

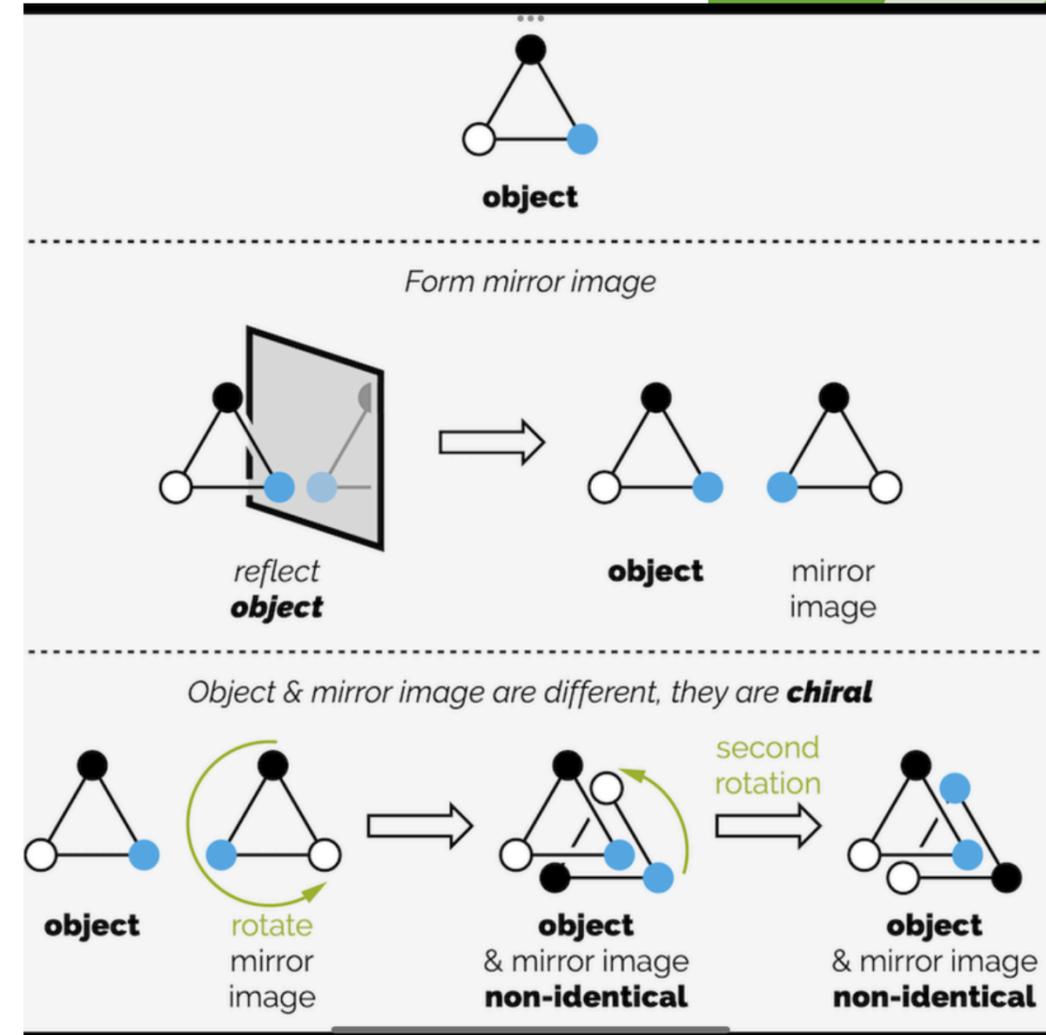


CHIRALITY

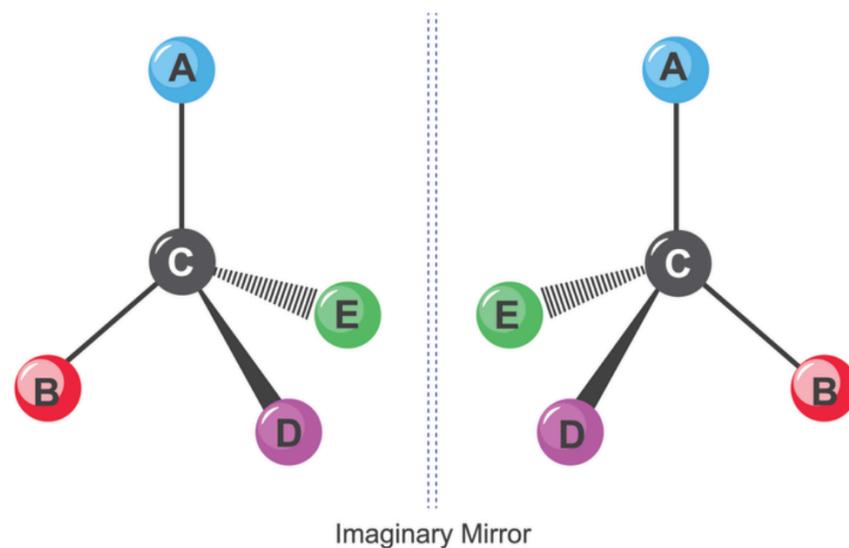
Medical bioChemistry
Dr. Rashad Rasheed

CHIRALITY IN BIOLOGICAL SYSTEMS

- Fundamental concept in biochemistry
- Determines molecular structure & biological function
- Essential for life processes and drug action



