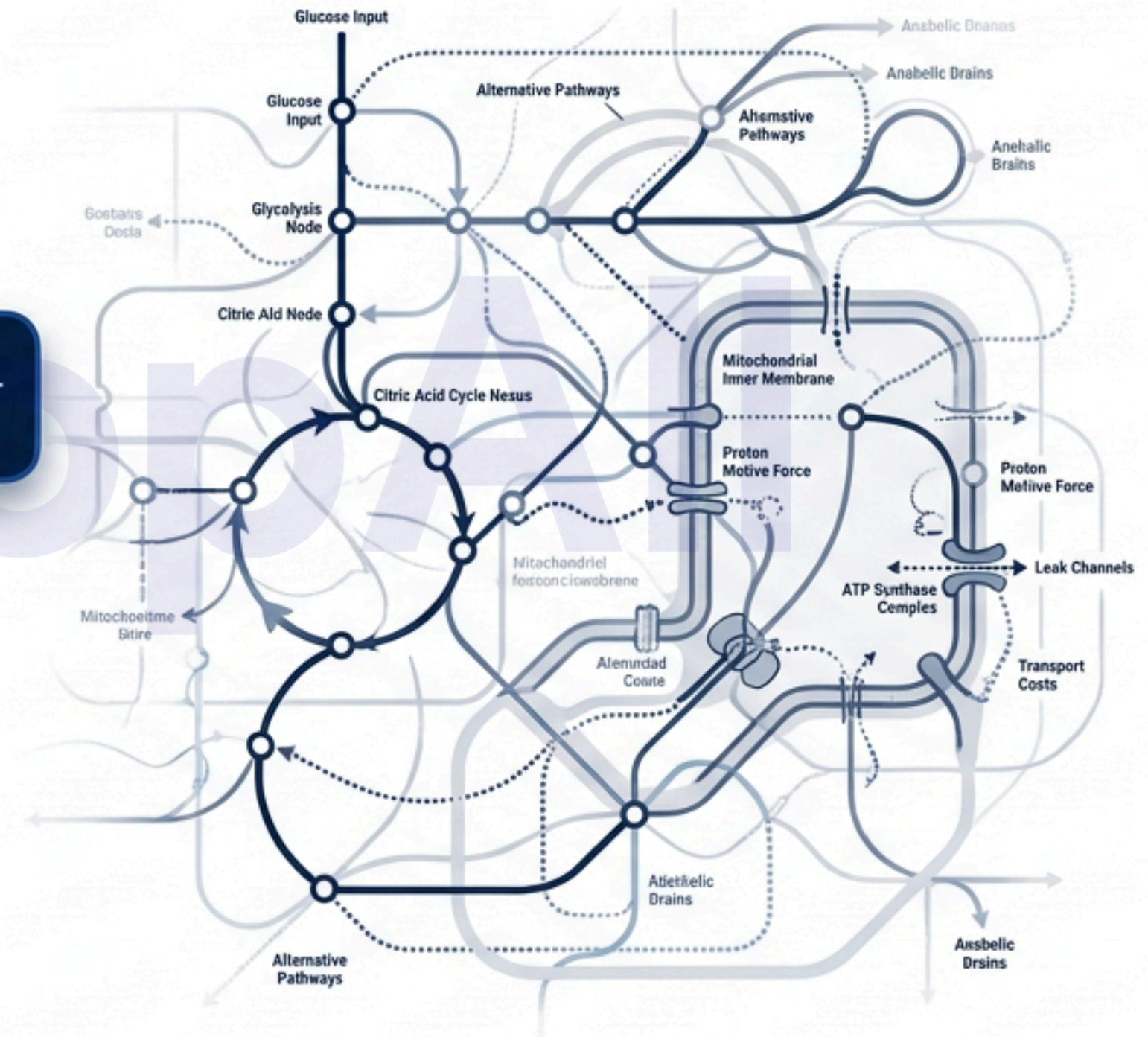


Why 38 ATP Is Theoretical

The Biological Balance Sheet: Idealized Math vs. Cellular Reality

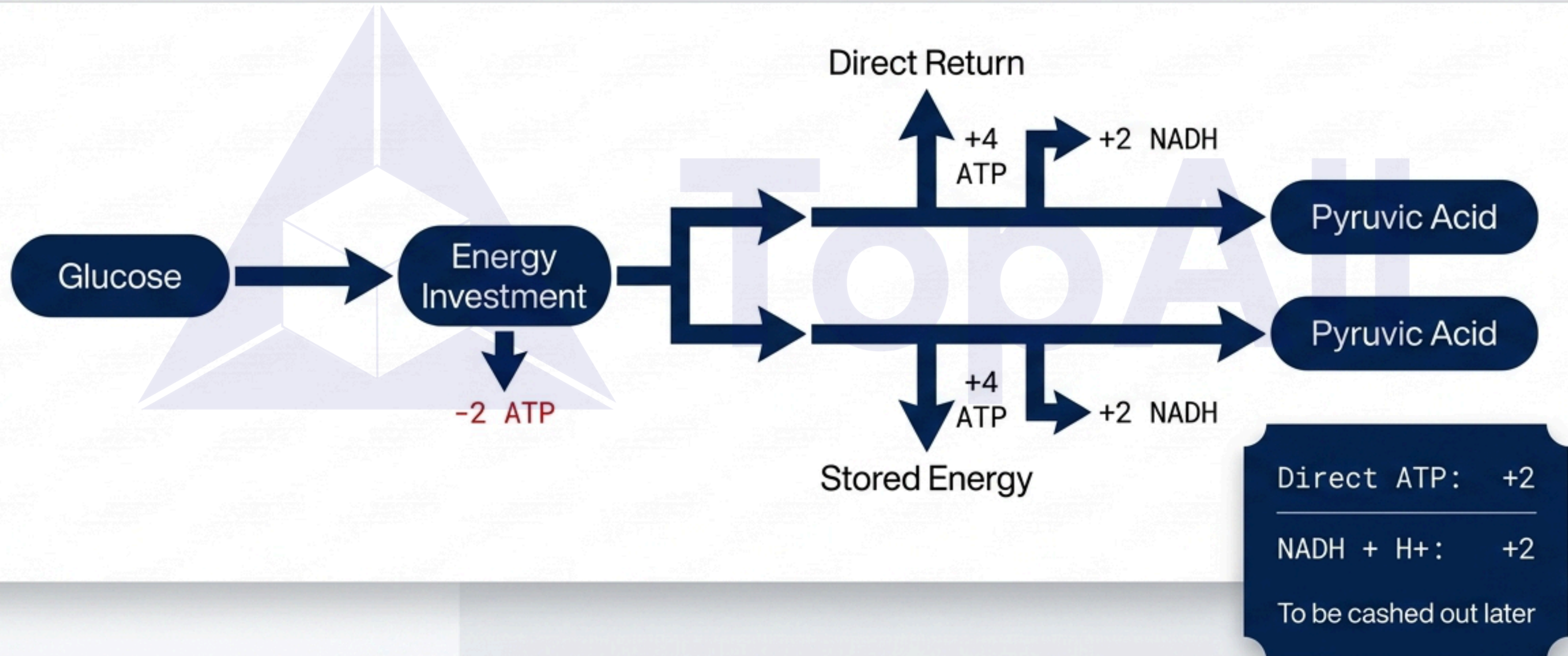
GLUCOSE		$C_6H_{12}O_6$
GLYCOLYSIS	-> 2 PYRUVATE	
	ATP NET GAIN:	2
	NADH NET GAIN:	2
PYRUVATE DEHYDROGENASE	NADH GAIN:	2
CITRIC ACID CYCLE	ATP GAIN:	2
	NADH GAIN:	6
	FADH ₂ GAIN:	2
ELECTRON TRANSPORT CHAIN		
OXIDATIVE PHOSPHORYLATION	NADH -> ATP:	30
	FADH ₂ -> ATP:	4
	PROTON GRADIENT YIELD:	34
		38

