# Chem 452 - Lecture 3
# Hemoglobin & Myoglobin
# 111007

Hemoglobin (Hb) and Myoglobin (Mb) function as oxygen transport and storage molecules in higher organisms. There functions have been long studied and, together, provide a wealth of examples of how the structure and function of proteins are related.

# Allosteric Regulation

- Other allosteric regulators include
  - $H^+$ (lower pH) - The Bohr Effect
  - $CO_2$
- Both of these metabolites signal increased metabolic activity

# Allosteric Regulation

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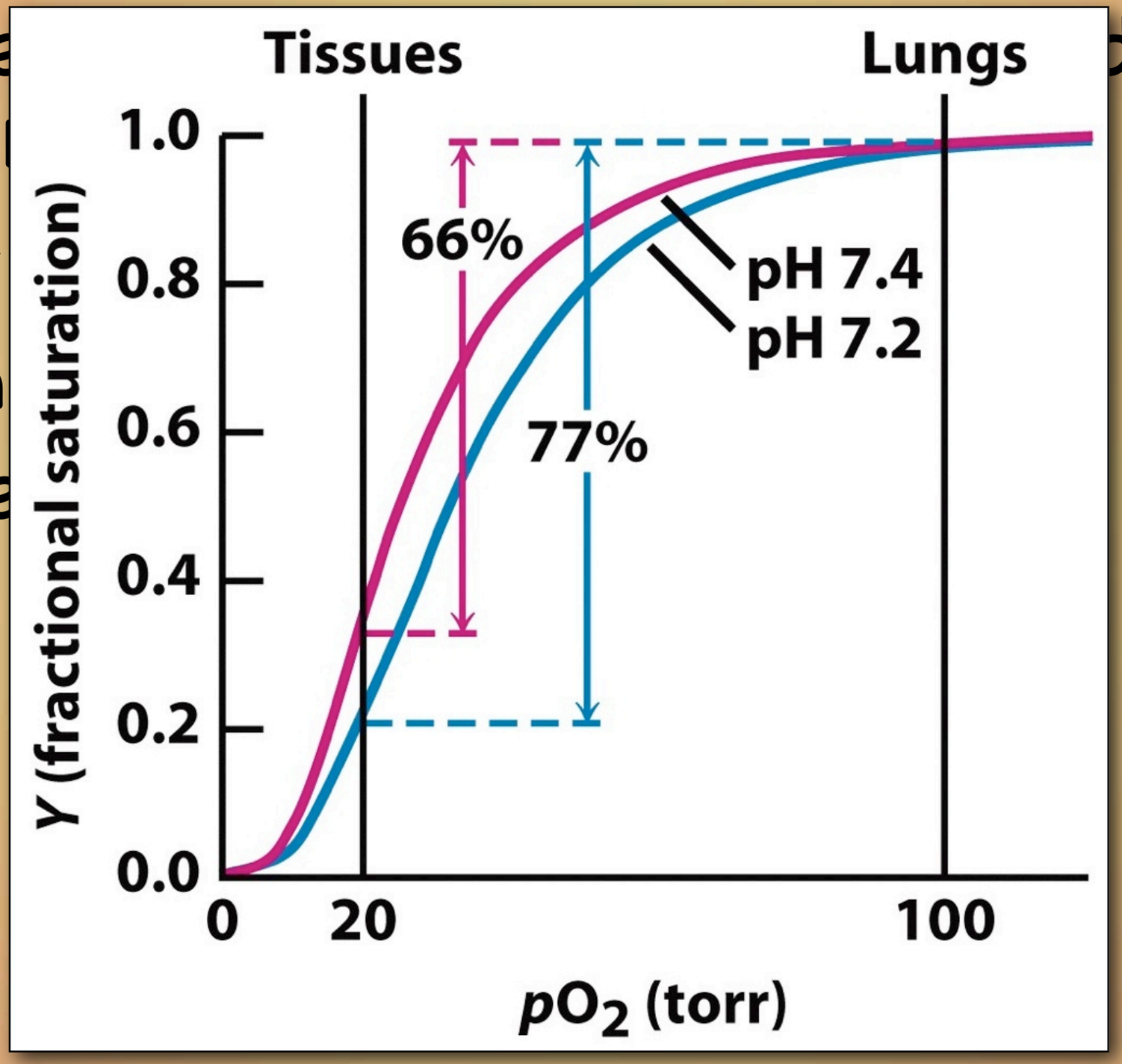

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- Lower pH leads to the formation of salt-bridges (charge/charge interactions), that stabilize the T-state.
  - α-chain α-amino group
  - β-chain H146
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# Allosteric Regulation

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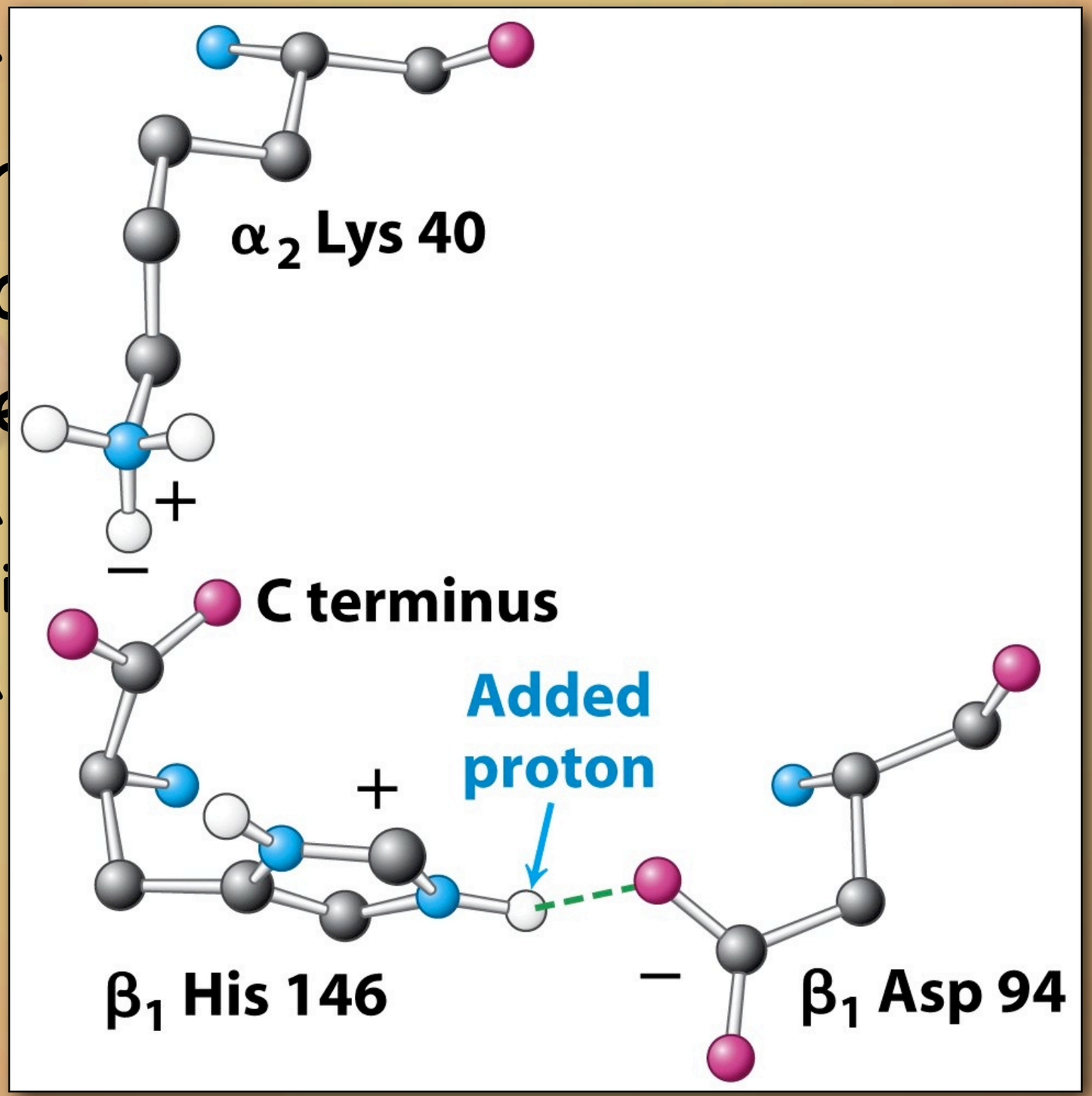

