

Dopo il genoma: alla scoperta delle basi molecolari della qualità nel frumento duro

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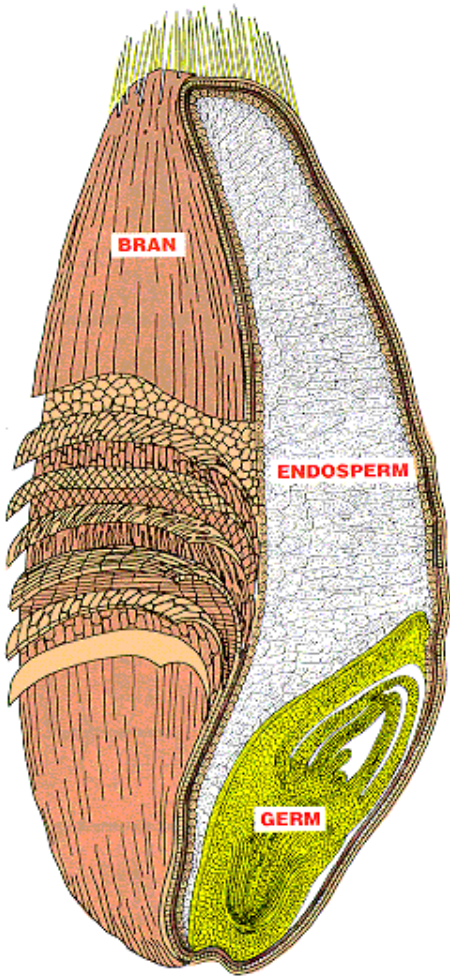
Il sequenziamento del frumento duro per una cerealicoltura più ecosostenibile e competitiva

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Università degli Studi di Bologna



Wheat seed composition



- carbohydrates (70 - 80 %)
- lipids (1.5 - 2.5 %)
- proteins (8 - 18 %)

Wheat is unique



Gluten is essential for the formation of a visco-elastic dough

Breadmaking



Retention of gas produced during fermentation and oven-rise

Pastamaking

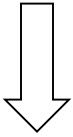


Retention of starch during cooking

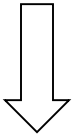
Gluten proteins

Prolamins

Gliadins

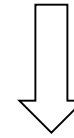


Monomeric

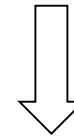


α, γ and ω

Glutenins



Polymeric

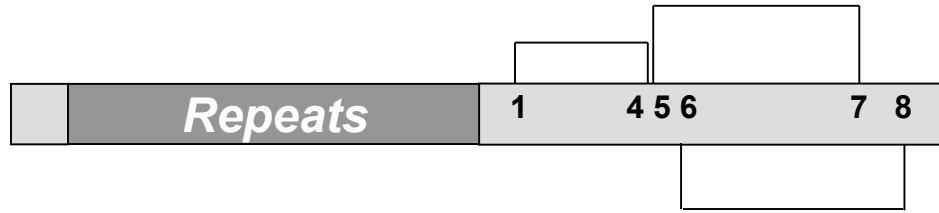


•High molecular weight subunits (HMW-GS)

•Low molecular weight subunits (LMW-GS)

