Olympic Gold Begins with Good Genes

by Stefan Lovgren

Michael Phelps is 193 centimeters tall and **weighs** 88.5 kilograms, with the **broad** shoulders and slim waist common to the elite swimmer. But consider his body **measurements** a little closer and it becomes clearer why Phelps is dominating these Olympic Games. He has an **extended** trunk and relatively short legs, a **distinct** advantage in the water. The inseam of his pants (trousers) is **reportedly** 81 centimeters, shorter than that of Hicham El Guerrouj, the great Moroccan runner, who is 175 centimeters but all legs. Phelps has double-jointed elbows, knees, and ankles, which allows him to bend himself like few swimmers can. His (European-size) 48.5 feet are like giant fins. Add to that the extraordinary work **rate** of his lungs and heart and Phelps appears almost superhuman—a different species from the rest of us. Of course, he also trains **extraordinarily** hard. But so do others. To be an Olympic champion, a person's genes must first be **set up** for maximum athletic **performance**. After all, great athletes are born, then made better. "The best athletes in the world are a result of good genes and optimal training," said Phillip B. Sparling, who is a professor of applied physiology at the Georgia Institute of Technology in Atlanta. "A person who has great dedication, motivation, and excellent training will not **achieve** world-class level unless he or she has **inherited** a supercharged physiological system for the sport."

Stretching the **boundaries** of normal physiology, elite athletes strive **primarily** for **strength**, speed, and **endurance**. The speed of a sprinter is **determined** in large part by physiology. Muscle proteins, including key energy-producing enzymes, are dictated by genes, as is **muscle**-fiber **composition**. Great sprinters, like Maurice Greene and Marion Jones, have a high percentage of fast-twitch muscle fibers. These fibers **contract** quickly but tire quickly too. A cyclist, in contrast, needs great lung capacity, for superior endurance, and strives for a high "VO2 max," the maximum amount of oxygen the lungs can **use up**. Great cyclists generally have an extraordinary heart capacity. The **average** resting **heart rate** is 66 to 72 beats per minute (bpm). A well-trained endurance athlete has a resting heart rate of 40 bpm. Miguel Indurain, a five-time Tour de France winner and Olympic gold medalist in 1996, recorded a resting heart rate of 28 bpm. In the mountain stages of the Tour de France, Indurain could take his pulse rate up to 190 beats per minute and drop it back to 60 on the descent within half a minute. To a varying degree, these **traits** are all **hereditary**. As the renowned Swedish exercise physiologist Per-Olof Åstrand once said, "The most important thing an aspiring athlete can do is to choose the right parents."

Stephen Gladstone, the head crew coach at the University of California, remembers when Sebastian Bea, a 2000 Olympic silver medalist in rowing, began training in the fall of 1996. "I saw immediately that he was at a level you can't **get to** without significant gifts," Gladstone said. "His endurance capabilities were phenomenal. He could **go on** forever." No wonder: Bea's father was an Olympic basketball player, and his mother was a swimmer. The performance **gap** between men and women in sports is also due to genetics. Androgens – sex hormones such as testosterone – make males taller, heavier, and more muscular than females. "**Consequently,** when applied to human sports competition, men are faster and stronger," Sparling said. "These are simply biological truths **associated with** being male or female."

So, how much better can elite athletes get? Some scientists have **noted** that world records have been broken more **seldom** in recent Olympics than they were in, say, the 1970s and 1980s. This has led some experts to **suggest** that human beings are finally **approaching** the limits of their physical **accomplishment**. Gladstone disagrees. "Every generation feels as if this is it – we can't go any faster, we can't go any further," he said. "Then somebody comes along and breaks the record and the same pundits will be on board to explain why it happened." But most scientists agree that we have entered an era of smaller **improvements**, in which the time periods between world records could become longer. "If you graph the improvement of a sport, the **slope** of the **curve** will angle up **sharply** at first," Henson said. "But as athletes improve, the slope of the curve decreases and begins to **level off**." "No one is ever going to run a mile in 60 seconds," he said. "On the other hand, I don't know if we will ever reach the point where we say a record can't be broken."

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