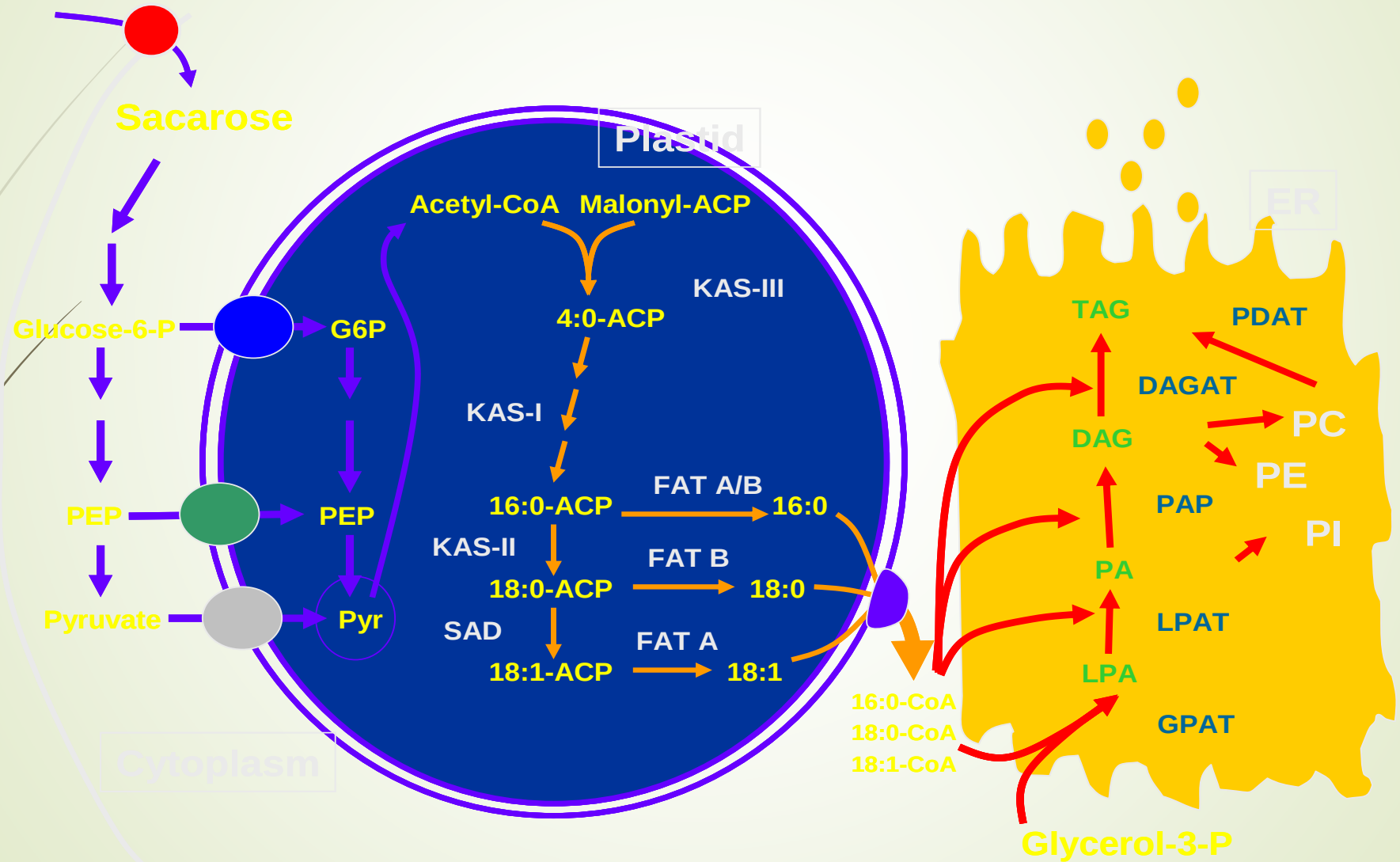
Developing healthy fats from sunflower oil

Sevilla 2015

WHY??"To avoid the use of animal, partially hydrogenated or transesterified fats in Food Industry"

- For food companies, high-stearic (HS) high-oleic (HO) oils will offer a non-trans, high solid baking ingredient for use in packaged foods requiring an extended shelf life such as cookies, crackers, breakfast cereals, and more…

