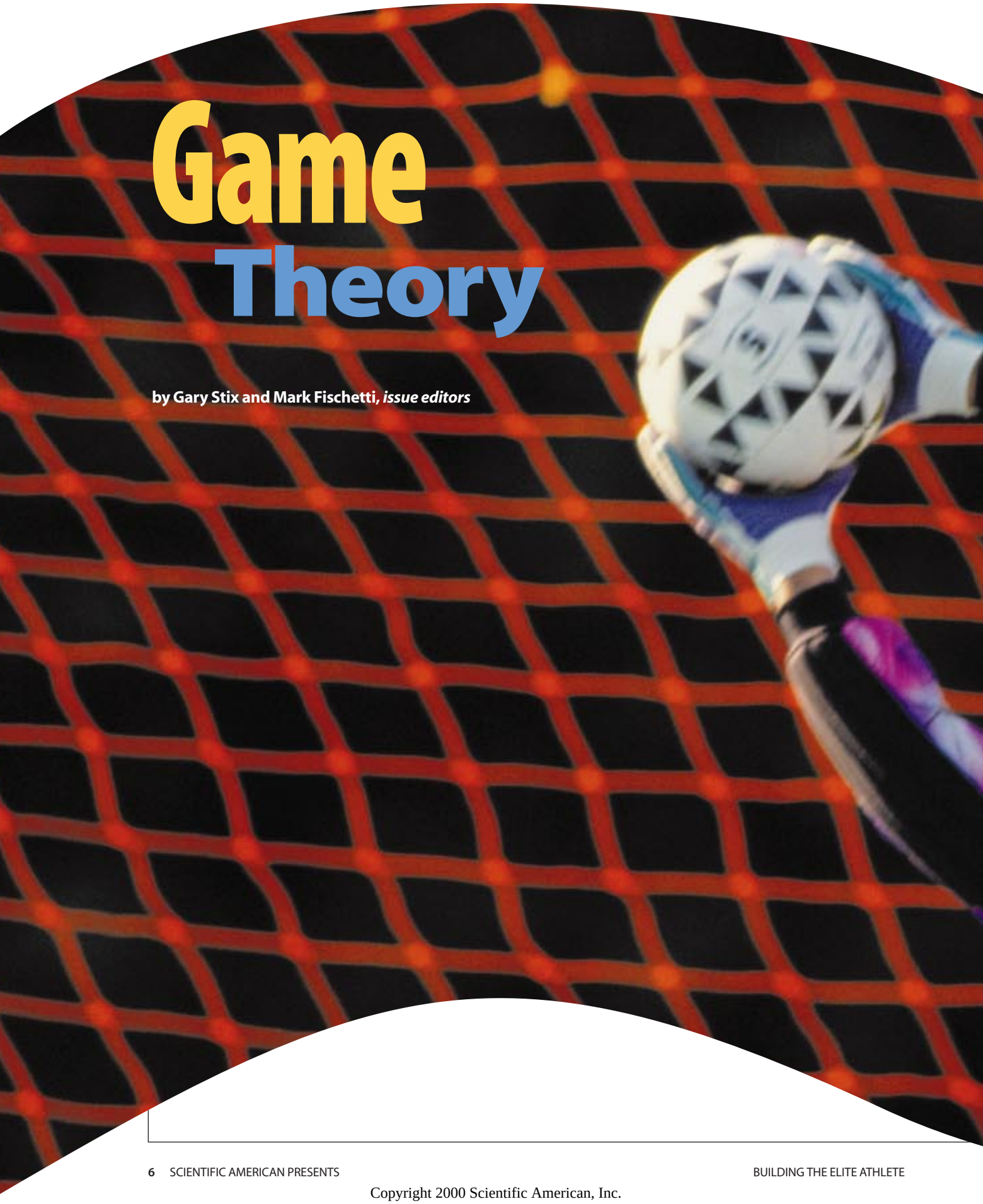

Game Theory

by Gary Stix and Mark Fischetti, *issue editors*

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At the ancient Olympics, the Greeks practiced the long jump. But no one really knew how long anyone jumped. Exact distance was a sketchy notion. As sports historian Allen Guttmann notes, a unit of length in Sparta differed from one in Athens. Comparison of performances from one competition to the next was impossible and bore no interest anyway to the sponsors of what were mostly religious and ritualistic events.