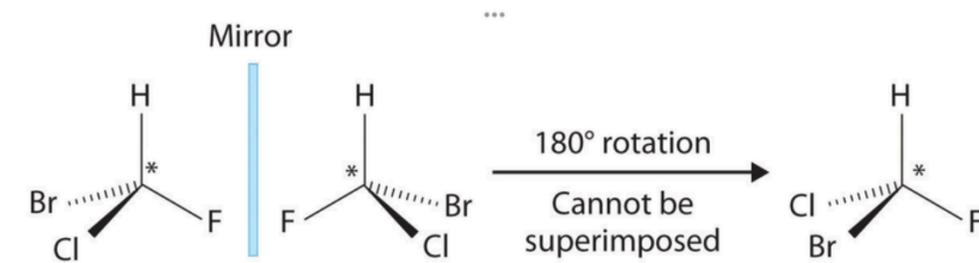
Optical Isomerism



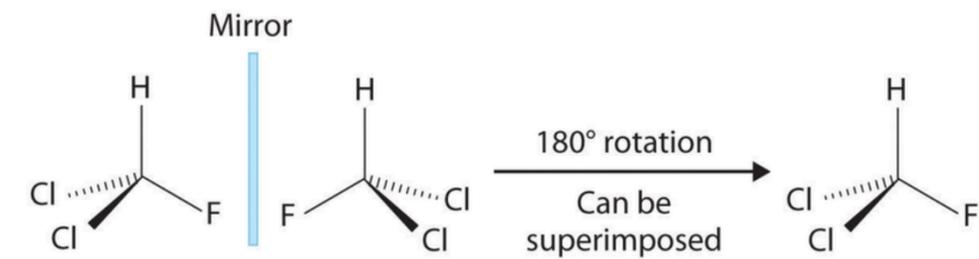
DEFINITION OF CHIRALITY

Chirality = molecule cannot be superimposed on its mirror image

- Occurs when carbon atom binds to four different groups
- Produces two mirror forms (enantiomers)