Theoretical
Maximum



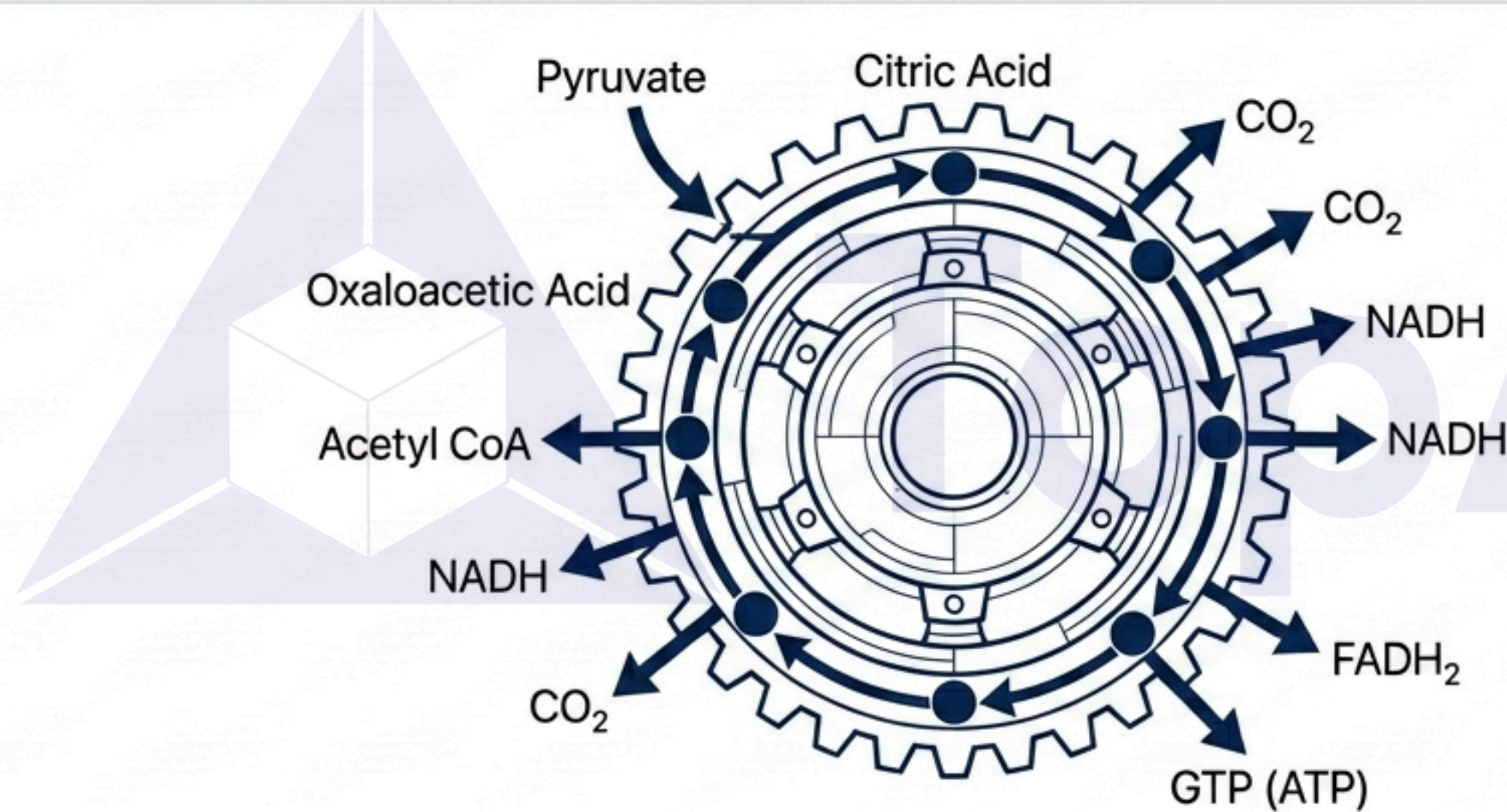
Phase 1: The Glycolytic Investment

Glucose (6C) $\rightarrow$ 2 Pyruvic Acid (3C)



Phase 2: The Krebs' Cycle (TCA)

2 Pyruvate $\rightarrow$ 2 Acetyl CoA $\rightarrow$ 6 CO₂



Multiplied for 2
Pyruvate molecules
(1 Glucose)

Direct ATP +2
(via GTP):

NADH + H⁺: +8

FADH₂: +2



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$$E=mc^2$$



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Key Highlights

- » Free Study Material, Videos & Infographics
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- » Climb the Leaderboard Among Fellow Aspirants
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- » Get Clear Explanations, Not Just Marks
- » Track Your Performance Smarter



Phase 3: The ETS “Cash Out”

Conversion Matrix

10 NADH × 3 ATP	= 30 ATP
2 FADH ₂ × 2 ATP	= 4 ATP
Glycolysis & TCA	= 4 ATP

Net Theoretical Yield: 38 ATP

The Fragile Math: 4 Theoretical Assumptions

Sequential,
orderly pathway
(Glycolysis ->
TCA -> ETS).

**Pathways run
simultaneously**

Cytosolic NADH
perfectly
transfers to
mitochondria.