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# Allosteric Regulation

- $CO_2$ lowers Hb's affinity for $O_2$ by two different mechanisms.
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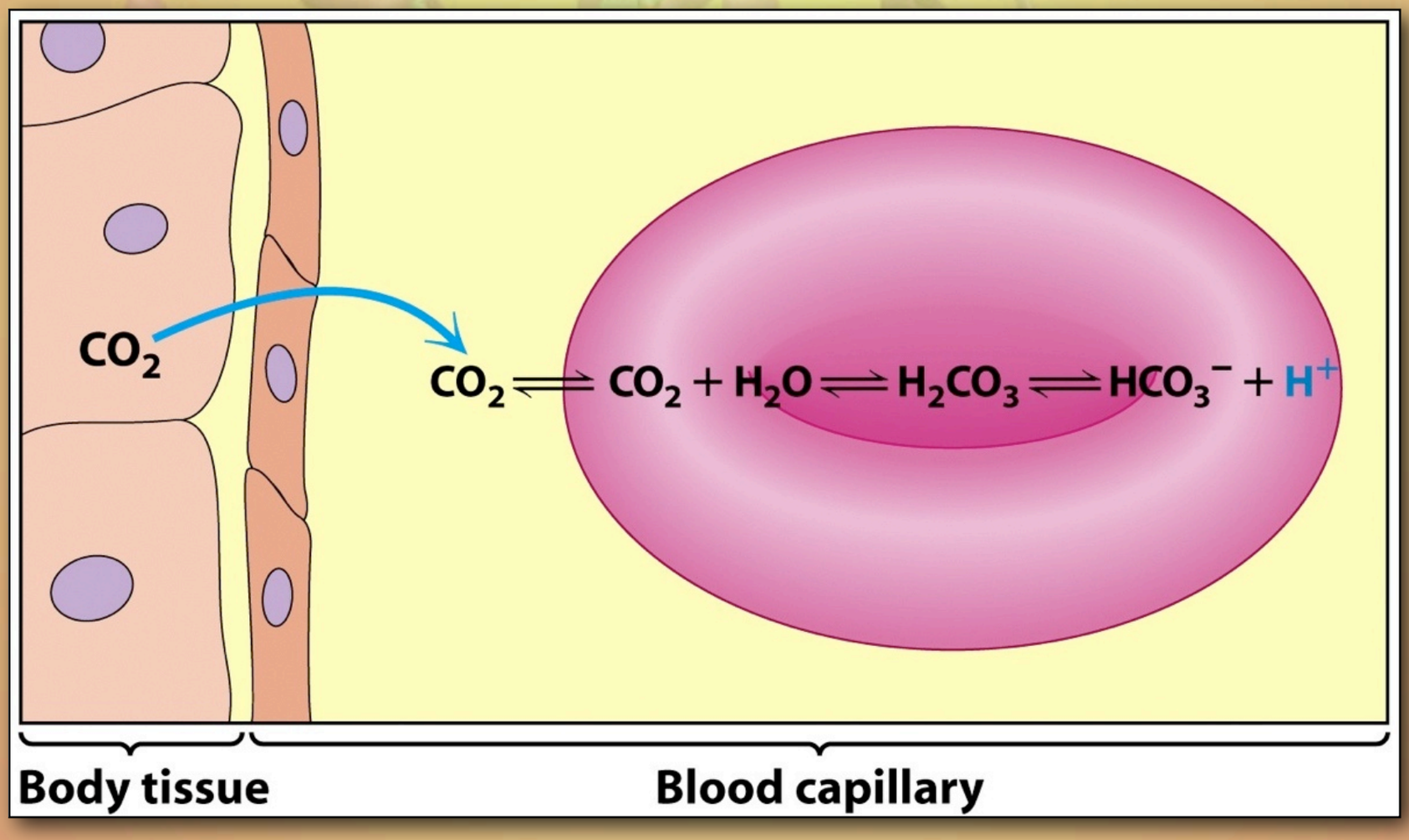