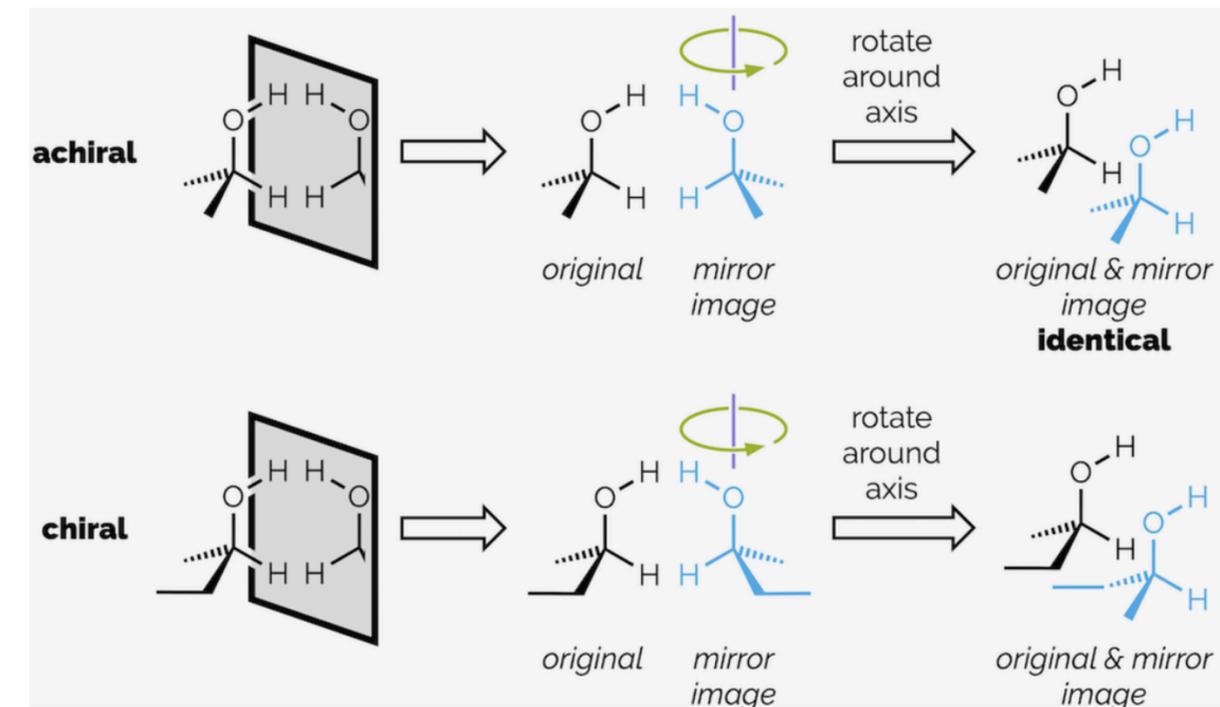
(a) Bromochlorofluoromethane



(b) Dichlorofluoromethane

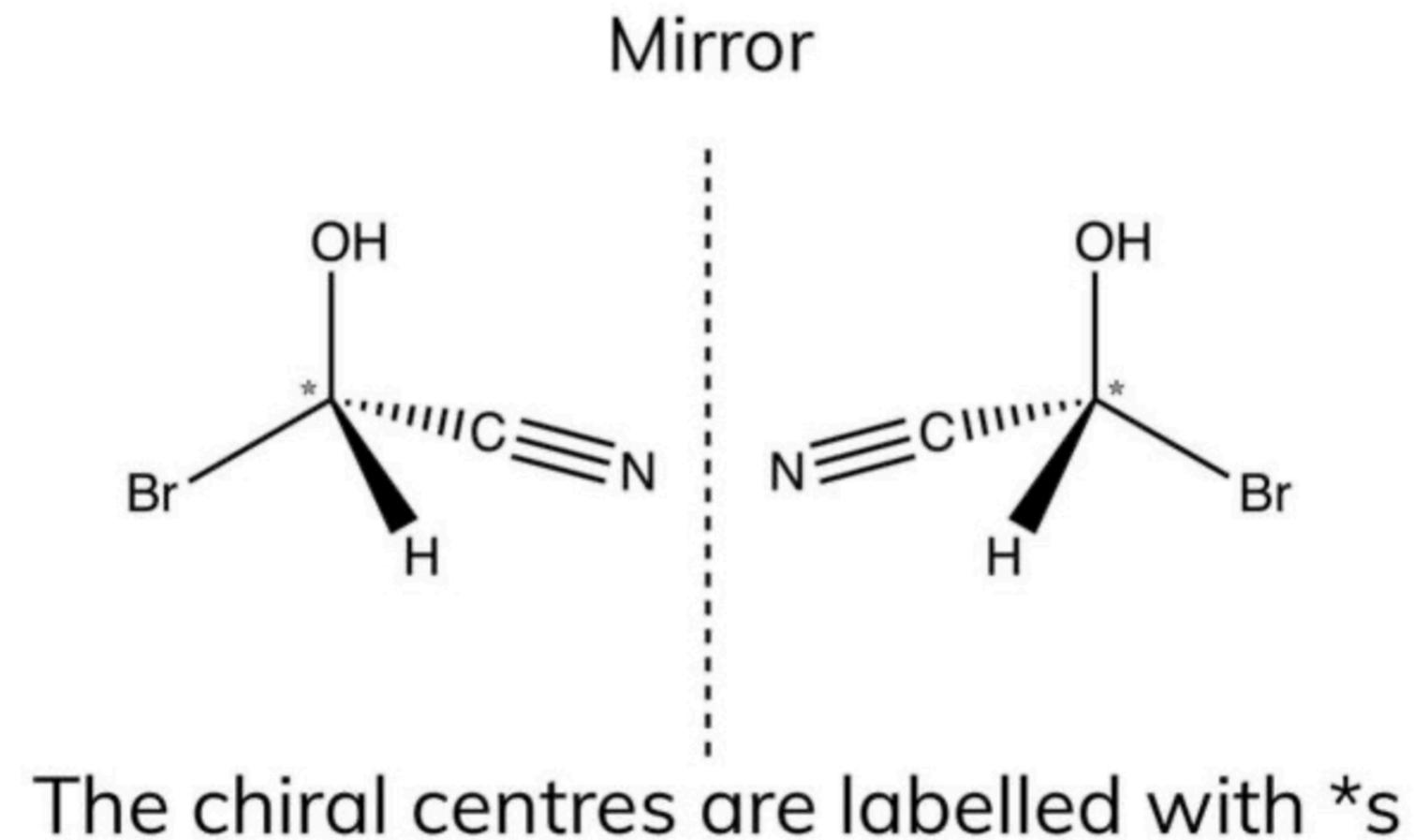
ENANTIOMERS

- Mirror-image molecules (like right & left hands)
- Same chemical formula
- Different 3D arrangement
- May produce different biological effects



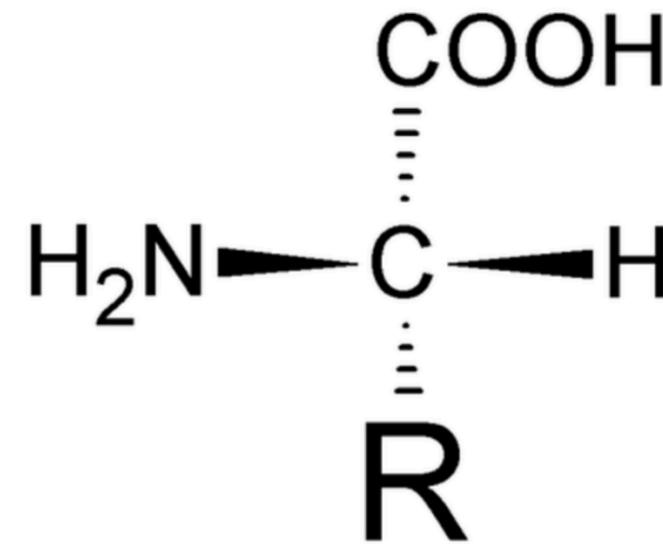
BIOLOGICAL IMPORTANCE