Interplastidial fatty acid biosyntesis regulation

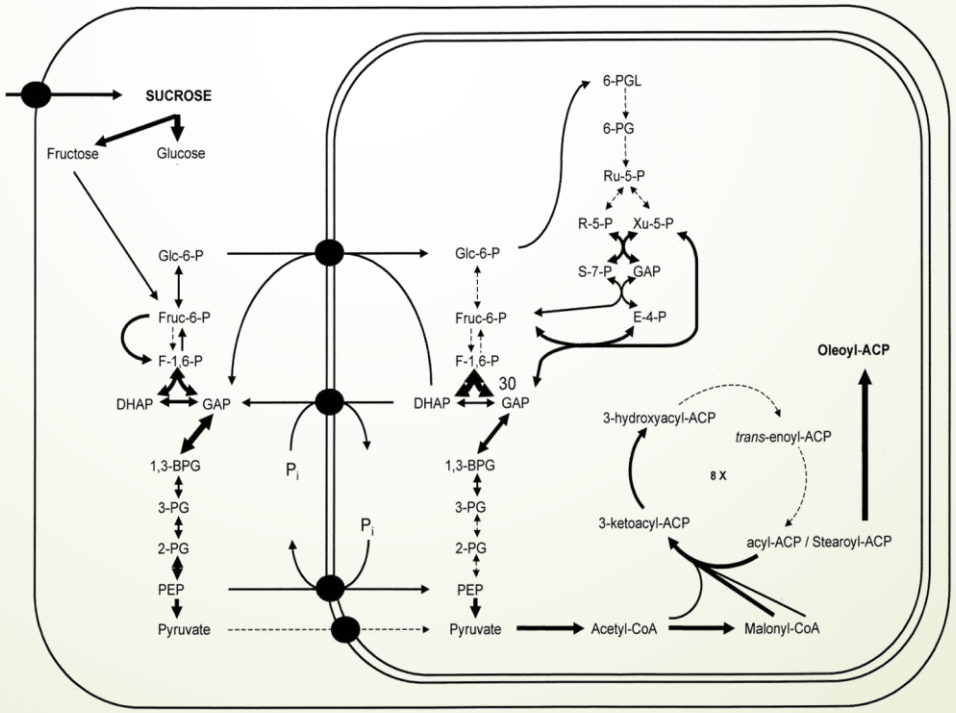


- A biochemical characterization of all glycolytic activities was carried out in crude extracts of developing sunflower seeds from CAS-6 to localize possible bottlenecks.
- In addition, all glycolytic activities were characterized using isolated **plastid** to confirm the integrity of this pathways inside the plastid.
- Developing sunflower seeds rely on the sucrose that comes from the mother plant to synthesize lipid precursors.

  Glycolytic initial metabolites and enzyme activities from developing seed of two different sunflower lines, of high (CAS6) and low (ZEN8) oil content, were compared during storage lipid synthesis.

  The analysis of the photosynthate and sugars content suggests that, although the hexoses levels were quite similar in both lines, the amount of sucrose produced by the mother plant and available for lipid synthesis was higher in CAS-6. Although, a smaller amount of sucrose is available in the ZEN-8 line, its seeds maintain the levels of intermediate sugars in the initial steps of glycolysis due to an increase in the levels of the invertase, hexokinase and phosphoglucose isomerase activities in ZEN-8, with respect to CAS-6.

