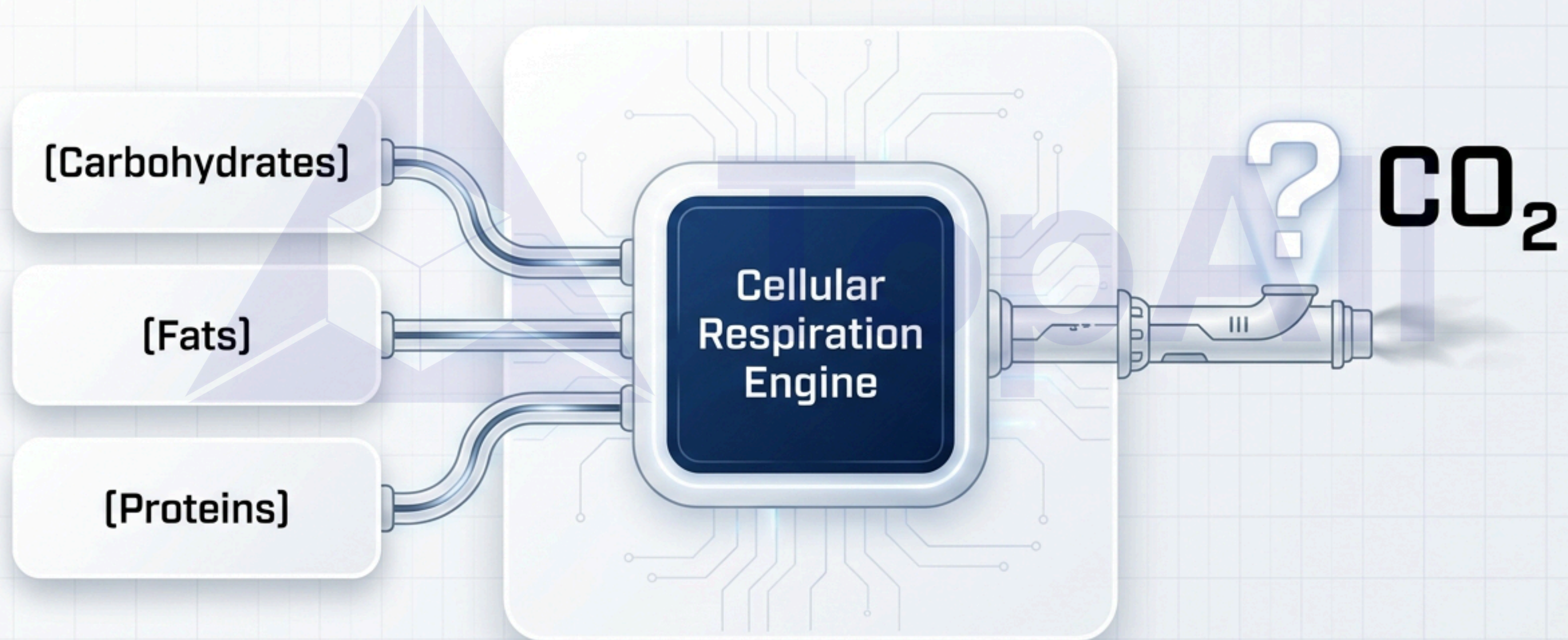
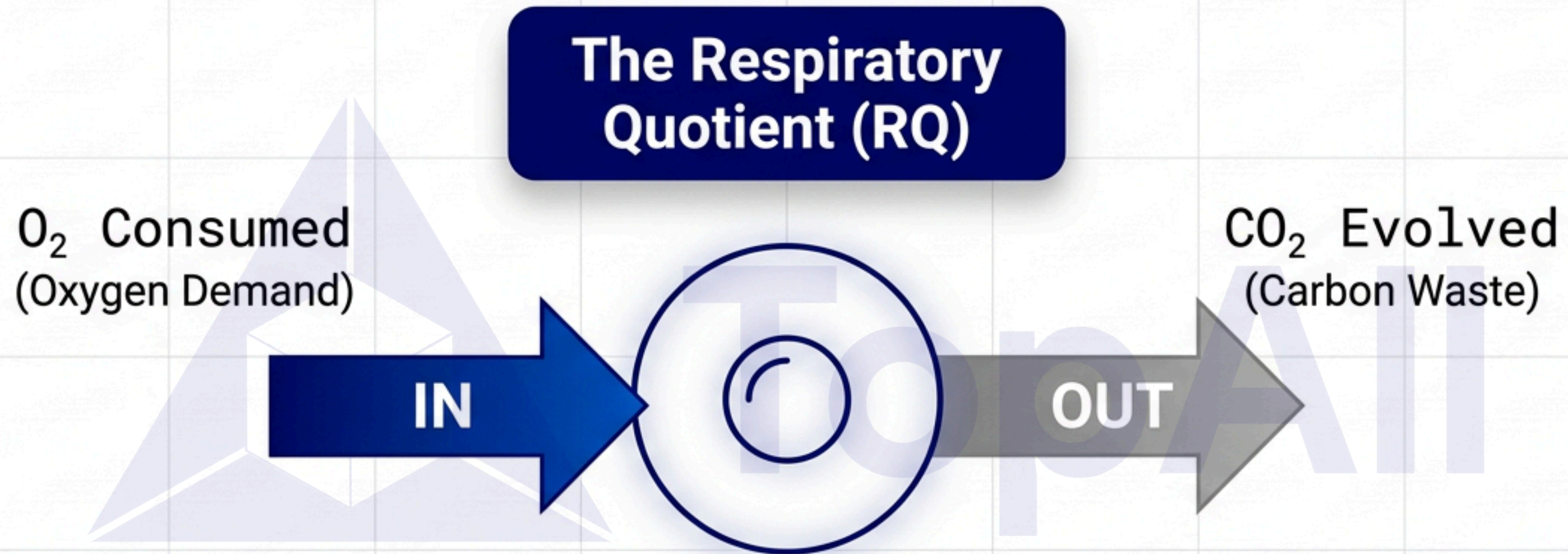