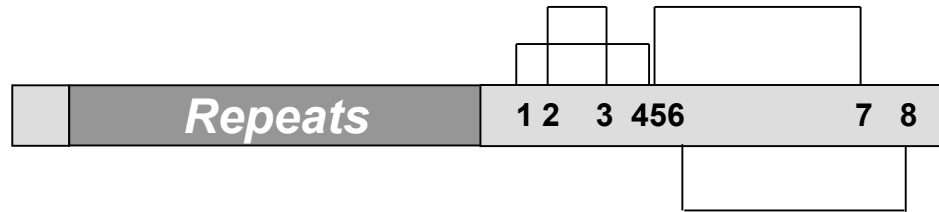
Monomeric gluten proteins

α -gliadins



6 Cys residues

γ -gliadins



8 Cys residues

ω -gliadins



No Cys residues

Polymeric gluten proteins

LMW subunit



Glu-A3
Glu-B3
Glu-B2

75-85% of
total glutelin

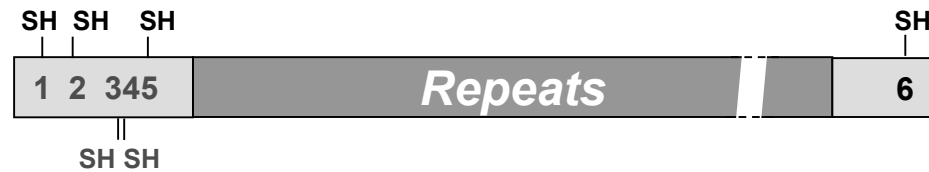
HMW subunit X-type



Glu-A1
Glu-B1

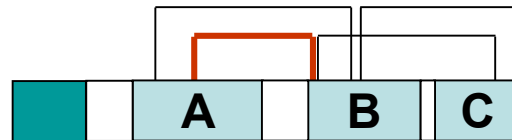
15-25% of
total glutenin

HMW subunit Y-type



