#1 ATP

The Currency of Muscle Contraction

Adenosine triphosphate — ATP — is the **only molecule a muscle cell can actually spend to produce movement.** Every stride a racehorse takes requires ATP. Every training adaptation is ultimately about the body getting better at producing and regenerating ATP faster than it is being consumed.

Everything a horse eats — carbohydrate, fat, protein — must first be converted into ATP before a single muscle fibre can contract. **Feed is not fuel until it becomes ATP.** This is why feeding decisions and training decisions are inseparable: the goal is always to supply enough raw material to regenerate ATP at the rate the work demands.

KEY POINTS

- ATP is the *only* direct fuel for muscle contraction — no ATP, no movement
- The body cannot store large amounts of ATP — it must be **continuously regenerated** during exercise
- Three energy systems all serve the same function: rebuild ATP as fast as it is used
- Training improves the horse's ability to **regenerate ATP faster and more efficiently**
- Understanding ATP makes every training and feeding decision logical, not guesswork

THE NUMBERS

A horse's muscles can only store enough ATP for **1–2 seconds** of maximal effort. Everything beyond that relies on regeneration systems working in real time.

WHY IT MATTERS

The three energy systems — phosphocreatine, glycolytic, and aerobic — are simply **three different ways to rebuild ATP**. Speed, endurance, and recovery all come back to this single molecule.

STABLE QUESTION

"When your horse tires mid-race, what is actually running out — and what does that tell you about what to train?"

TRAINER TAKEAWAY

Every training session, every feed choice, every rest day has one ultimate purpose: ensure the horse can regenerate ATP fast enough for the work being asked of them. When you understand ATP, training stops being routine and starts being **deliberate**.

#4 The Aerobic System

The Dominant Energy Engine for Racehorses

The aerobic system uses **oxygen and mitochondria** to burn carbohydrate, fat, and some protein, producing large amounts of ATP per fuel molecule. It is not the fastest system — but it is by far the **biggest, most efficient, and most trainable** of the three energy systems.

For any race distance beyond a short sprint, the aerobic system is doing the majority of the work. Even in a 1200m race, aerobic metabolism contributes **over 70% of total energy production.** Trainers who underestimate this system and focus only on speed work are leaving the most trainable system underdeveloped.

KEY POINTS

- Kicks in within seconds of exercise onset; reaches full contribution at **2–3 minutes**
- Dominant energy system for **all races beyond a very short sprint**
- Horses produce up to **200+ ml/kg/min VO_2max** — roughly 3× elite human capacity
- The aerobic system is the **most trainable** of all three energy systems
- A strong aerobic base also speeds **recovery** between hard workouts

FUEL SOURCES

At lower intensities: **fat is the primary fuel**, sparing glycogen. As intensity rises, carbohydrate takes over. Training improves fat-burning efficiency — a critical adaptation for stamina horses.

TRAINING STIMULUS

Long, lower-intensity work builds the aerobic base. Short high-intensity bursts early in a session drive **mitochondrial growth** in fast-twitch fibres. **Both are needed.**

STABLE QUESTION

"How much of your weekly programme is genuinely building the aerobic engine — versus sharpening speed that doesn't yet have a base to sit on?"

TRAINER TAKEAWAY

Your slow, long work days are not easy days — they are **aerobic engine days.** The horse that can sustain a high aerobic output for longer, and recover faster between efforts, wins more races over a season. The aerobic system is the foundation everything else is built on.

CONNECTS TO →

Wednesday (Concept #3): The anaerobic system bridges the gap when aerobic supply cannot keep up — understanding both together explains every race fade. | **Friday (Concept #5):** VO_2max is the ceiling of aerobic capacity — the number that quantifies how big this engine actually is.