- Most biomolecules are chiral
- Includes:
 - amino acids
 - sugars
 - nucleotides
- Chirality determines molecular interactions

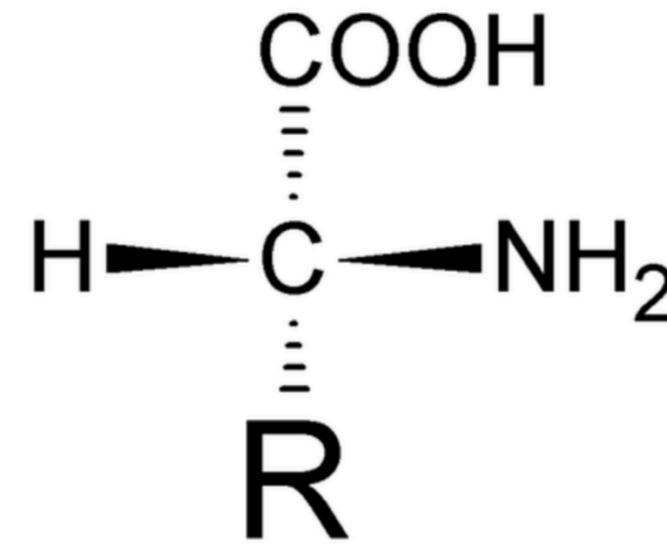


CHIRALITY OF AMINO ACIDS

- Natural amino acids exist mainly in L-form
- D-forms are rare
- Chirality affects:
 - protein folding
 - enzyme recognition
 - biological activity