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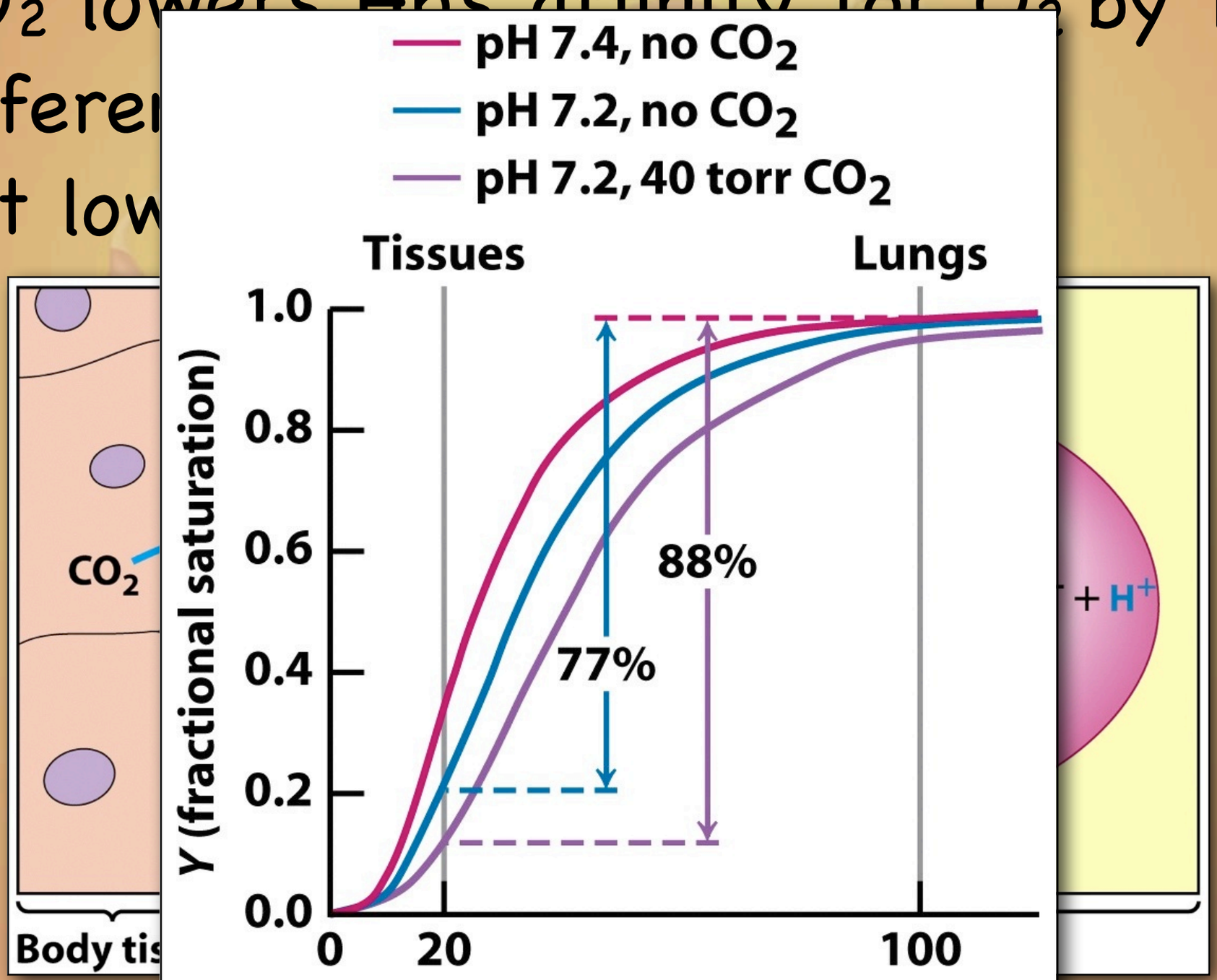

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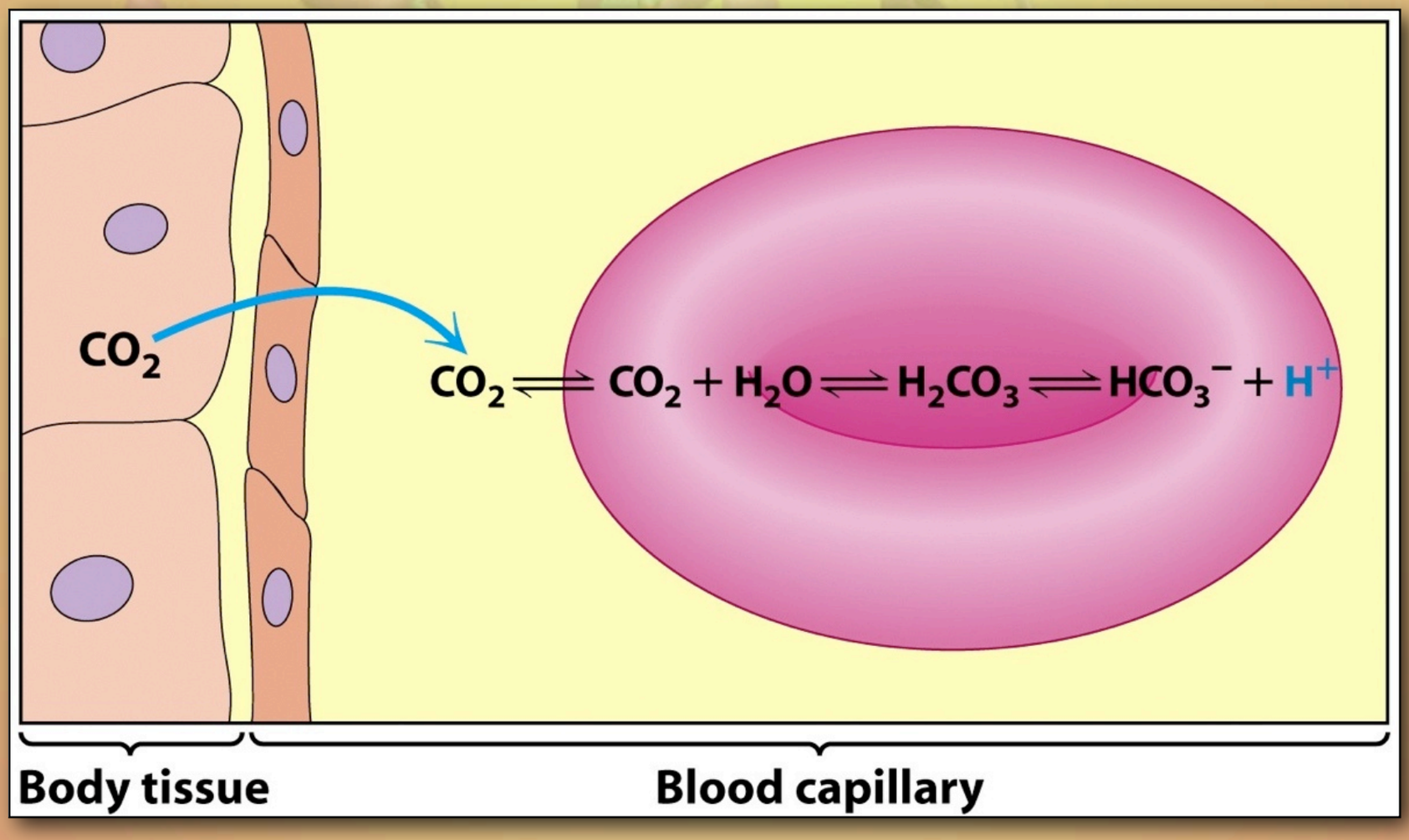

