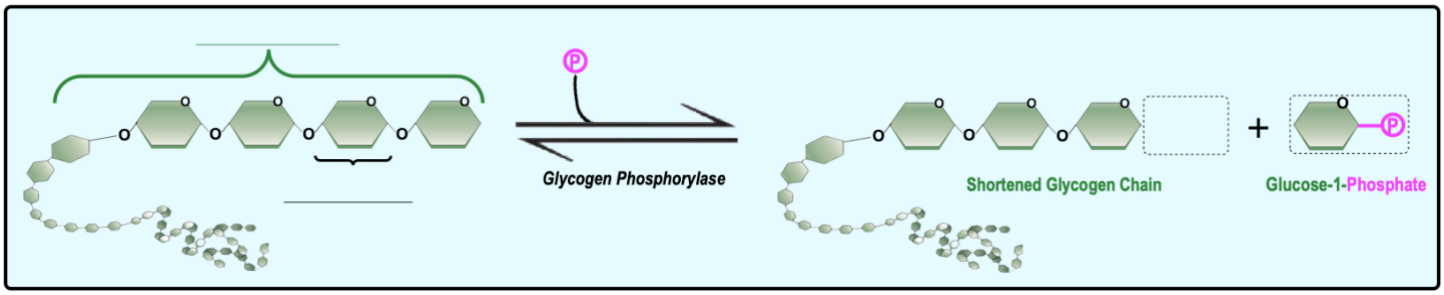
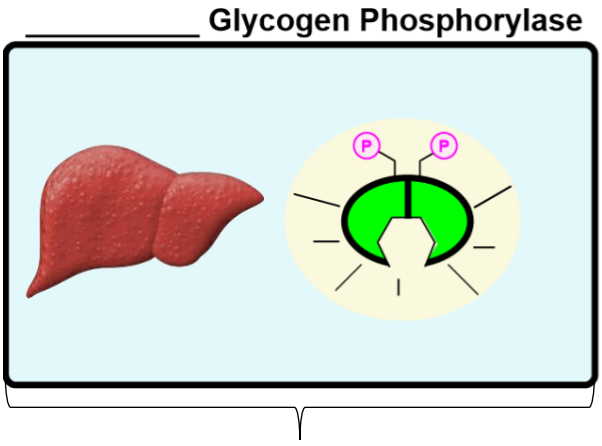
CONCEPT: GLYCOGEN PHOSPHORYLASE

- *Glycogen phosphorylase*: catalyzes *glycogen breakdown* with _____ & _____ *regulation*.
  - □ Has _____-subunits, each of which has a _____ residue (Ser-14) that can be *phosphorylated*.
  - □ Uses _____ (polymer) as a *substrate* & catalyzes removal of a single _____ (monomer).
- Primarily expressed in *liver* cells & *muscle* tissue where glycogen _____ is critical.
  - □ Subsequent reactions allow the released glucose to be used in *cellular respiration* to generate energy (ex. ATP).

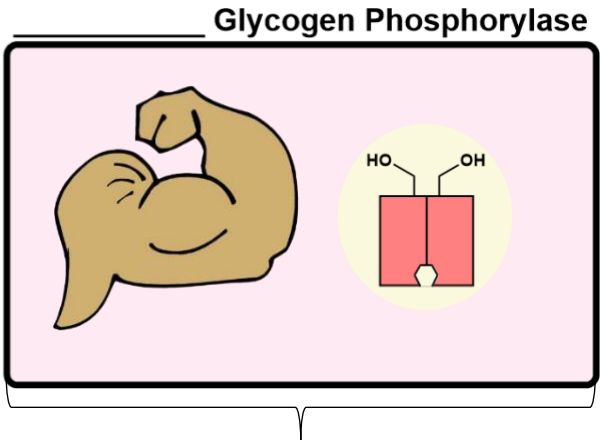


Two Isozymes of Glycogen Phosphorylase

- *Two* different _____ of glycogen phosphorylase: 1) _____ *Phosphorylase* & 2) _____ *Phosphorylase*.
  - □ *Isozymes*: catalytically/structurally _____ enzymes that are *genetically* & *allosterically differently*.
- Liver/muscle phosphorylase isozymes are regulated *differently* due to *different* biological roles of glycogen breakdown.
  - □ *Liver Phosphorylase Isozyme*: usually _____ *unless* allosterically *signaled* to stop.
  - □ *Muscle Phosphorylase Isozyme*: usually _____ *unless* allosterically *signaled* to make ATP for contraction.