Conserved regions and disulfide connectivity in the cereal prolamin superfamily

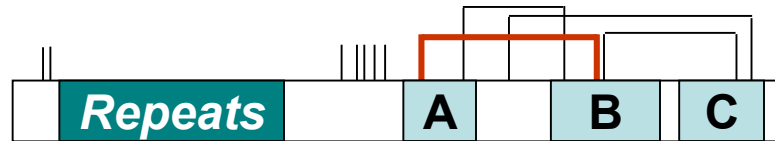
Sunflower SF8



Wheat γ -gliadin



Maize γ -zein



Wheat HMW-GS

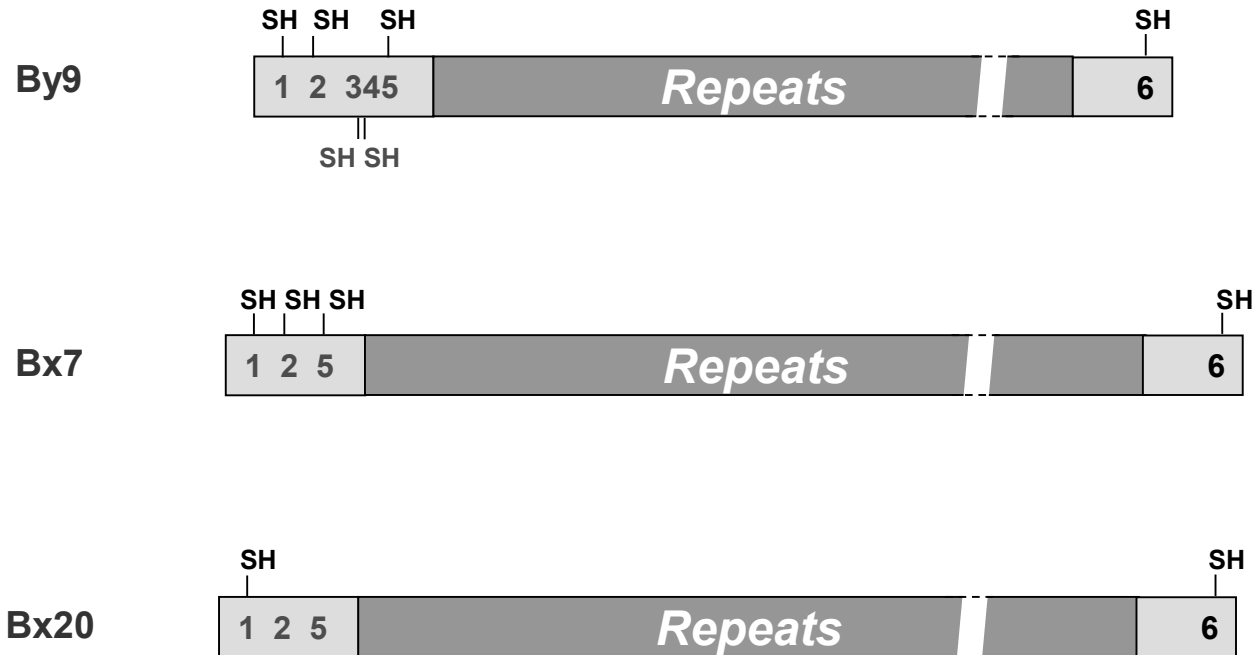


Main factors influencing quality in durum wheat

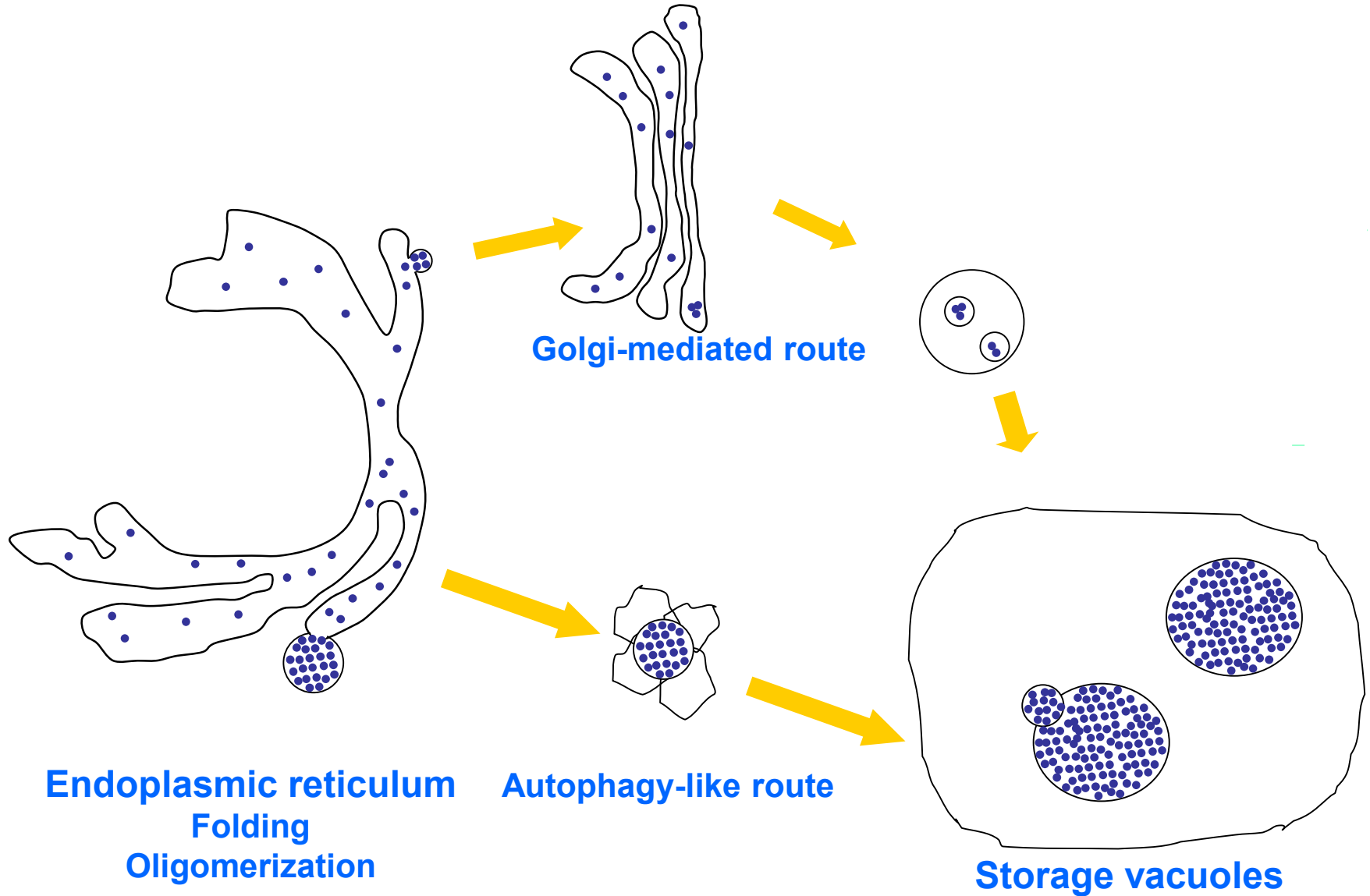
Trait	Must be
Protein content	High
Glutenin subunit composition	▪ HMW Bx20 vs others ▪ LMW subunit composition
HMW/LMW ratio	Low
Polymerization state	High