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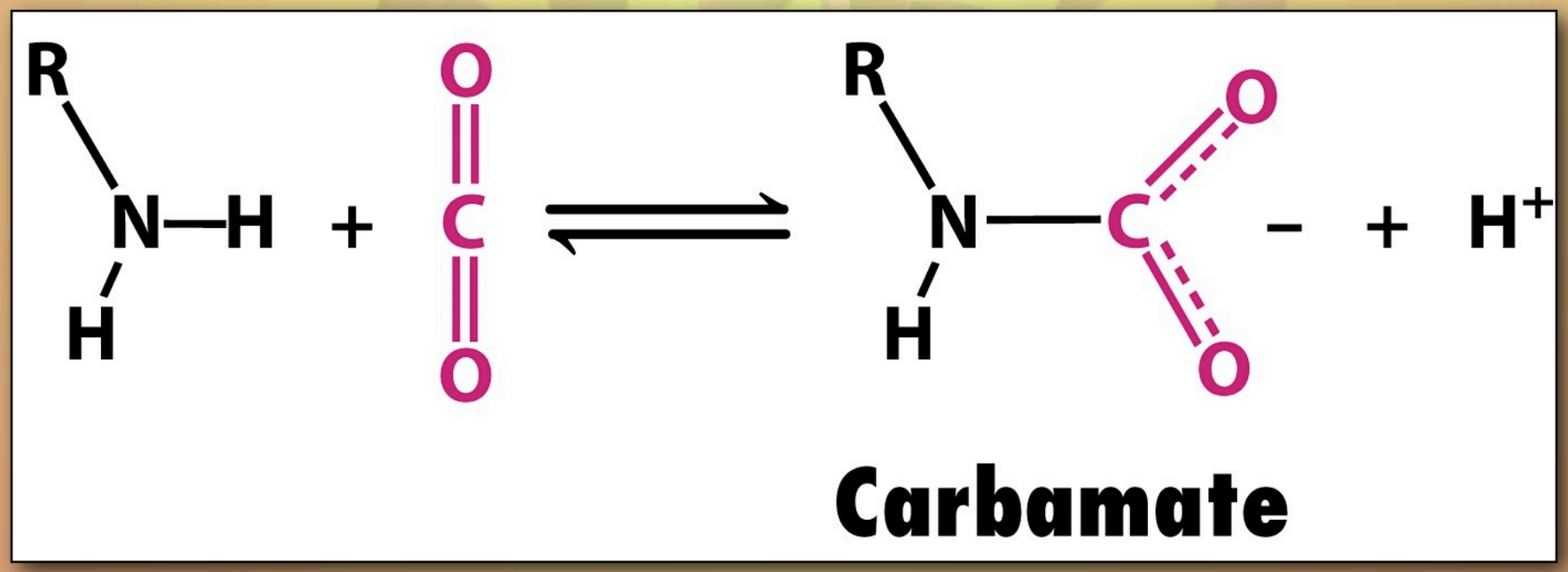

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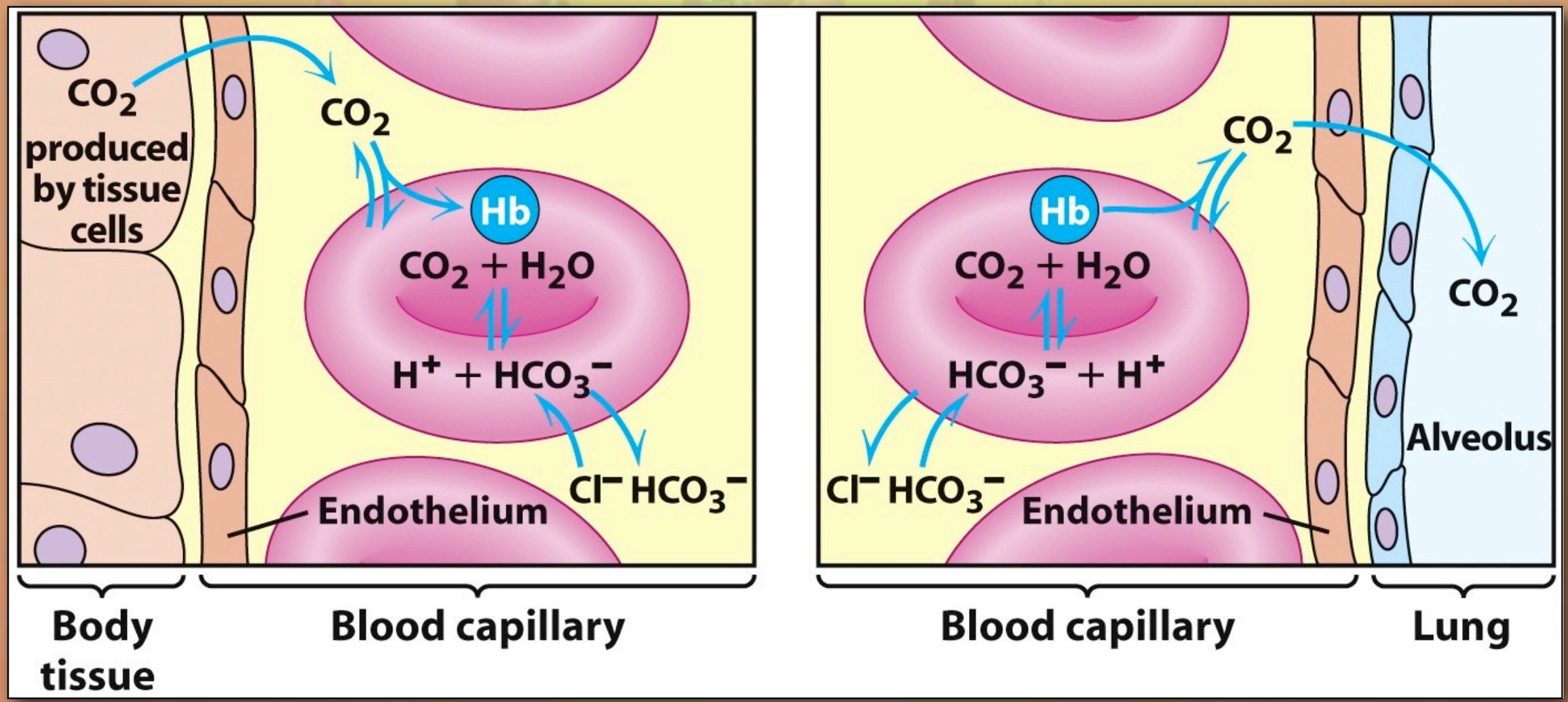