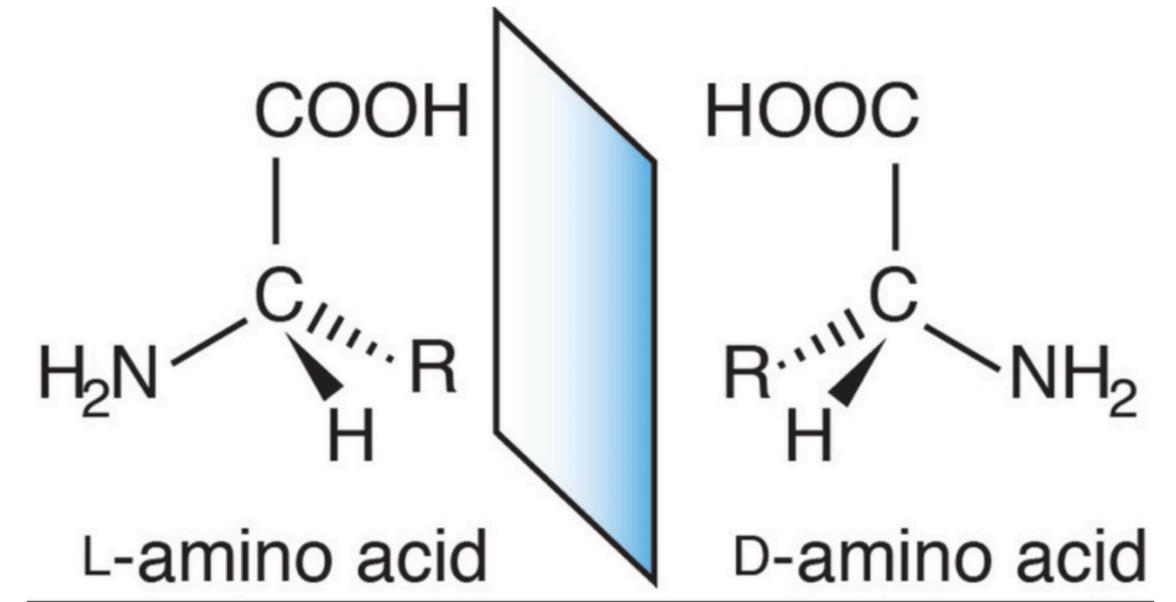
L-Amino acid



D-Amino acid

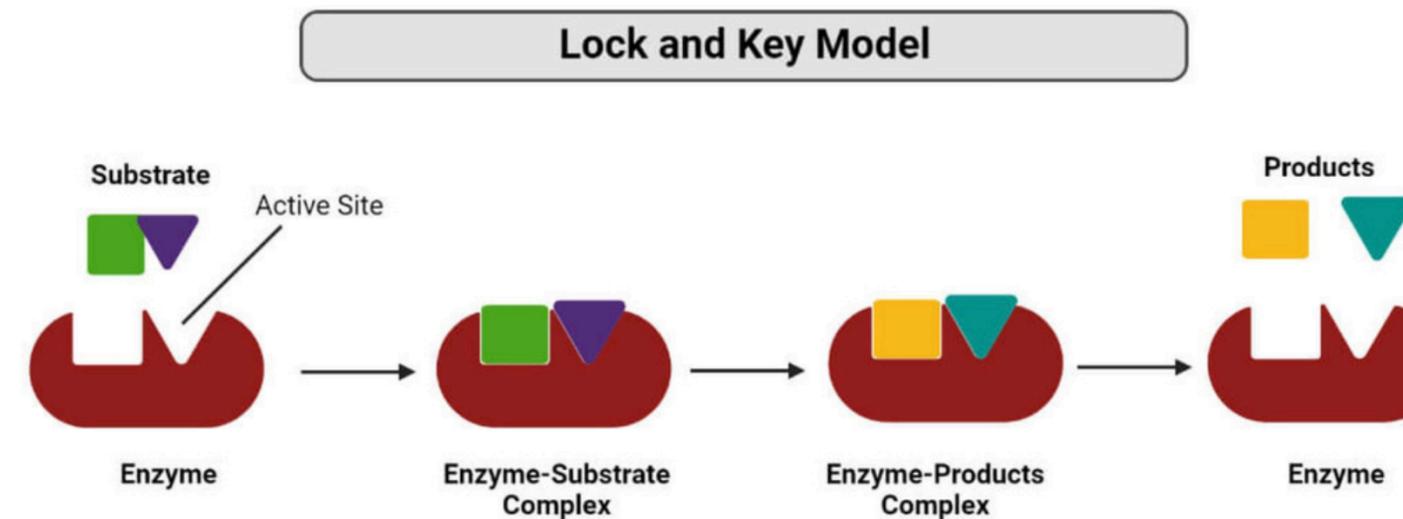
CHIRALITY OF SUGARS

- Most sugars exist in D-configuration
- Determines metabolism & enzyme reactions
- Example: D-glucose used for energy



ENZYLE SPECIFICITY (LOCK & KEY MODEL)

- Enzymes bind only one enantiomer
- Requires perfect 3D fit
- Wrong isomer → no reaction