Disulfide structure and polymer branching

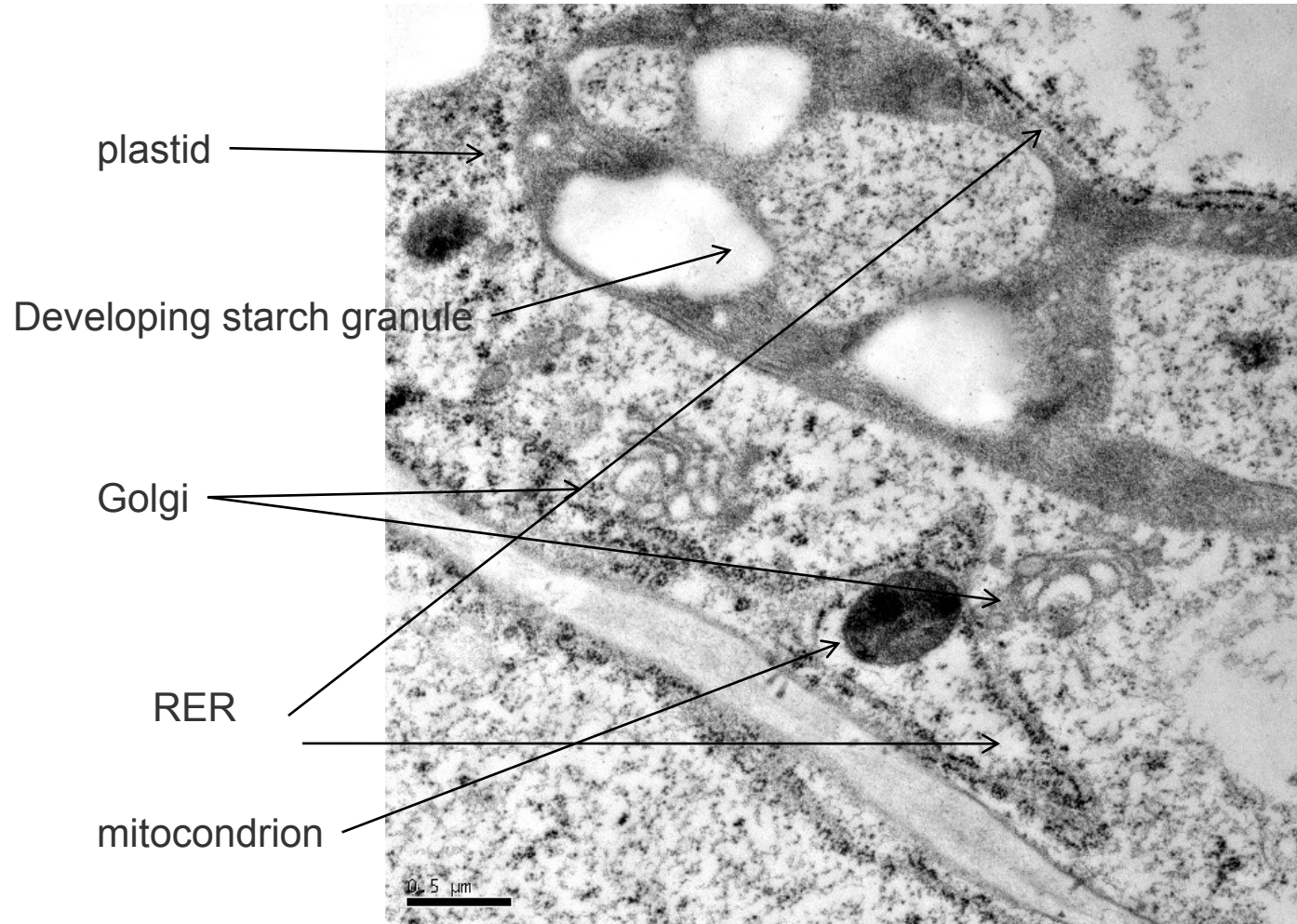
Branching



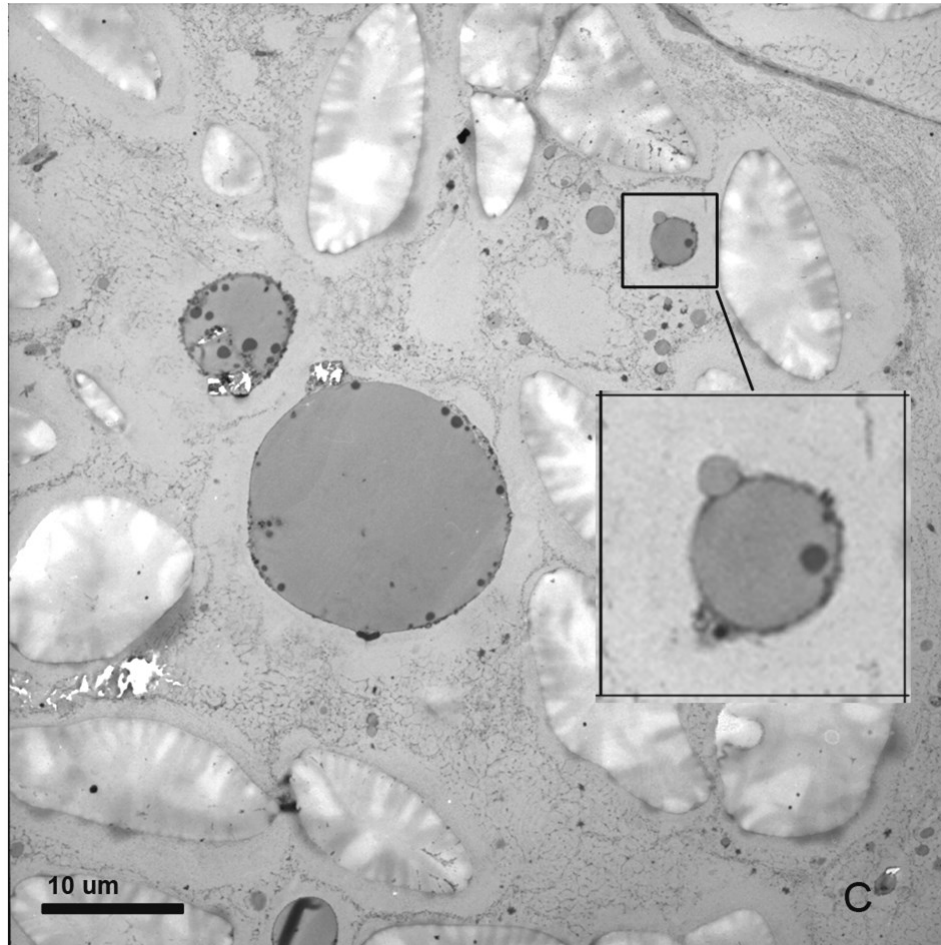
Biosynthesis of wheat storage proteins



