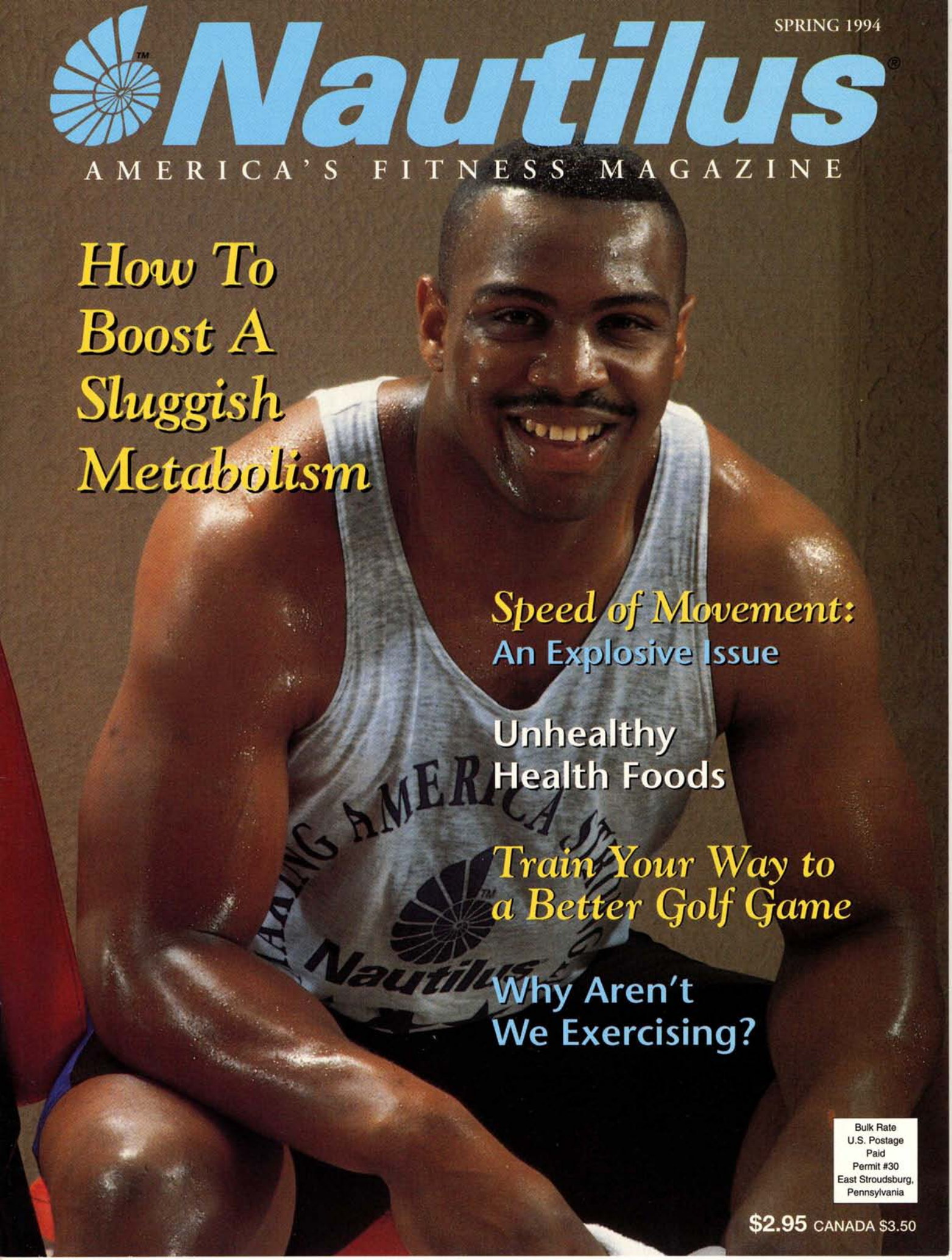
SPRING 1994

Nautilus

AMERICA'S FITNESS MAGAZINE



How To Boost A Sluggish Metabolism

Speed of Movement: An Explosive Issue

Unhealthy Health Foods

Train Your Way to a Better Golf Game

Why Aren't We Exercising?

