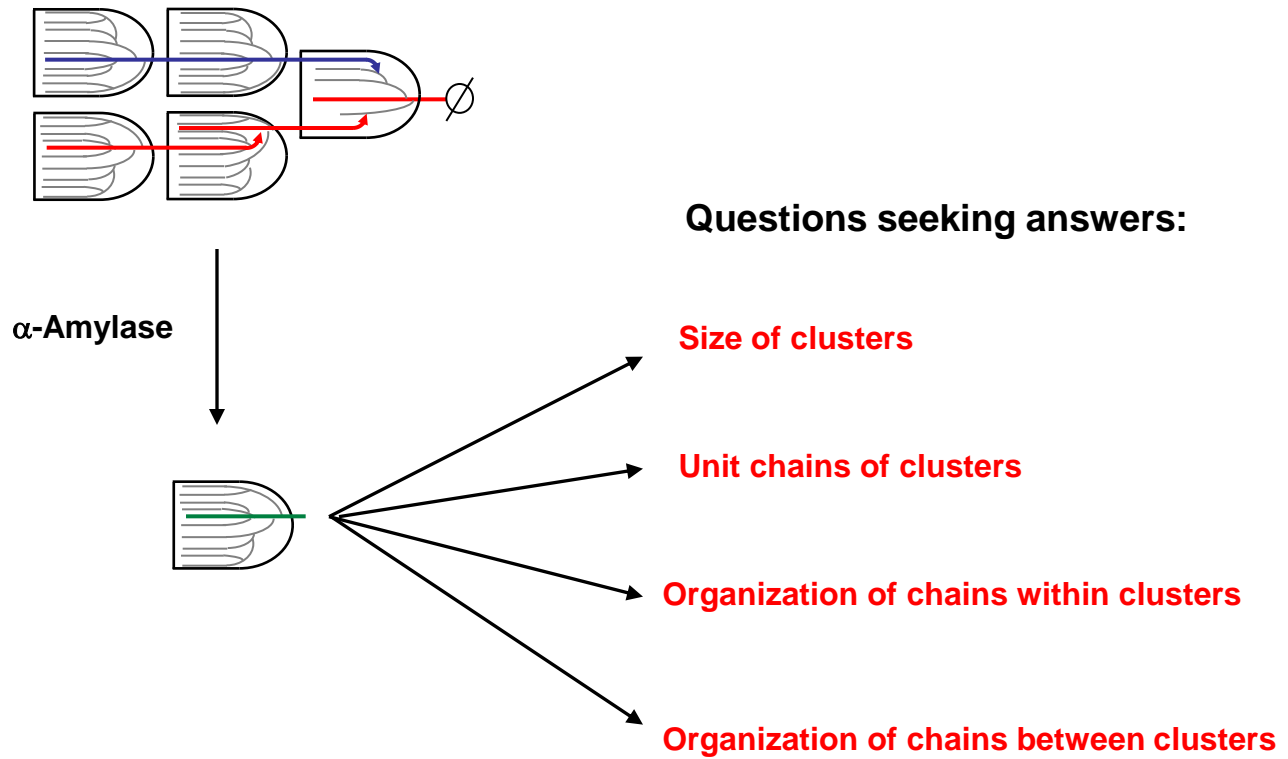
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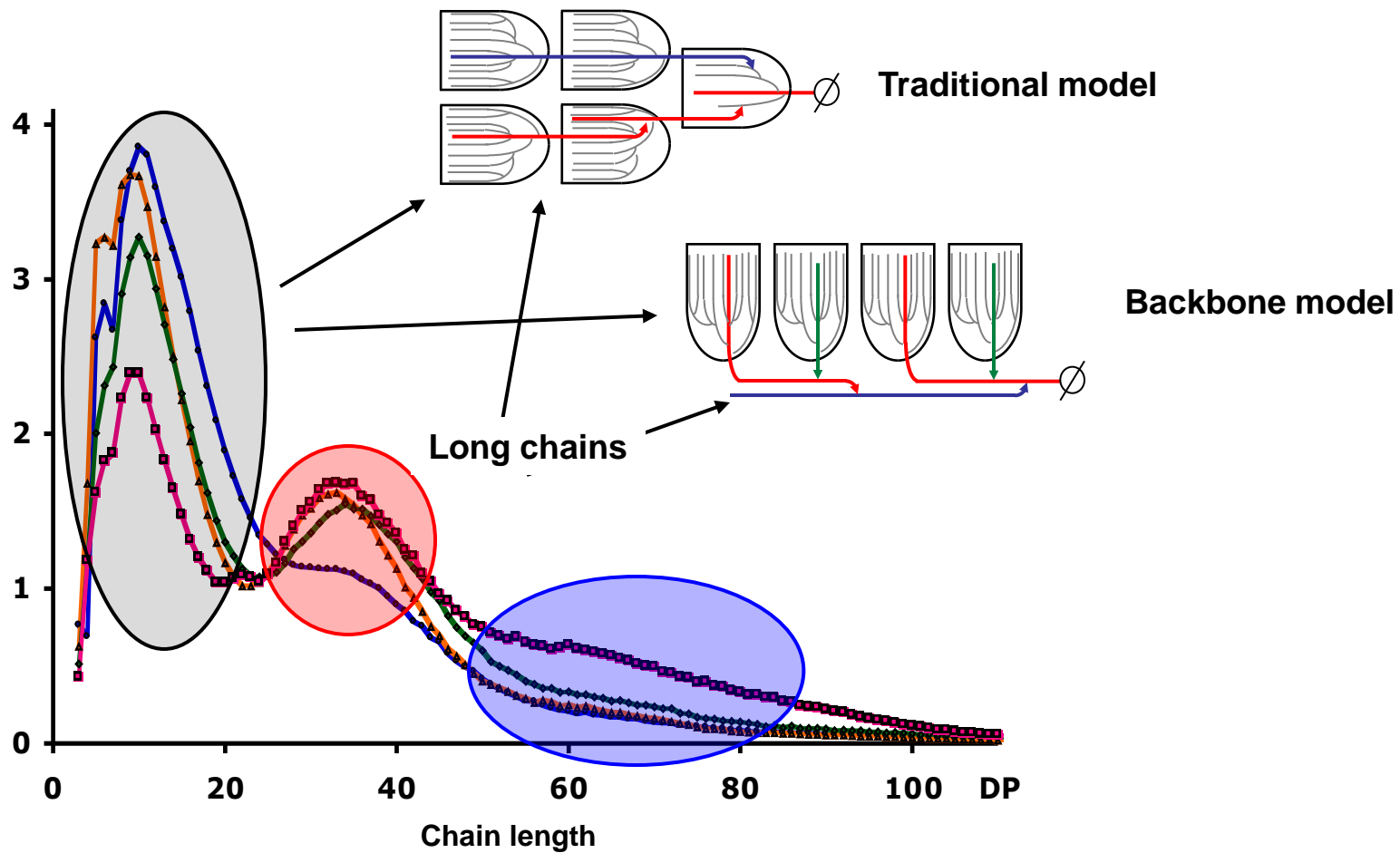
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