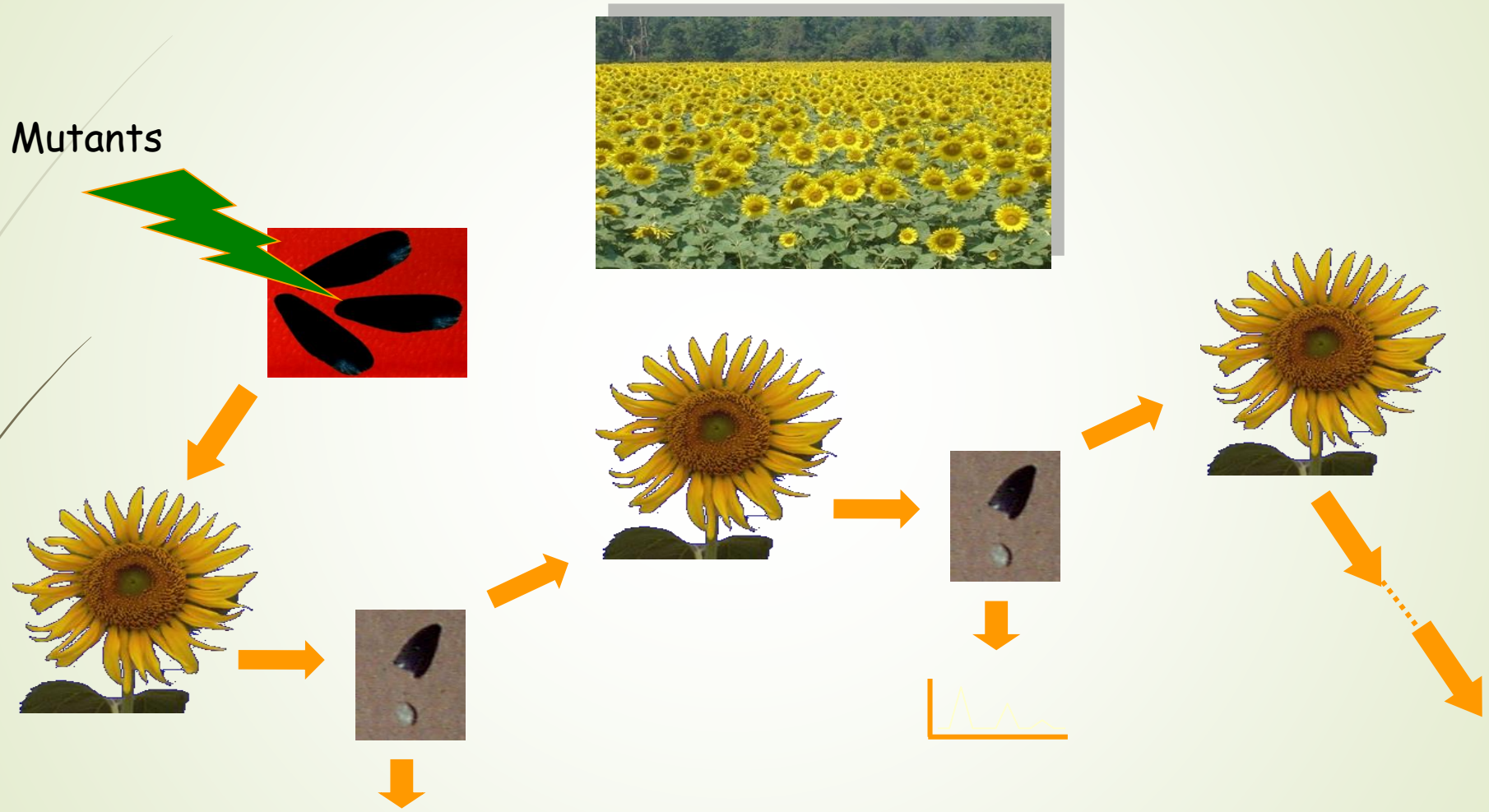
- Also, a readjustment in the final part of this metabolic route took place, with the activities of phosphoglycerate kinase and enolase in CAS-6 being higher, allowing increased synthesis of phosphoenolpiruvate, the intermediate carbon donor for fatty acid synthesis.
- These data together point to these last two enzymatic activities, phosphoglycerate kinase and enolase, as being responsible for the lower fat content in the ZEN-8 line.
- Fatty acid biosynthesis C-skeletons supply in sunflower seeds:



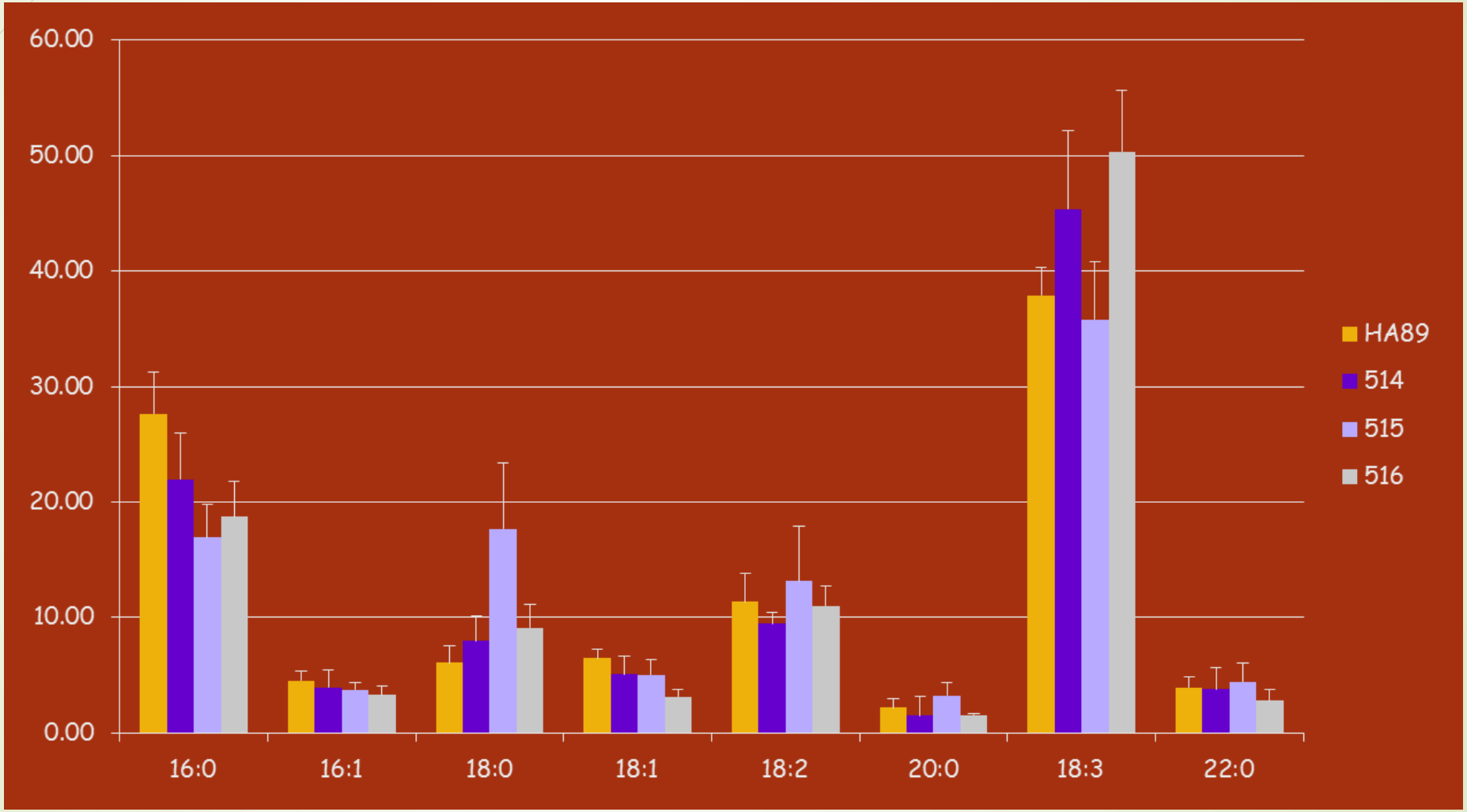
- *Strategies to increase disaturated TAG species:*
- *Develop technological approaches. Current oil fractionation by temperature or organic solvents.*
- *Increase the stearic acid content.*
- *Characterize and modify the sunflower acyl-transferases system.*

- *These new mutants have single changes in the stearoyl-ACP desaturase (SAD) affecting its activity and increasing the stearic acid content in the oil.*
- *Enzyme SAD is responsable for higher concentration of stearic acid in the oil.*
- *To further characterize these new mutations, SAD17 gene was "in vitro" mutagenized producing the same changes observed in the mutant SAD alleles, and expressed heterologously in Escherichia coli to produce recombinant SAD proteins. Those were purified and biochemically characterized.*
- *Once obtained "in vitro" the mutant alleles, were cloned in pQE-80, over-expressed in E. coli and purified.*

- Now they are characterizing the fatty acid composition of polar lipids species in mutant leaves and the evolution of the fatty acid composition during seed development.



New high-stearic sunflower mutants. Fatty acid composition:



- High staric sunflower oil is used now in many new products.

- Working it this laboratory was one of my best experience. I learned so much and met really nice people.