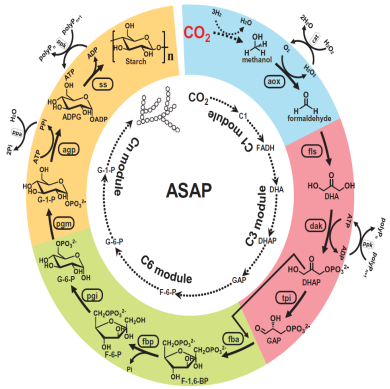
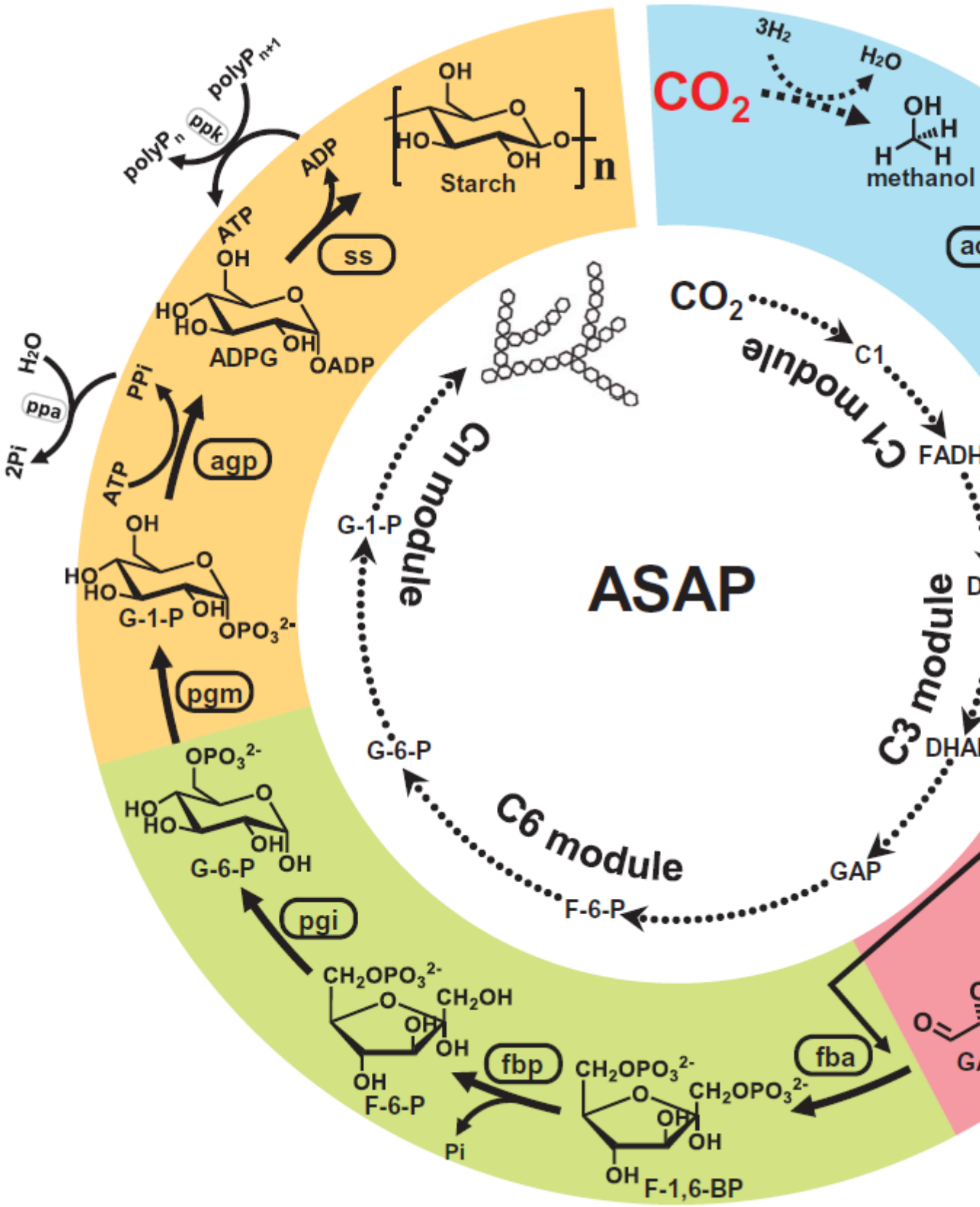


Cell-free Chemoenzymatic Starch Synthesis from Carbon Dioxide

Description

The design of innovative pathways other than plant photosynthesis for converting CO_2 to starch, is a significant disruptive approach both in terms of conceptual and scientific achievement and promising technological output. The authors develop a chemoenzymatic system and an artificial starch anabolic pathway : **Artificial Starch Anabolic Pathway (ASAP)** consisting of only 11 core reactions. The pathway was drafted by computational design, established through modular assembly and substitution and fully optimized by protein engineering of three bottleneck-associated enzymes. In a chemoenzymatic system with spatial and temporal segregation, ASAP, driven by hydrogen, converts CO_2 to starch at 22 nanomoles of CO_2 per minute per milligram of total catalyst. The artificial route can produce starch from CO_2 with an efficiency 8.5-fold higher than starch biosynthesis in maize, suggesting a big step towards going beyond nature. It provides a new scientific basis for creating biological systems and opens the way toward future chemo-biohybrid starch synthesis from CO_2


ASAP
CO2
3H2
H2O
methanol
C1 module
Cn module
C3 module
C6 module
C1
FADH
G-1-P
G-6-P
GAP
F-6-P
F-1,6-BP
Starch
ADPG
OADP
ATP
ADP
PPi
2Pi
H2O
polyP n
polyP n+1
ss
agp
ppa
ppk
pgm
pgi
fbp
fba
Pi

Design and modular assembly of an artificial starch anabolic pathway

NB. The incorrect anomeric configuration shown in the starch panel, should be corrected as an alpha glycosidic configuration

Category

1. News