The endoplasmic reticulum is the site of storage protein synthesis



Wheat storage proteins accumulate in the vacuole



16 dpa

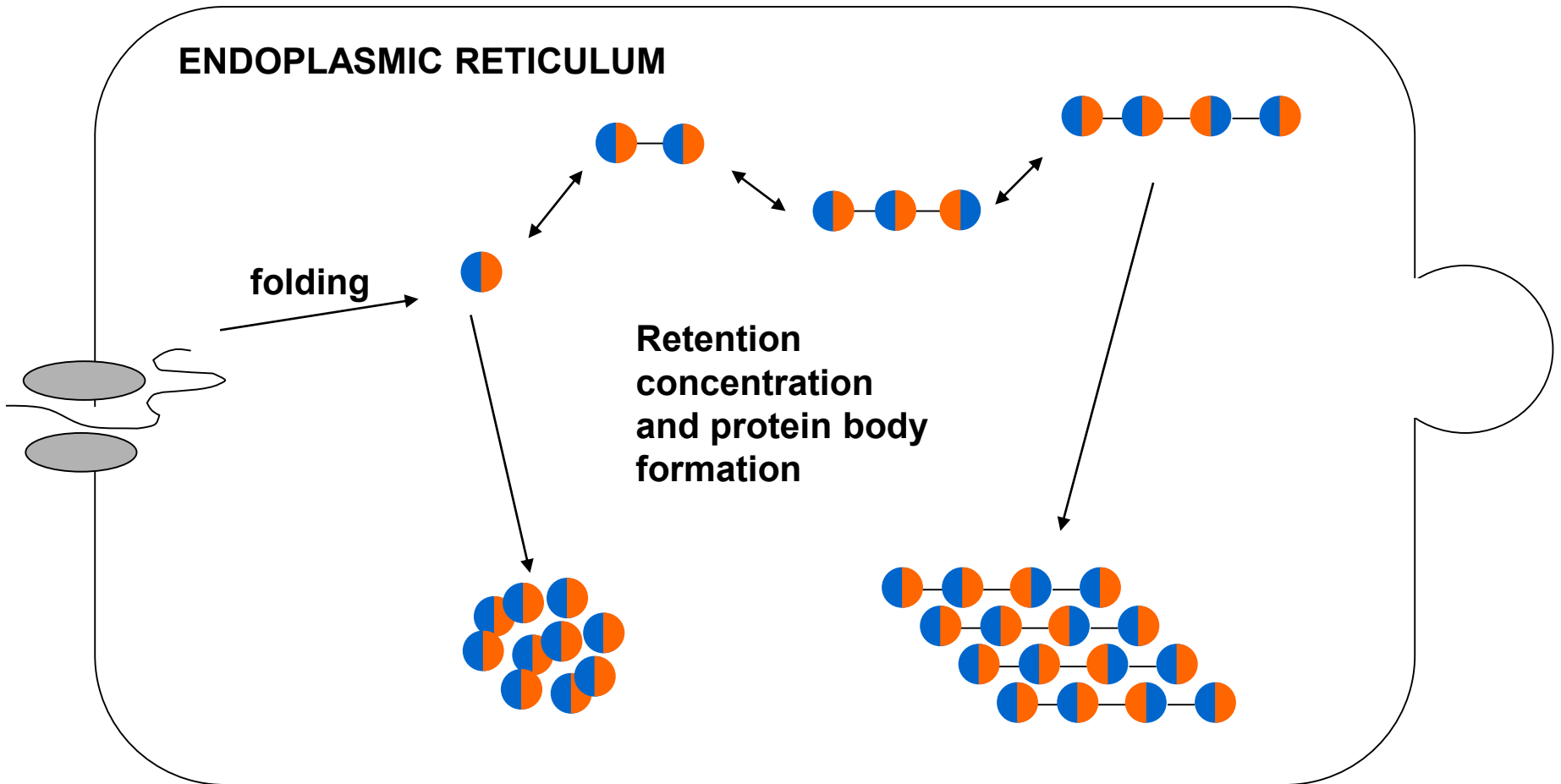
LMW-GS assembly and aggregation in the ER