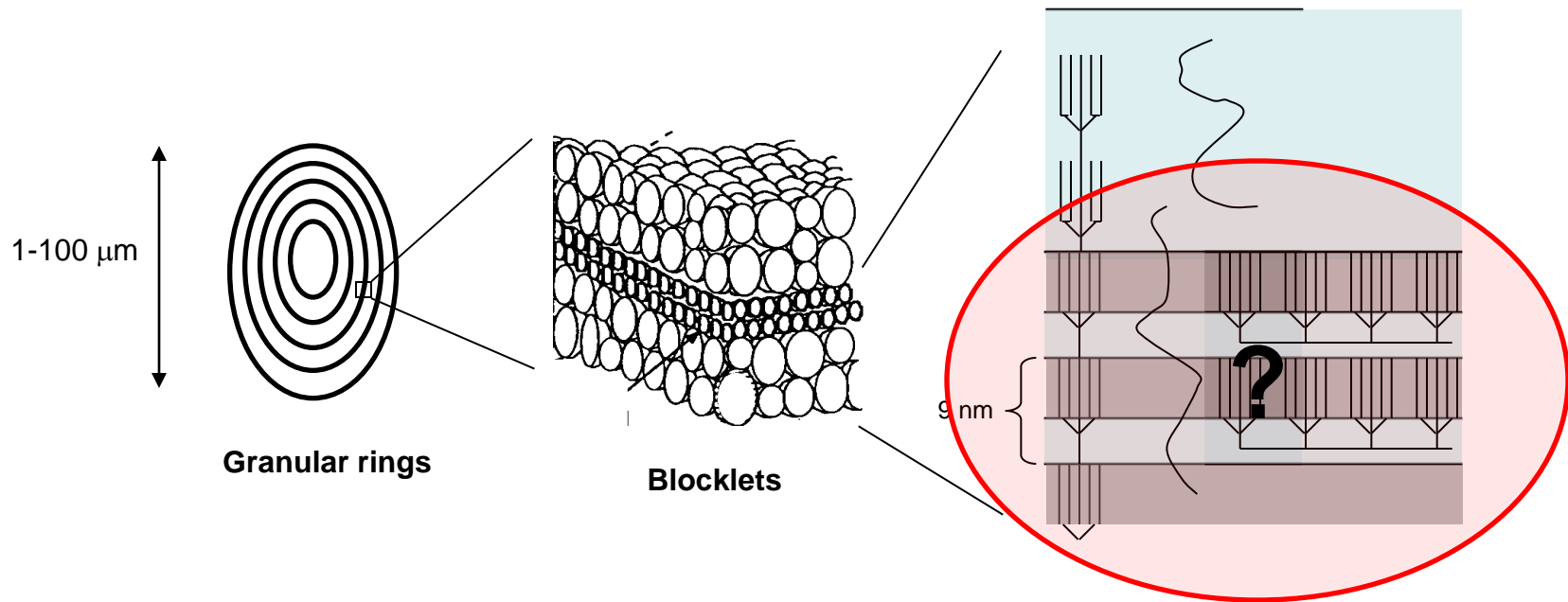
Principle analysis of cluster structure



The clusters can be organized by several different alternatives



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