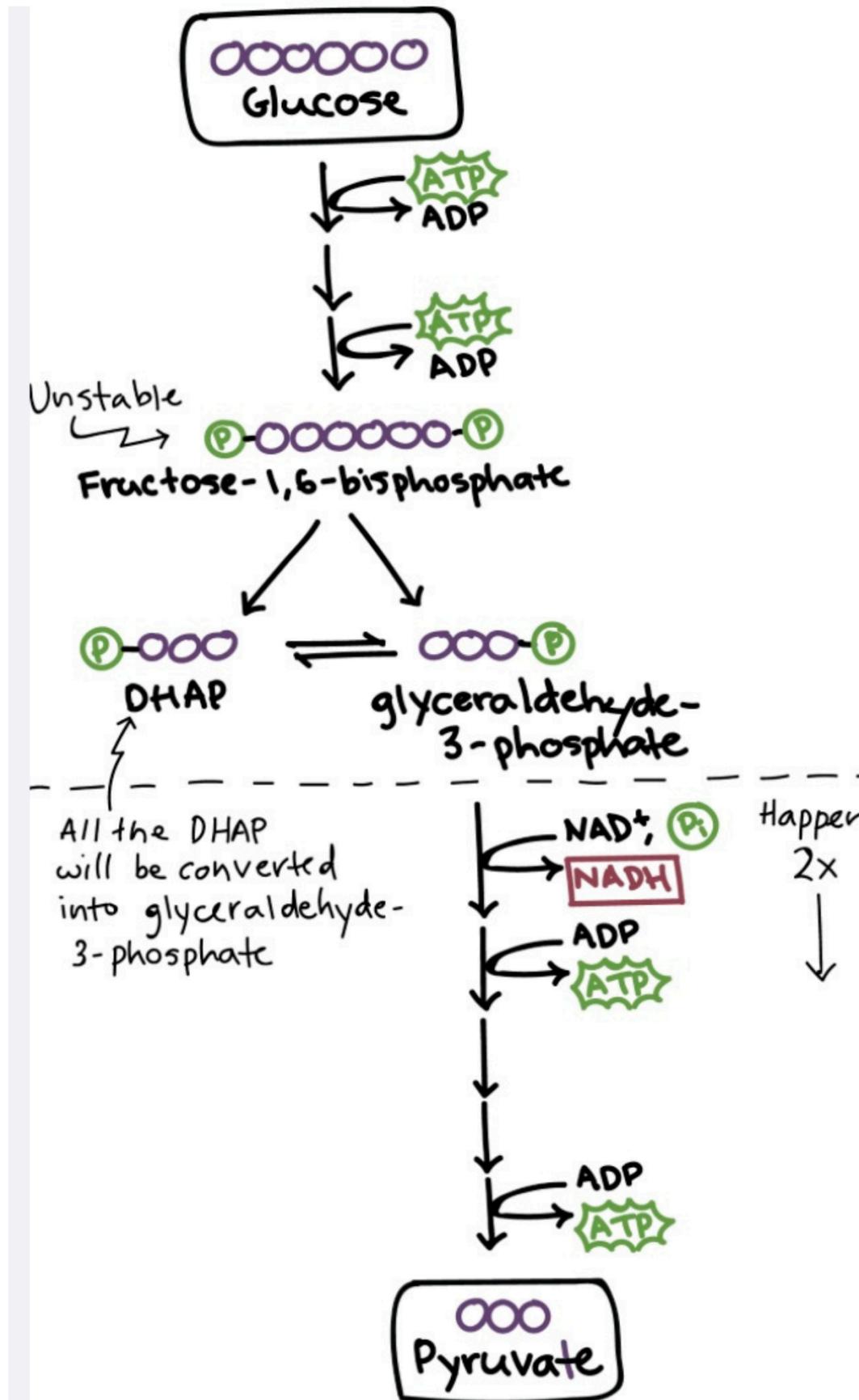
ROLE IN METABOLISM

- Metabolic pathways depend on chiral intermediates

Essential in:

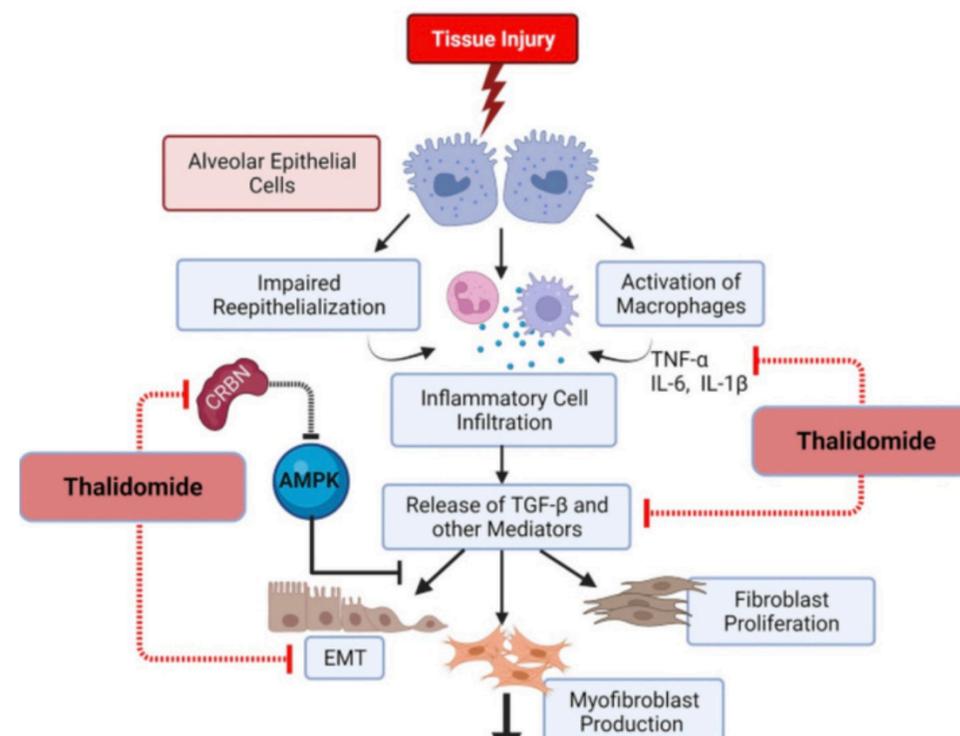
- glycolysis
- citric acid cycle

Proper chirality ensures enzyme function



PHARMACOLOGICAL IMPORTANCE

- Drug enantiomers may differ in effect
- One form = therapeutic
- Other form = inactive or harmful Example: Thalidomide tragedy





CLINICAL & BIOLOGICAL SIGNIFICANCE

- Influences receptor binding & signaling
 - Affects drug safety & effectiveness
 - Explains biological asymmetry (L-amino acids & D-sugars) .Essential for drug design & biotechnology
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THANK YOU