What Fuel Is the Cell Burning?

By measuring the exhaust, we can diagnose the exact fuel source driving cellular metabolism.



The Diagnostic Metric



During aerobic respiration, living tissues consume oxygen and release carbon dioxide. The specific ratio of these two gases acts as a distinct metabolic fingerprint, revealing the precise nature of the respiratory substrate being oxidized.



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Calculating the Respiratory Quotient



$$RQ = \frac{\text{Volume of CO}_2 \text{ Evolved}}{\text{Volume of O}_2 \text{ Consumed}}$$

Carbon Waste Output

External Oxygen Demand

The RQ formula is a simple volume ratio. Because different organic molecules contain different internal ratios of carbon to oxygen, they require vastly different amounts of environmental oxygen to completely burn.

Carbohydrates: Perfect Balance

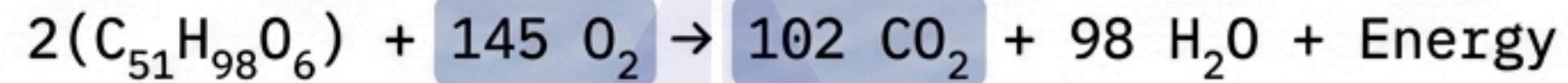
Glucose: RQ = 1.0



$$6 / 6 = 1.0$$

Carbohydrates contain enough internal oxygen to maintain a 1:1 ratio. For every molecule of oxygen consumed from the environment, exactly one molecule of carbon dioxide is produced.