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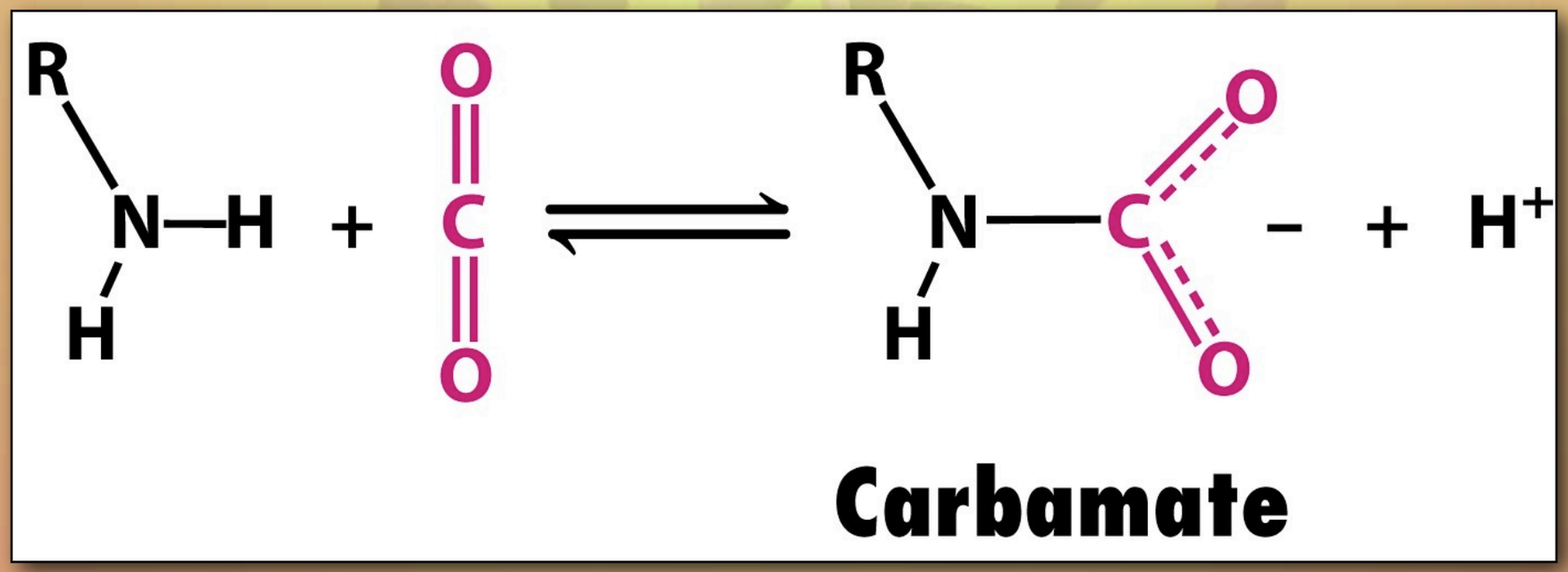
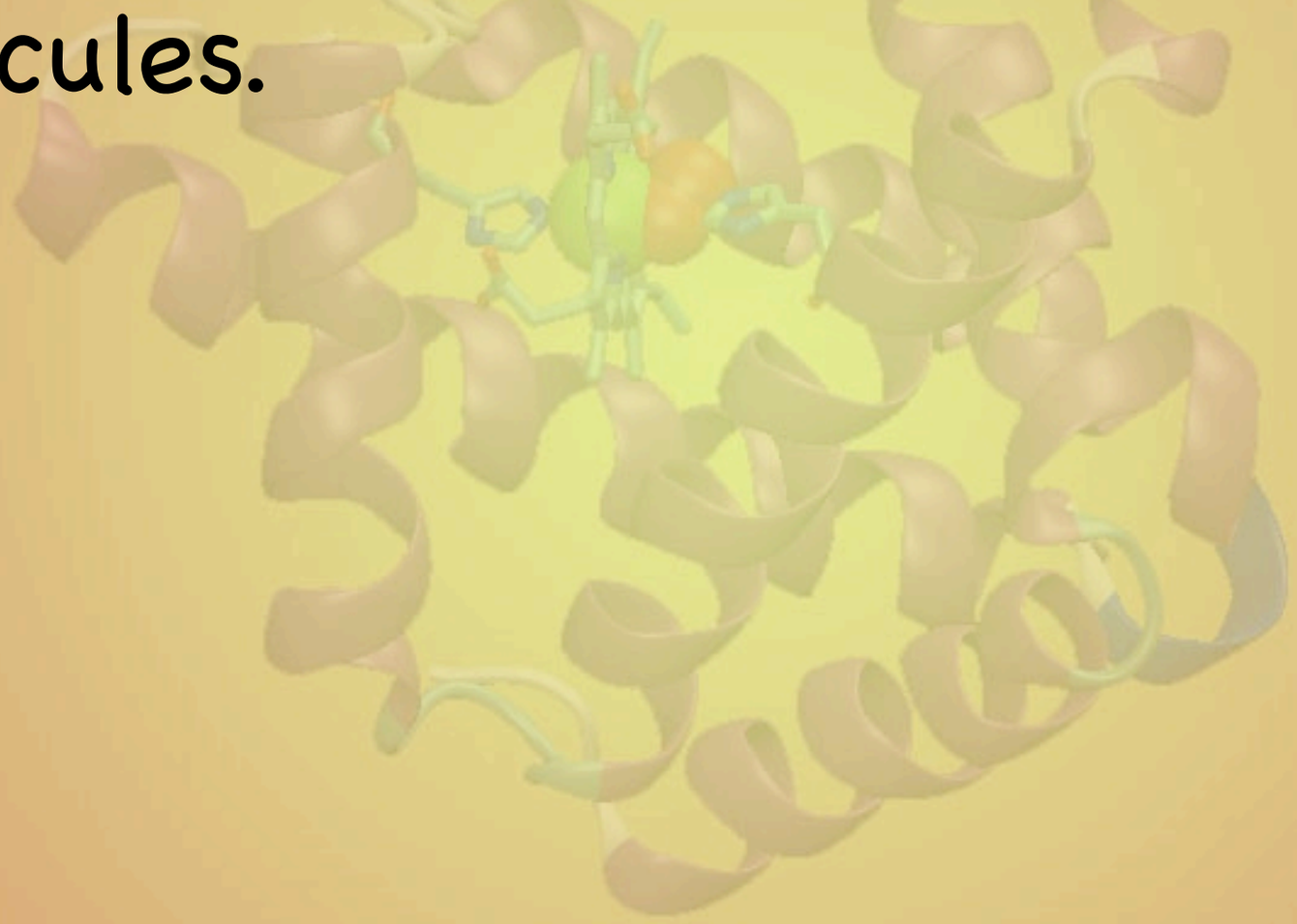


# Genetic Diseases Involving Hb

- Concept of diseases caused by molecular defect was proposed in 1949 by Linus Pauling
  - Sickle-cell Hb (Hb-S)

# Genetic Diseases Involving Hb

- Sickling of RBC's is caused by the aggregation (polymerization) of Hb molecules.



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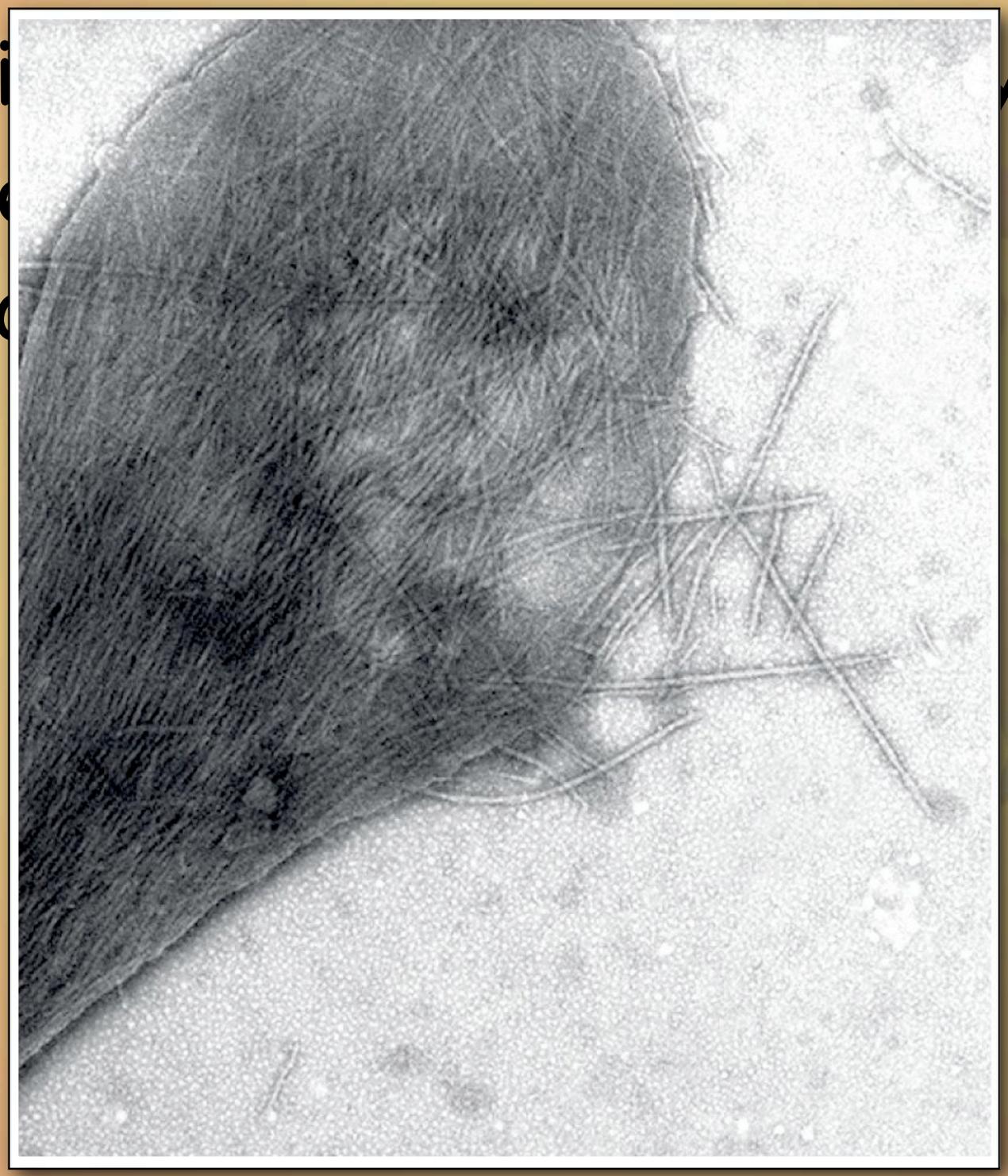