CYTOSOL

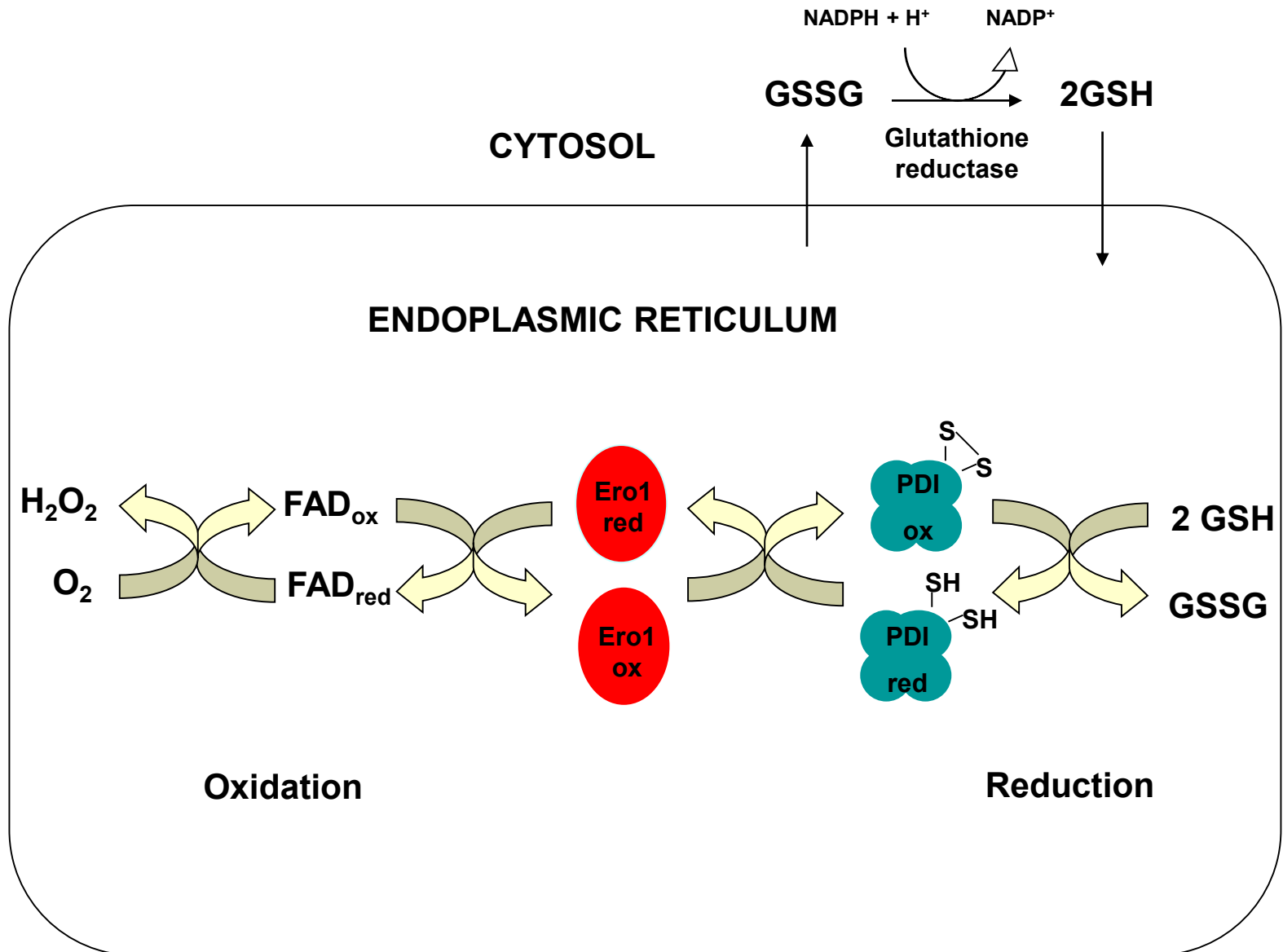
ENDOPLASMIC RETICULUM

folding

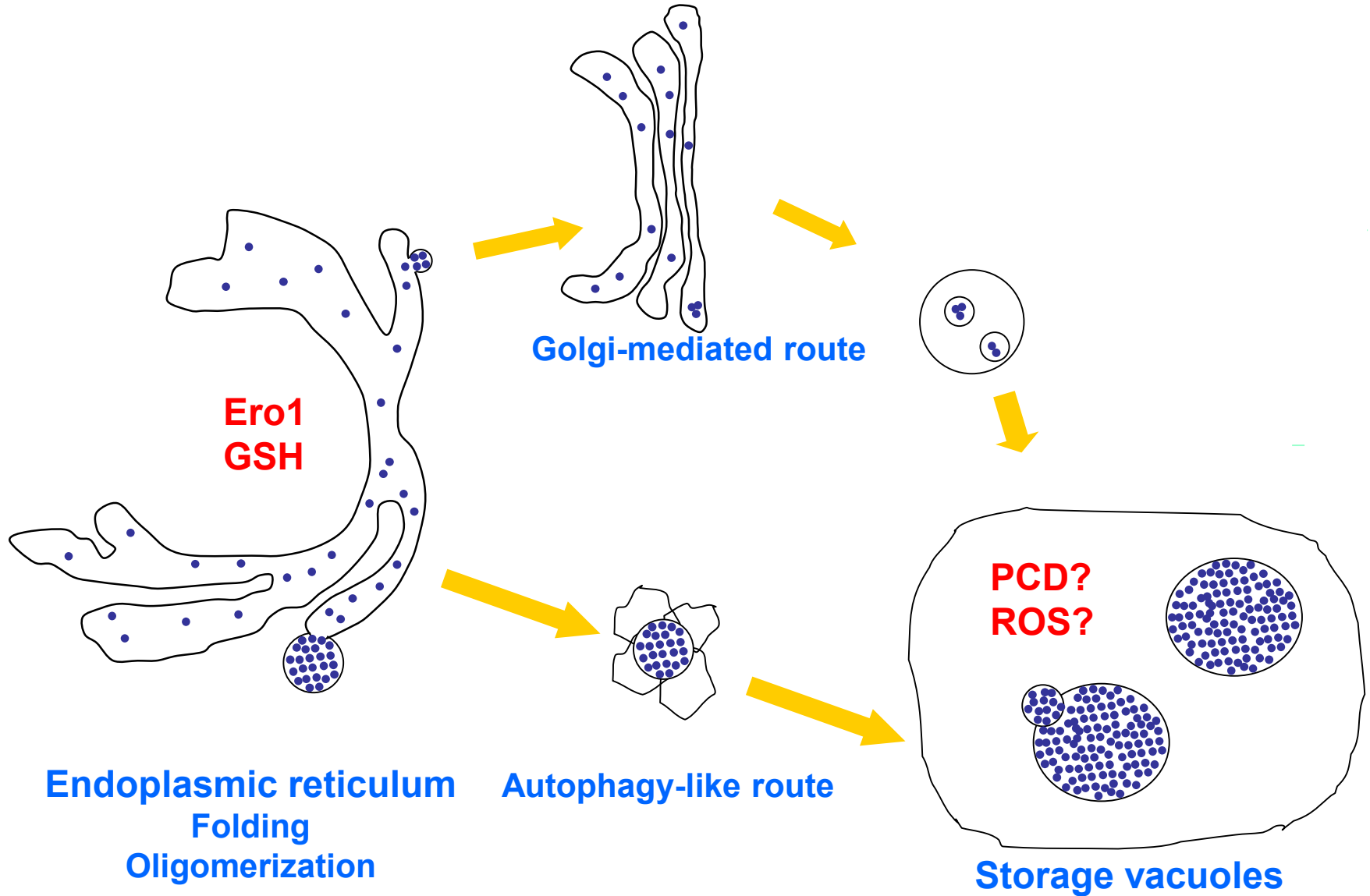
Retention
concentration
and protein body
formation



