Session 19 - Gluconeogenesis

"New" synthesis of glucose from noncarbohydrate precursors = GNG (A)

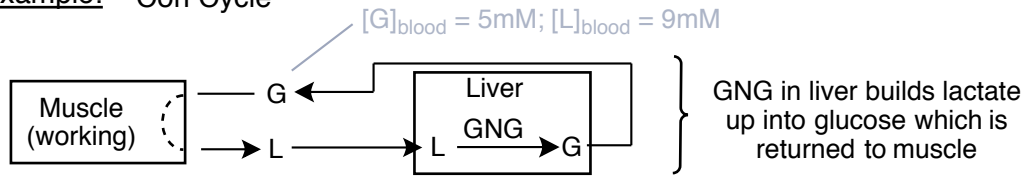
Problem: Brain, Renal Medulla, Erythrocytes, Testis } Require glucose as their primary metabolic fuel

-- Brain uses 120 g / day
-- Whole body uses 160 g / day
-- Total [glucose + glycogen] reserves = 190 g ⇒ Not much!

Solution: GNG = efficient way to manufacture glucose to meet steady state needs

GNG happens in (a) Liver and (b) Renal Cortex

Example: Cori Cycle



Precursors to Glucose (GNG Substrates) (B)

1. Lactate
2. Ala
3. Glu
4. Asp
5. Odd Chain FA
6. Met, Ile, Val
7. Glycerol
8. (Ribose) (via Pentose Phosphate Pathway)

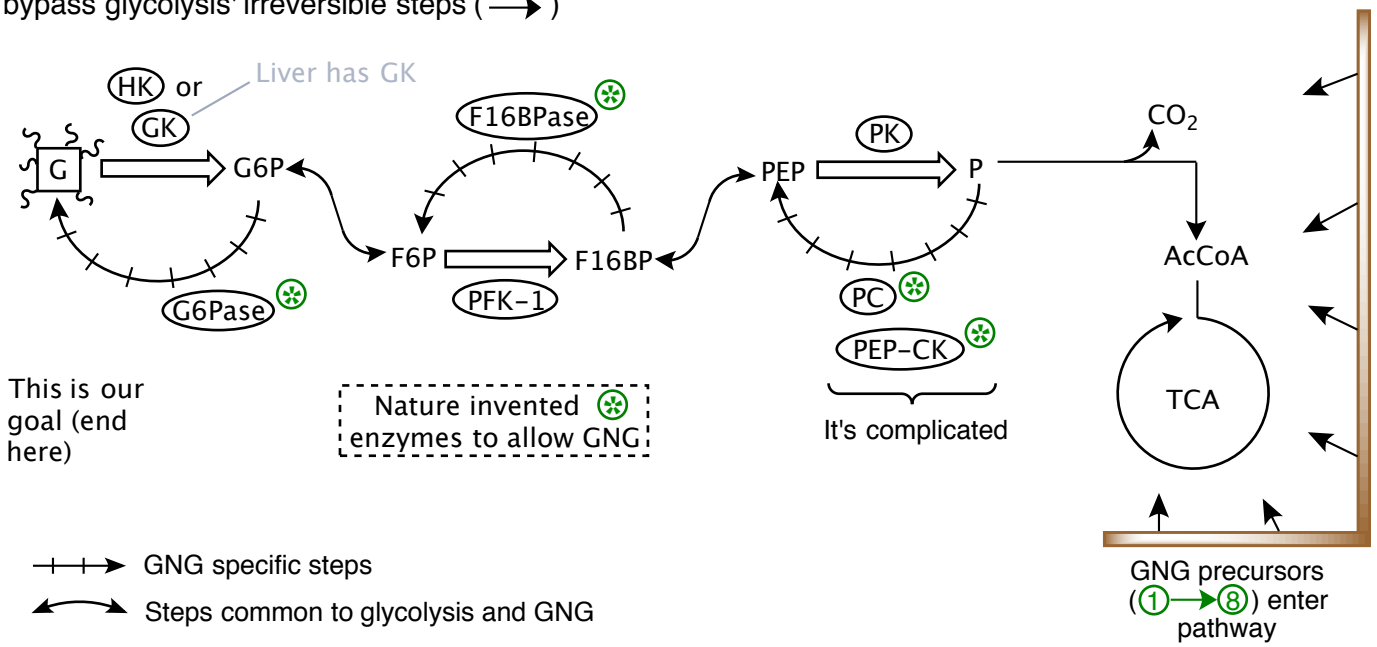
This actually is a carbohydrate but it can get converted to glucose via GNG

We'll map ① → ⑧ on detailed GNG Pathway (next page)

Pathway Overview

-- Looks like Glycolysis in Reverse
-- But must bypass glycolysis' irreversible steps (⟶)