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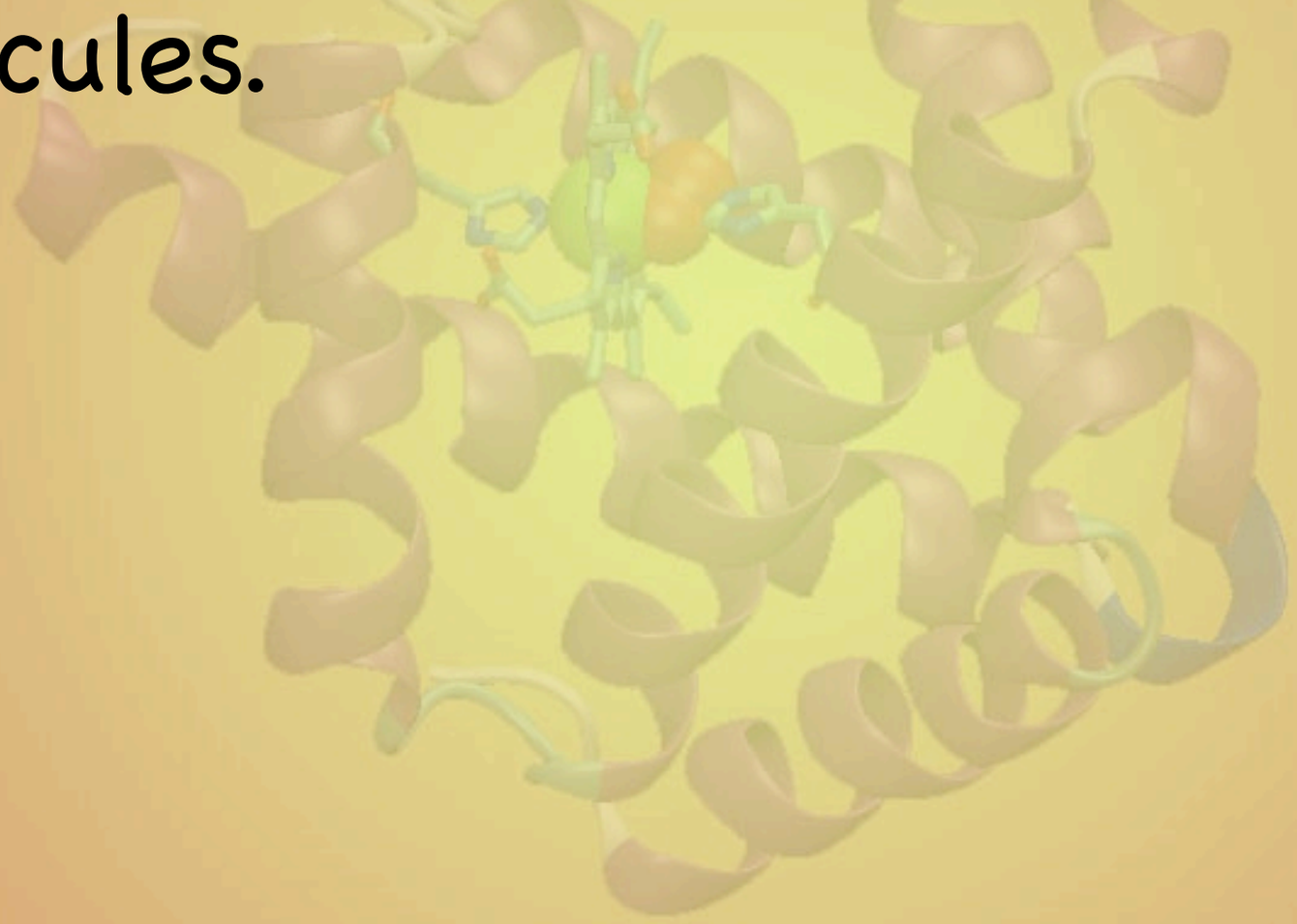