Redox balance in the endoplasmic reticulum



Biosynthesis of wheat storage proteins

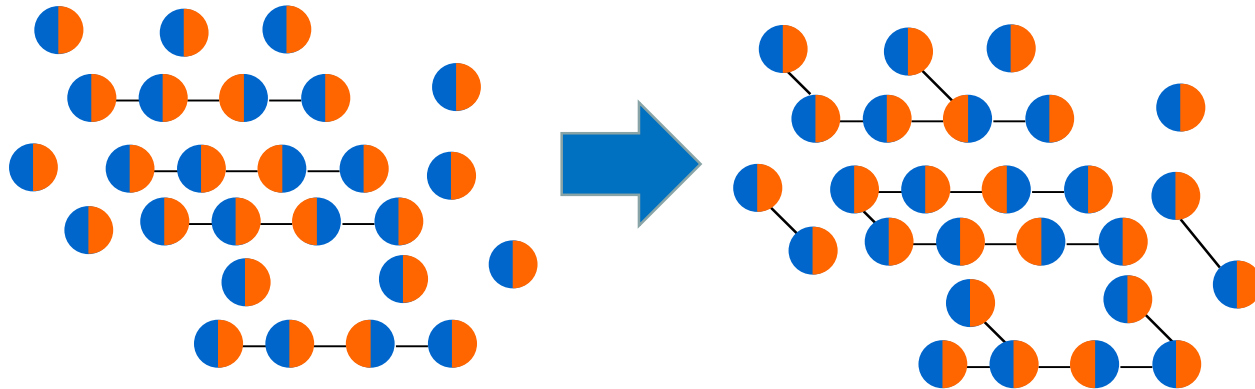


Polymer formation outside the endoplasmic reticulum

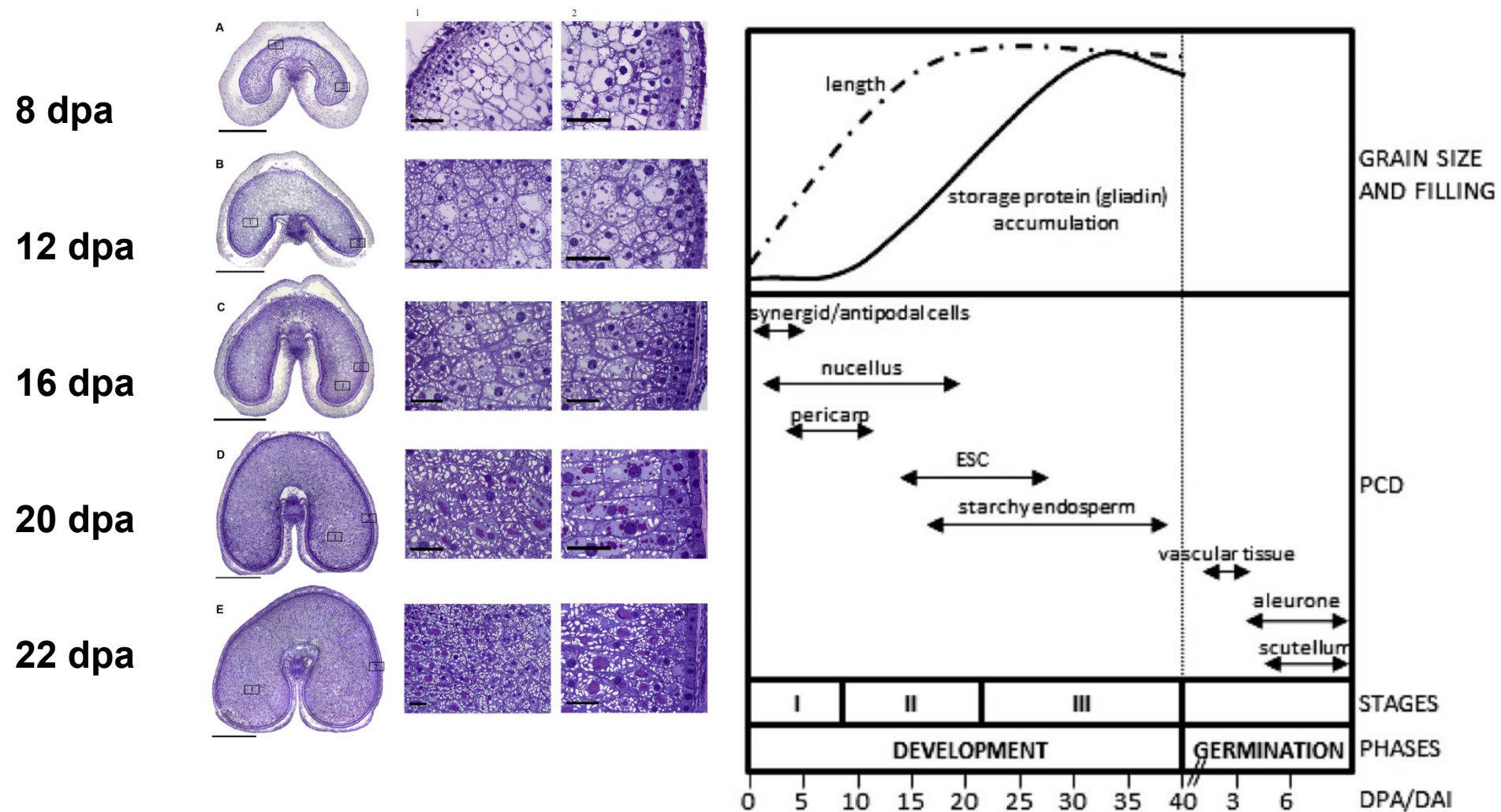
Cytosol

Vacuole

Hydrogen peroxide?
Dehydroascorbate?



Programmed Cell Death During Cereal Seed Development



Courtesy of Paola Tosi

Our goal

Molecular structure of individual subunits

Cellular environment

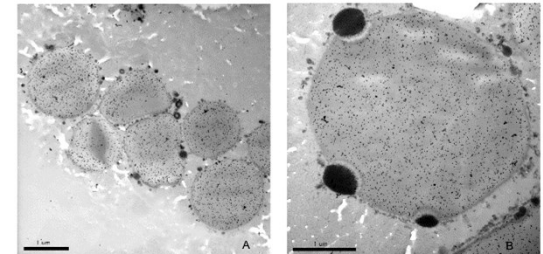
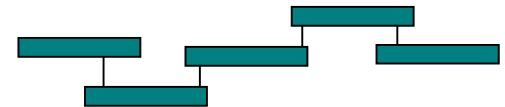
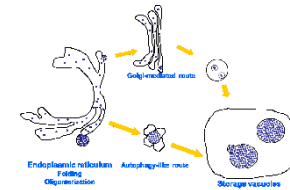