Usually _____/on
(*Except* when we eat a high carb meal)



Usually _____/off
(*Except* during muscle contraction)

CONCEPT: GLYCOGEN PHOSPHORYLASE

Phosphorylase a & Phosphorylase b

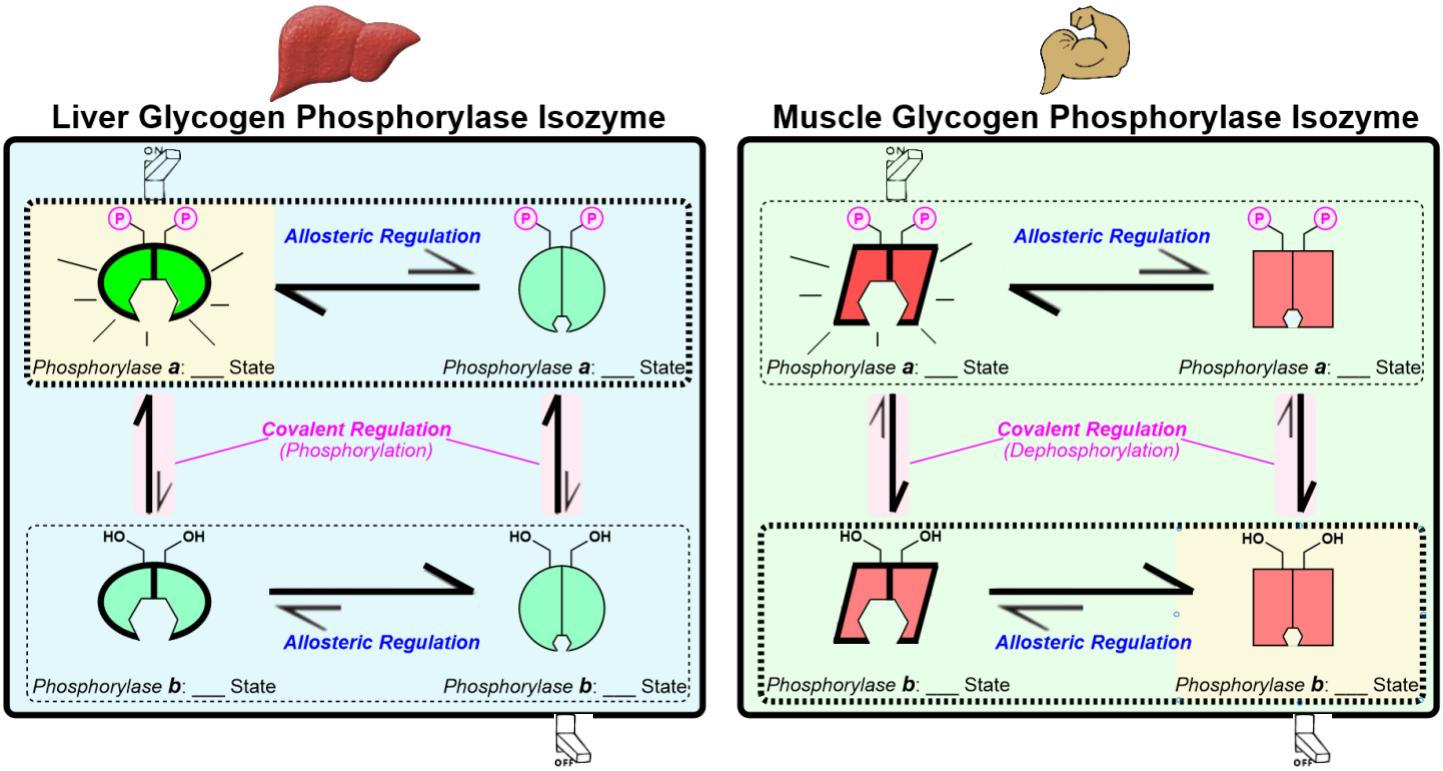
●Both liver/muscle isozymes have _____ different forms: 1) *Phosphorylase* ____ & 2) *Phosphorylase* ____.

□ Each form exists in equilibrium with their own ____ state & ____ state.

□ *Addition/removal* of _____ groups (*covalent* regulation) on 2 Ser residues coverts the two forms.

1) Phosphorylase ____: *phosphorylated* serines & is catalytically _____ active (⇌ favors R-state).

2) Phosphorylase ____: *unphosphorylated* & is catalytically _____ active (⇌ favors T-state).



PRACTICE: Glycogen phosphorylase is an enzyme involved in glycogen metabolism that's regulated by phosphorylation. Phosphorylation on serine residues results in more enzyme activity, while the dephosphorylated enzyme has little to no activity. What result would you expect on activity if the serine residues that served as phosphorylation sites on glycogen phosphorylase were mutated to aspartate residues?

a) No effect on activity, since aspartate residues can be phosphorylated similarly to serine residues.

b) The enzyme would be completely inactive if it has an Asp residue, since it will no longer recognize its substrate.

c) The enzyme likely has some activity, since Asp is negatively charged like a phosphoryl group, but activity would not be regulated by phosphorylation.

d) The enzyme would be mostly inactive, since the enzyme can no longer be phosphorylated.