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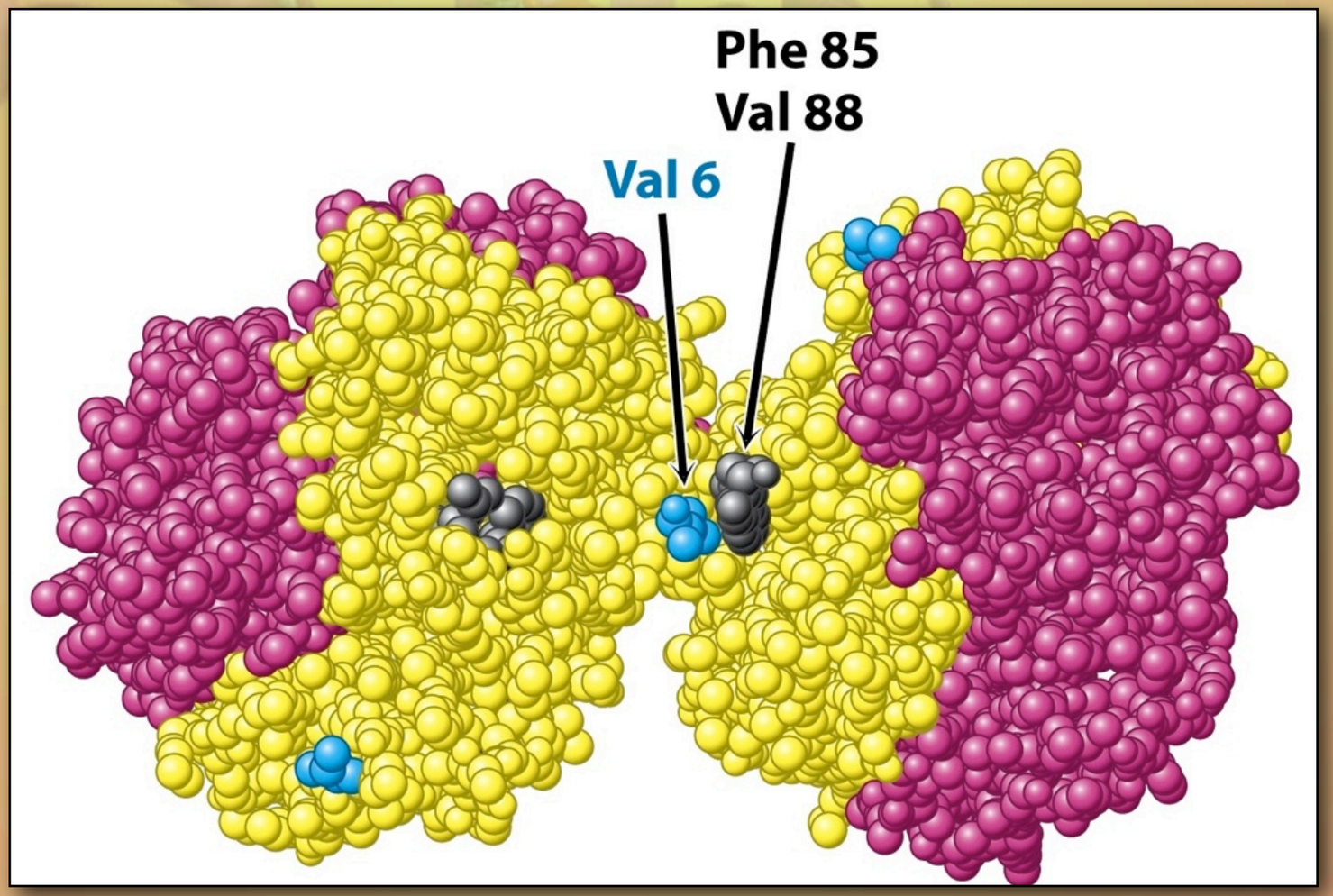
- Disease is caused by a substitution of a Val for a Glu at position 6 in the β-chain (E6V)



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- Sickle-cell disease is **homozygous recessive**.
- **Heterozygous** individuals do not express the disease
- However, they are more resistant to the malaria parasite (Plasmodium falciparum)

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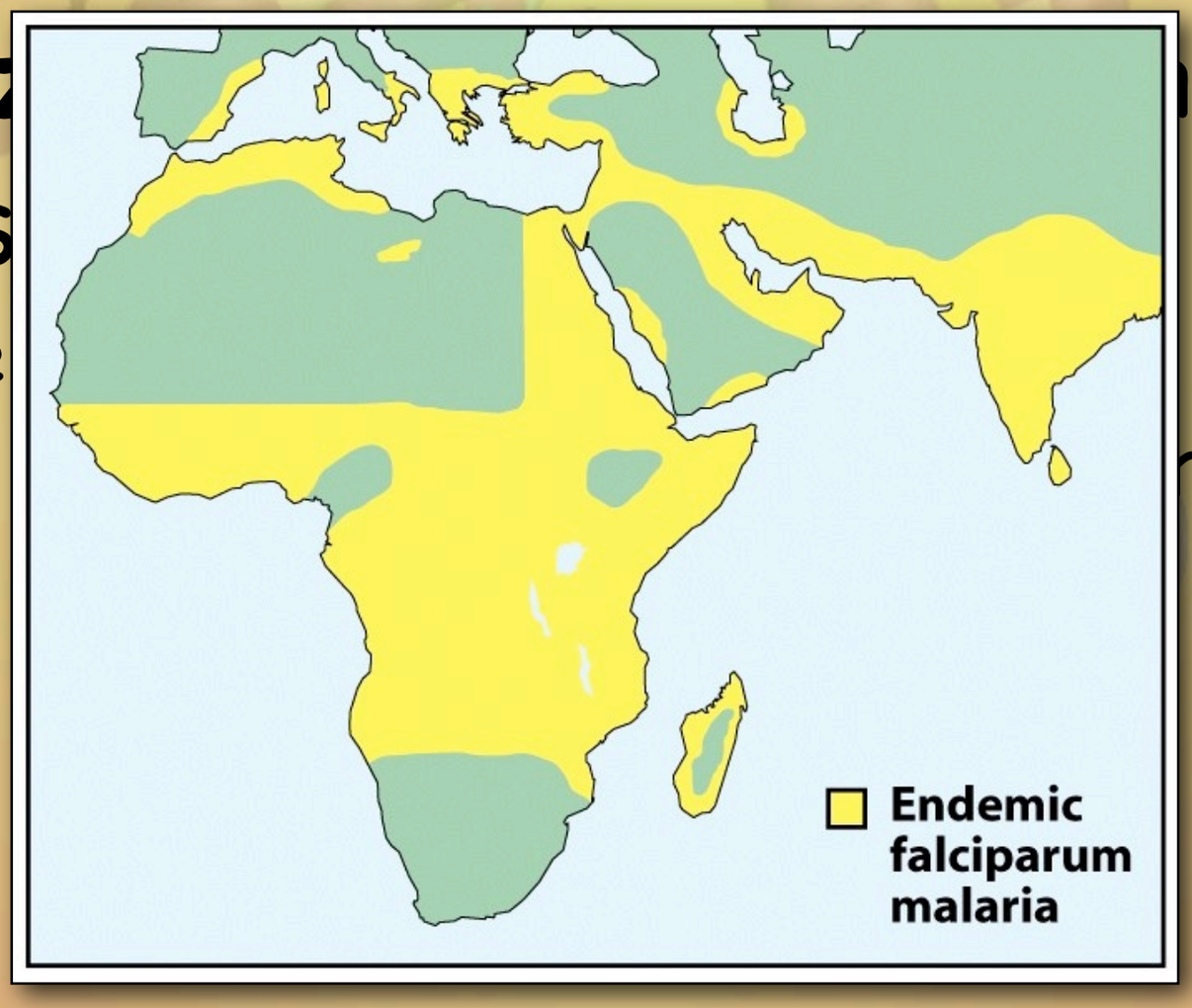