Fats: High Oxygen Demand



Tripalmitin: $\text{RQ} = 0.7$

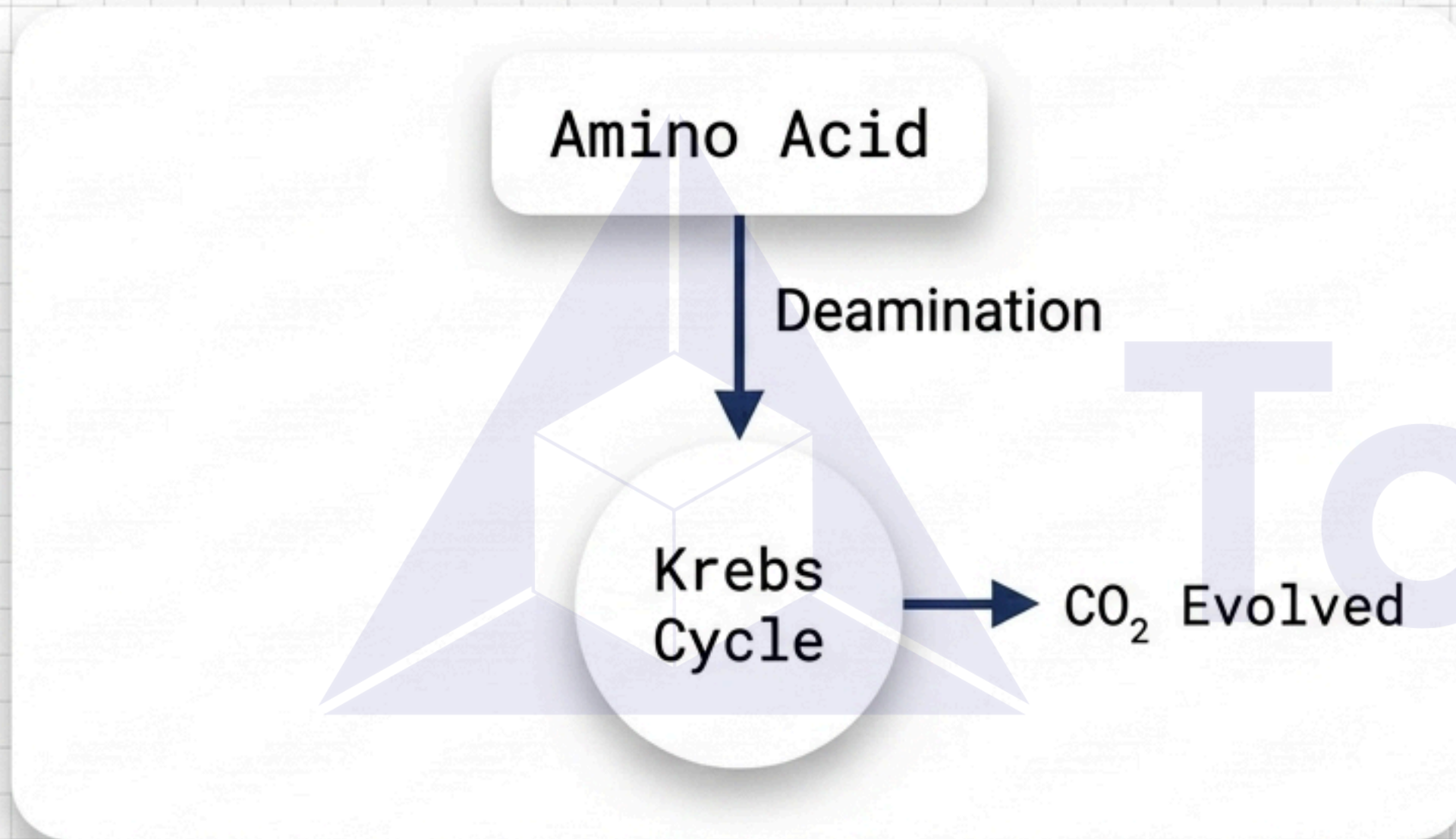


Warning: Oxygen Deficit. Fats have highly reduced hydrocarbon chains with very little internal oxygen (only 6 oxygen atoms for 51 carbons in Tripalmitin!).

$$102/145 = 0.7$$

Because fats lack internal oxygen, the cell must import a massive amount of external O_2 to complete the combustion, driving the denominator up and the RQ down.

Proteins: The Complex Substrates



Proteins: RQ $\approx$ 0.9



~ 0.9

Proteins are highly variable macromolecules. When deaminated amino acids are used as respiratory substrates, the ratio of carbon dioxide evolved to oxygen consumed averages out to slightly less than 1.0.

The Amphibolic Reality

Carbohydrates		1.0		Proteins		~0.9		Fats		0.7
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Reality Check

While these pure RQ values are vital diagnostic baselines, living organisms utilize an **Amphibolic Mix**.

In reality, pure **proteins** or **pure fats** are **almost never respired in total isolation**. Cellular metabolism dynamically **mixes respiratory substrates** based on **immediate physiological needs**.



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