Farah, Bolt — a study in science

FOR athletics fans, Usain Bolt vs Mo Farah over 600m offers an enthralling spectacle, as the most dominant athletes at the extremes of track running test themselves with one foot in the other's domain.

Predicting the winner is an exercise in stats, performance analysis and physiology. The fascinating question is where do the physiologies of these two "extreme" athletes cross? Key to that question is understanding the origin and capacity of the energy pathways used by each, and what it means for fatigue.

It boils down to a different question for each man. For Bolt, it's whether he can withstand the fatigue of going 300% further than his normal distance, and how much he would need to slow down to avoid complete failure to even finish. For Farah, it's whether his top speed is high enough to pressurise Bolt into premature fatigue.

A quick physiological lesson will explain: when you see athletes tying up and slowing down dramatically at the end of a sprint race, what you are witnessing is the result of a failure of energy production as well as a build up of metabolic by-products in the muscle. Nobody knows the full explanation for this, and it's likely far more complex than any current theory can explain, but the result is that the fatigued muscle becomes less powerful, and the brain also responds to physiological changes by holding the athlete back for his own protection. Fatigue thus occurs partly in the brain, partly in the muscle.

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The source of energy is crucial to both, and Bolt and Farah rely on different pathways for their energy. Bolt has a highly developed pathway that produces the energy needed for muscle contraction very rapidly, but not for very long.

His energy comes primarily from what are known as oxygen-independent (or anaerobic) pathways. They are all about speed, and the consequence — build-up of metabolites, is an accepted downside because he doesn't need more than 20 seconds of explosive power.

Farah can produce energy for hours, but more slowly, using primarily oxygen-dependent, or aerobic pathways.

There is always some contribution from both pathways, no matter the distance, but for shorter, high-intensity exercise like sprinting, the oxygen-independent pathways are more heavily relied upon (in the 200m event, for instance, the split is 70%-30% in favour of energy production without oxygen. By 1 500m, it is 30%-70%).

So, as much as Bolt and Farah lie at the opposite ends of the performance spectrum, they are also extremes of energy production. Their muscles also differ — Bolt's are more contractile, able to contract rapidly and forcefully, but they also fatigue more rapidly. Over the 600m, Farah will be forced to find a force and speed of muscle contraction and energy production with which he is unfamiliar, while Bolt will be asking his biochemistry to withstand an accumulation of metabolites and resultant fatigue that he is also unaccustomed to.

As for a prediction, the biochemical odds are slightly tilted in Farah's favour.