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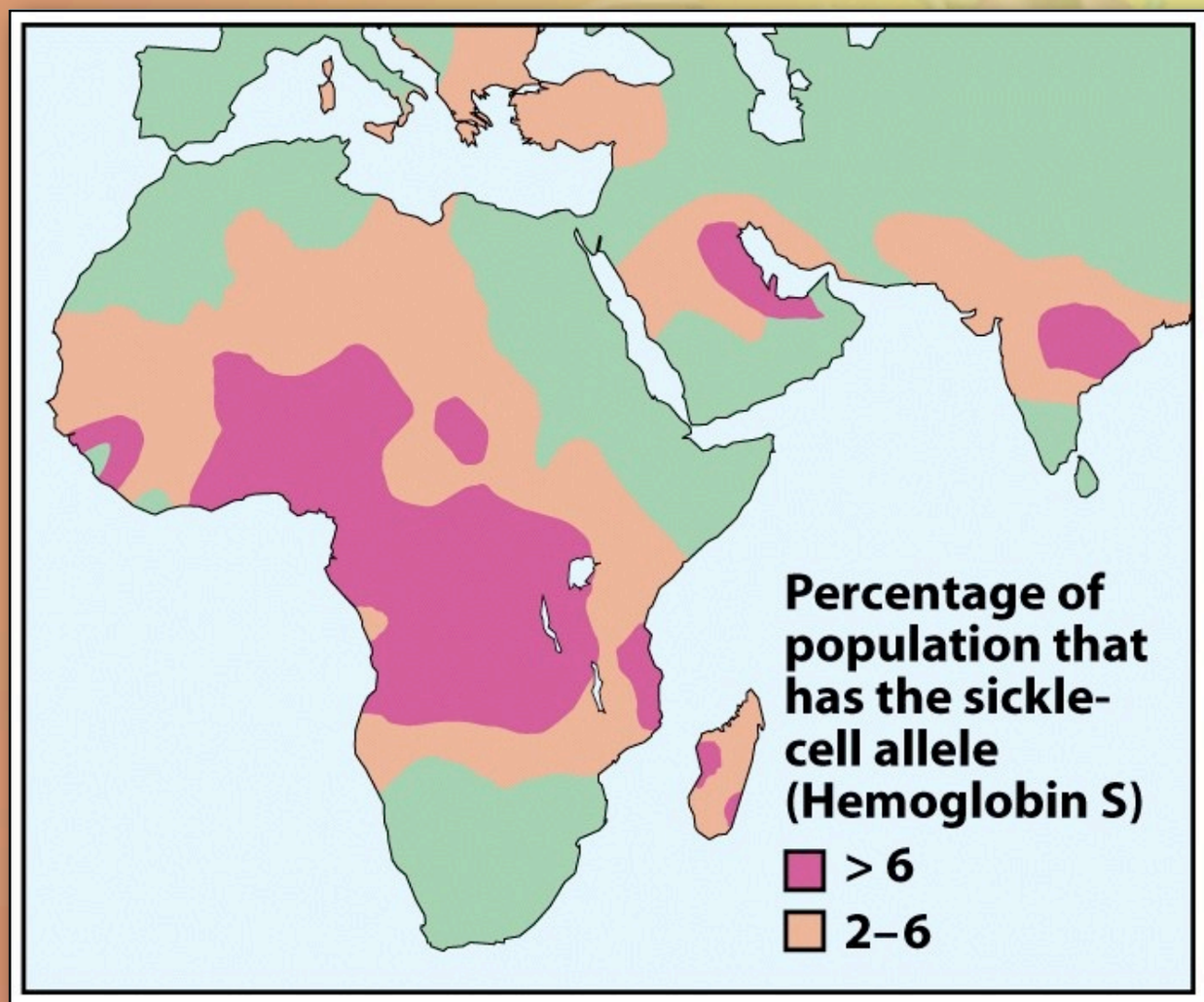


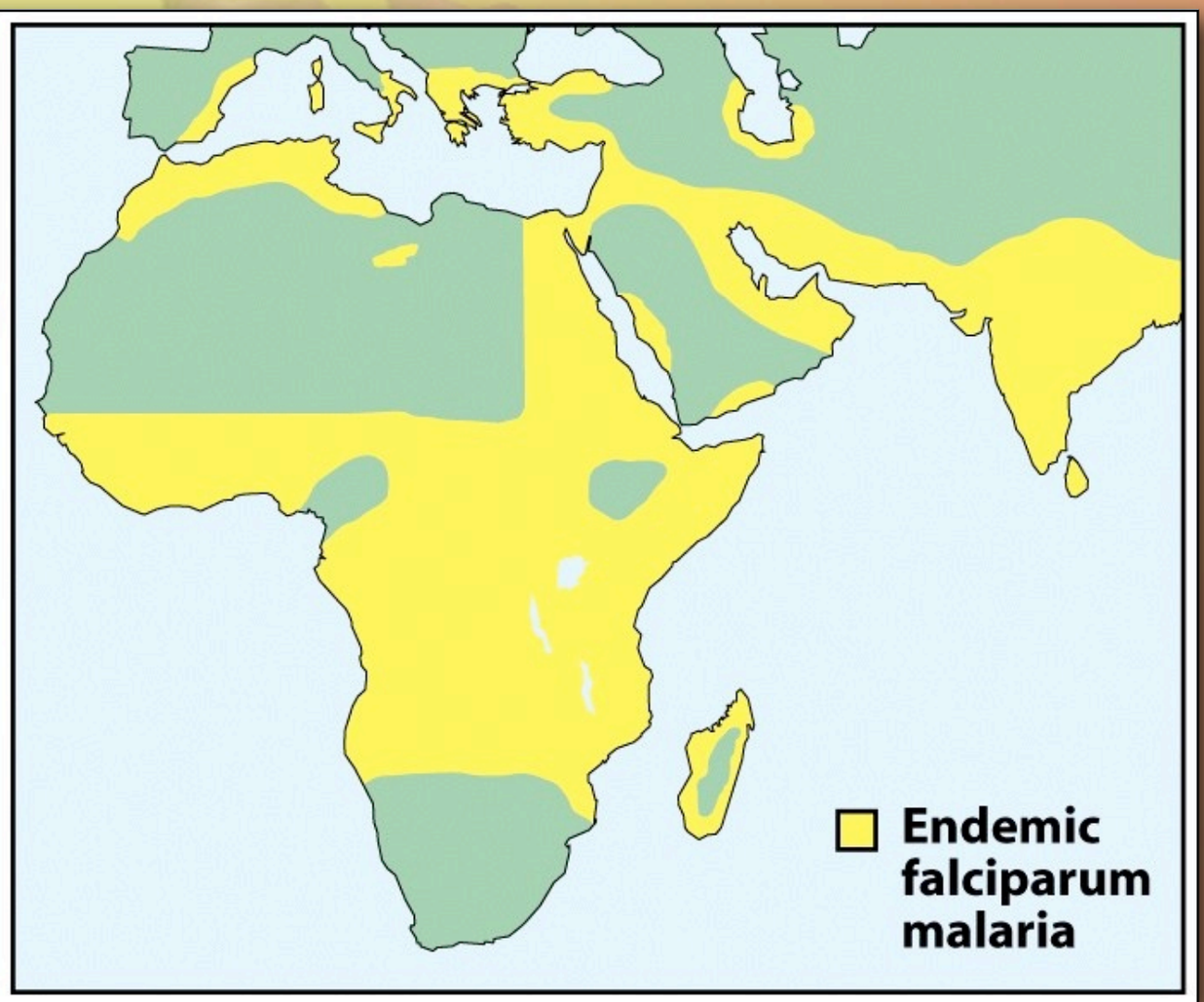

# Next up

- Enzymes (Chapter 8)