Structure and size and intracellular trafficking of glutenin polymers

Protein body formation

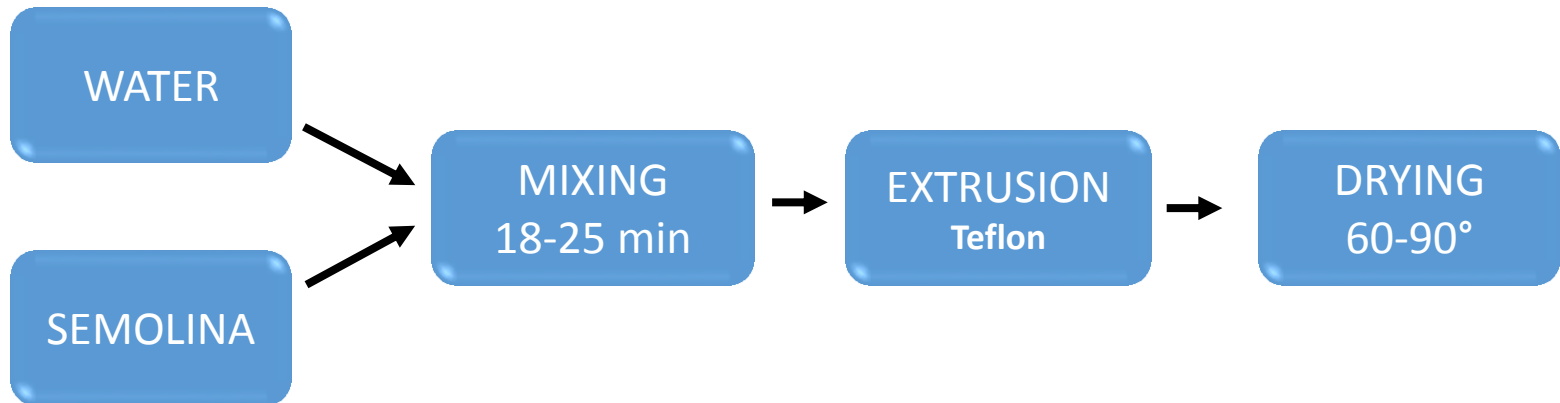


Technological properties of wheat flour

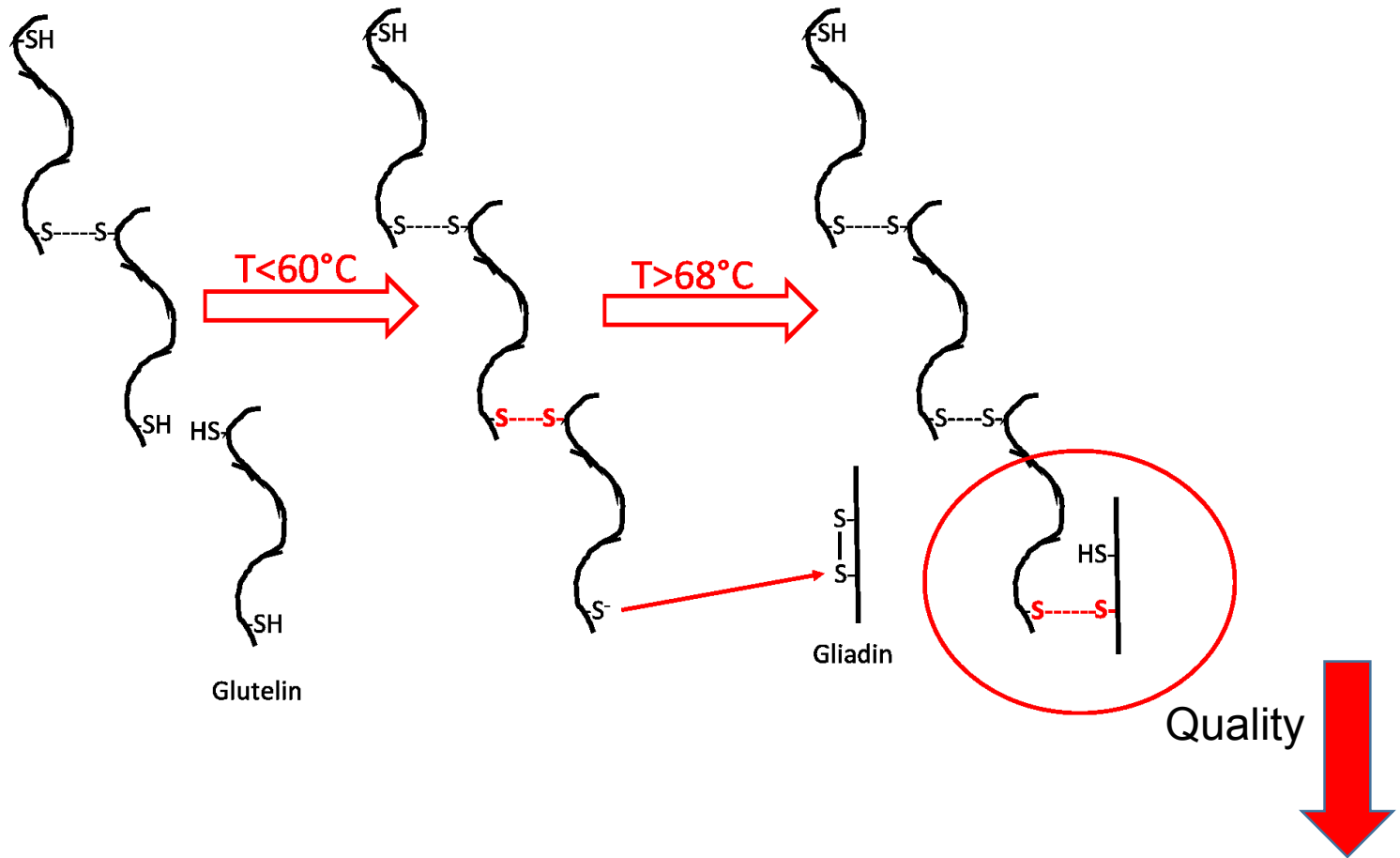




Pasta making



Polymer extension and gliadin involvement at high temperature



Quality after the genome