**Transfer
mechanisms
vary in
efficiency**

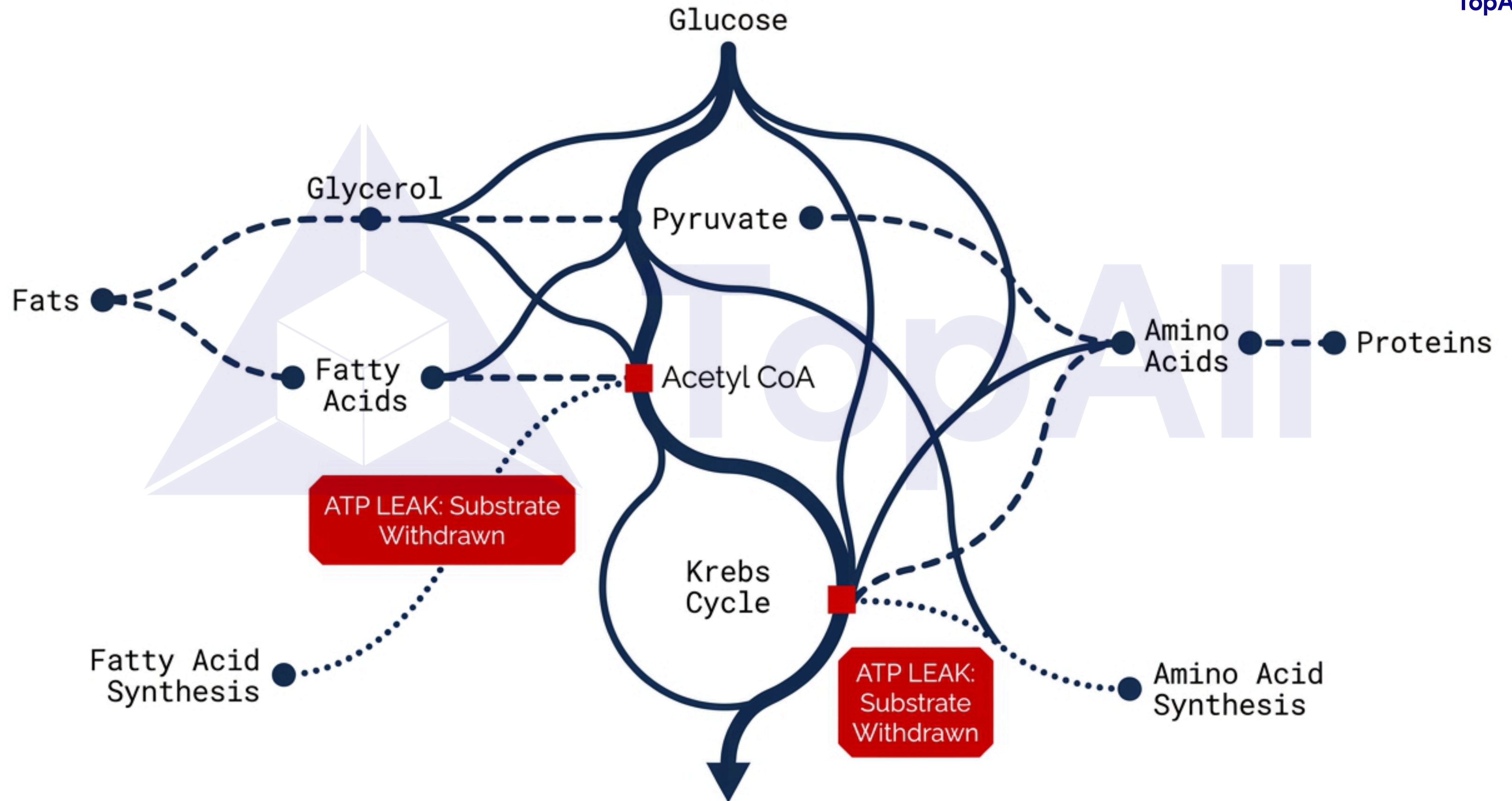
Intermediates
are never
extracted.

**Precursors
constantly
diverted.**

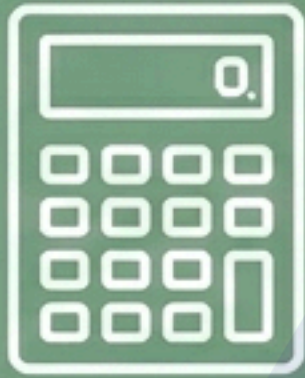
Only glucose
is respired.

**Fats &
proteins
also enter**

The Reality: Amphibolic Pathways



The Value of the Theoretical Model



Efficiency
Benchmark



Living
Reality

If 38 ATP is impossible, why calculate it?

It serves as a vital benchmark. While cellular pathways are messy, simultaneous, and amphibolic, calculating the maximum theoretical yield allows us to appreciate the incredible thermodynamic efficiency of living systems in extracting energy.



You've Learned the Theory.

Now Let's Test It.

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