It wasn't until a few millennia later that modern sport made its debut, characterized by precise quantification of distance and time. The machine age began an era of standardization in sport, which prompted rules and regulations, timepieces, set-length playing fields, scoring systems and sophisticated equipment.

This rationalism was gradually applied to improving an athlete's body and skill. Physical conditioning has ancient roots in the Greek and Roman desire to develop superior soldiery. But a rigorously scientific approach to *citius, altius, fortius*—the Olympic motto of swifter, higher, stronger—came only in the 20th century.

Today the burgeoning base of scientific and technical knowledge in industrial countries has channeled enormous effort into transforming sport into science that goes beyond traditional trial-and-error methodology. To provide the elite athlete with that critical edge, scientists and technologists are now trying to de-

fine athletic performance as a set of physical parameters (force vectors and acceleration), biological processes (pulse rate and maximum oxygen uptake) and mental states (psyched up or psyched out).

Physiologists, kinesiologists, nutritionists, biomechanists and psychologists (and sometimes even coaches) have put their thoughts to formulating questions about how to translate fundamental insights from physics and biology into practical training technique. Is there a "perfect" swimming stroke that can create the hundredths-of-a-second advantage that distinguishes a winner from an also-swam? Can skateboarders, snowboarders, gymnasts and divers perform even more complex maneuvers with a better understanding of how to exploit the physics of twisting bodies?

Inquiries into physiology can sometimes spill over into sociology: Do black athletes have an inborn advantage over whites? And why is it that certain poor, tiny countries are able to produce the dominant players in particular international sports?

Engineering better equipment can aid athletes as well—sometimes too much. Advances in golf balls, javelins, speed skates and tennis rackets have so improved performance that occasionally they have had to be regulated or banned so as not to undermine the fundamental human challenge that defines a game.

Technology has also helped spawn the phenomenon of extreme sports: rebreathers used by cave divers, which recycle their own breathing gases, let them remain submerged in black, water-filled passages deep in the earth for more than 12 hours.

The importance that society accords to ensuring the health and welfare of a linebacker or point guard has fostered a concurrent boom in sports medicine. Clearer understanding of how an individual responds to being elbowed repeatedly in the head during the course of a hockey season has led to a startling lesson about the physiology underlying concussions—even a series of seemingly minor blows can cause permanent damage to the brain. And the widespread participation of women in sports has prompted a long-overdue focus on the special types of injuries they experience.

Sports scientists may have finally reached a point where they have bragging rights. New insights into fast-twitch muscle fiber and VO_2max, combined with the introduction of better gear, may help explain why almost every athletic record in the books continues to be broken. And this unceasing one-upmanship highlights a more profound scientific debate over whether we have begun to approach the limits of human performance in running, jumping and lifting.

All this achievement, though, masks a stark reality. So far we have attained only an imperfect realization of sport as science. Logically, the search for the ultimate athlete would culminate in combing through human DNA for genes that can distinguish between the future Olympian and someone who

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will have a tough time making high school junior varsity. Genetic investigators have found a few tantalizing clues but mostly dead ends for what could pass as "performance genes." Coaches, too, are often at odds with a science that in some cases replaces one theory with another every few years. Does the Bernoulli effect or Newton's third law explain a swimmer's propulsion? Does it matter? And sports psychology, which is supposed to keep the athlete locked into the mental game, may be less a system for training the mind than a sophisticated pep talk clothed in jargon.

The notion of the engineered athlete has also suffered because some citadels of sports science have turned out to be Potemkin villages. Confessions and court inquisitions have shown that the Soviet and East German sports institutes—which trumpeted themselves as bellwethers of systematic, dispassionate training—guaranteed success by serving as major dispensaries for anabolic steroids.

Still, sports science will have its contribution to make. As records keep falling and competition intensifies, it will become ever more difficult for an athlete to shave off that extra hundredth of a second or to squeeze another millimeter of clearance over the bar in the unceasing quest to win a ticket to the top step on the winner's podium at the next Olympics. Any leverage an athlete or coach can wrest from the wisdom of a Newton or from the engineering wizardry of a Nike will be welcomed.