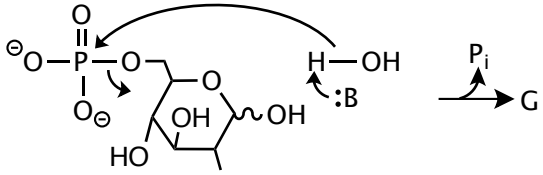
(C) ⟹ Sites of Pathway Control



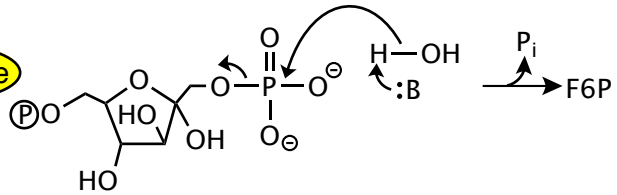
Mechanisms of GNG Enzymes

A

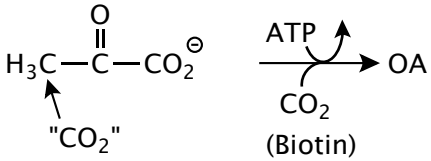
1.) G6Pase



2.) F16BPase



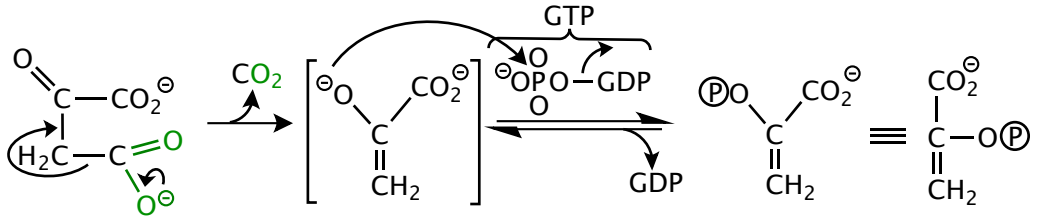
3.) PC



B

4.) Phospho Enol Pyruvate Carboxylase (PEP-CK)

-- The same CO_2 is lost that was put on by PC



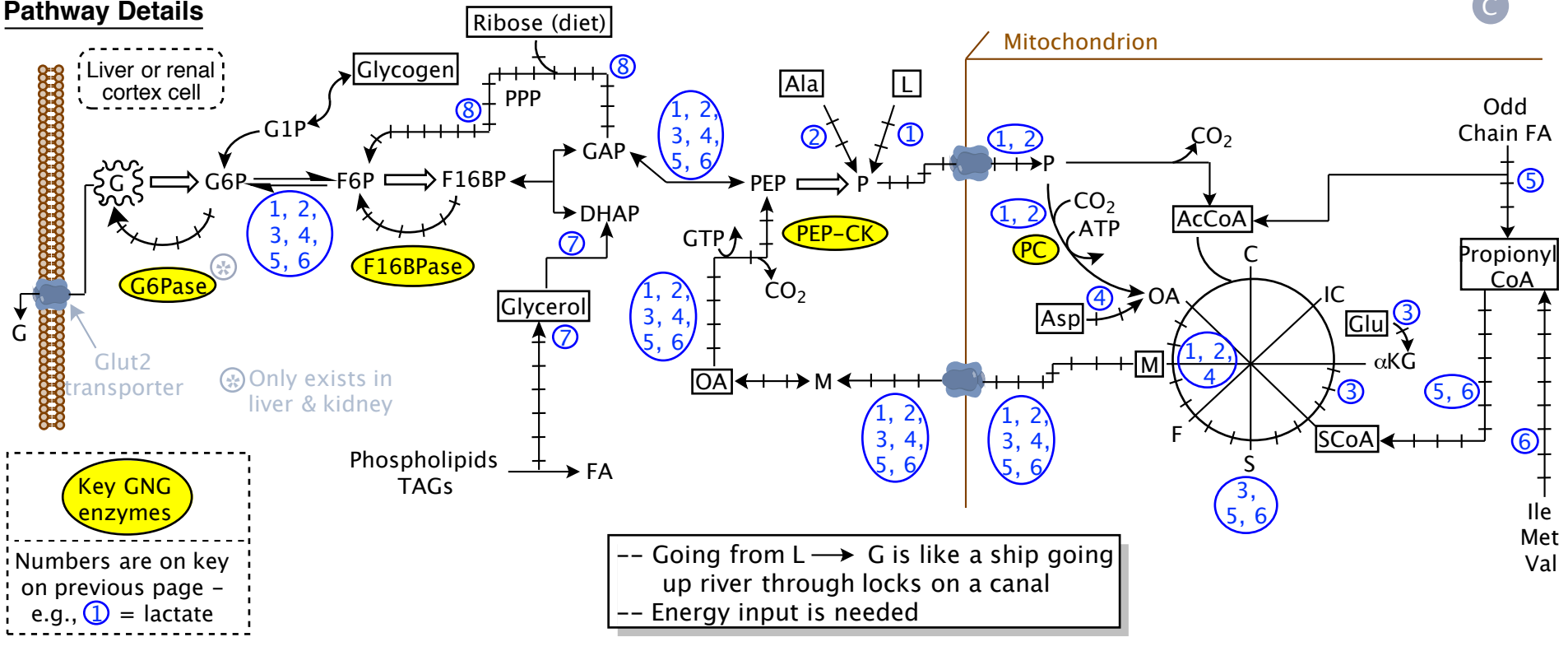
OA (β-keto acid)

PEP

-- PEP-CK can be cytosolic, mitochondrial, or both (depending on species)
-- If mitochondrial, PEP can freely go into cytoplasm via transporter to participate in GNG

Pathway Details

C



Key GNG enzymes

Numbers are on key on previous page – e.g., ① = lactate

-- Going from L ⟶ G is like a ship going up river through locks on a canal
-- Energy input is needed

5.07SC Biological Chemistry I
Fall 2013