Bulk Rate
U.S. Postage
Paid
Permit #30
East Stroudsburg,
Pennsylvania

$2.95 CANADA $3.50

SPEED OF MOVEMENT: AN EXPLOSIVE ISSUE

BY MATT BRZYCKI

Invariably, athletes and coaches are always looking for ways to increase speed, power and explosiveness. The search for these elusive athletic ingredients has led to one of the most heavily-debated subjects in the field of strength and fitness.

The dispute concerns the speed at which an exercise or movement should be performed. Essentially, there are two schools of thought: some strength and fitness professionals advocate high velocity or explosive movements that are ballistic in nature, whereas others recommend deliberate movements that are performed in a controlled manner.

The Birth of a Controversy

In 1970, Nautilus first began educating fitness enthusiasts by providing guidelines for safe and efficient strength training. In retrospect, this was a critical time to disseminate training advice since the so-called "fitness boom" was just entering it's embryonic stage. Included in this new information was the suggestion that each repetition should be done by raising a weight in two seconds and lowering a weight in four seconds. (This was sometimes referred to as simply "up two, down four.")

During that era of resistance exercise, protocols were heavily influenced by the opinions and training methods of the competitive, Olympic-style weight lifters, who perform their repetitions in a rapid, explosive fashion. The advancement of the idea that weights should be lifted with a controlled speed of movement went against the prevailing train of thought, sparking a fiery controversy that continues to rage.

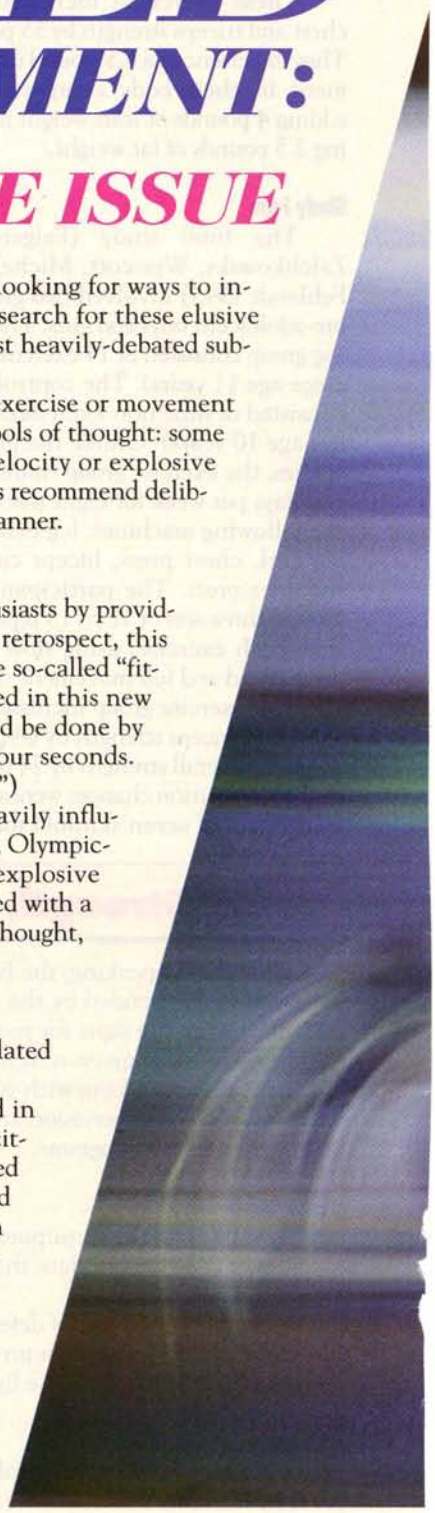
Questionable Research

The debate over the appropriate speed of movement has stimulated quite a number of research studies.

Unfortunately many of the studies have left much to be desired in terms of providing definitive conclusions. One of the most frequently cited studies used by advocates of explosive training is the research performed by Moffroid and Whipple in 1970. Their research has been referenced hundreds of times as evidence that weight training should occur at high speeds. However, the authors violated a basic principle of statistical analysis and experimental design. As a result, their conclusions were unsupported by their data.

Fiber Recruitment

Proponents of high speed movements argue that to become "explosive," you must train in an "explosive" manner. Their assumption is that by lifting explosively in the weight room, the fast speed of movement will



Encouraging anyone to explode with a weight is inviting musculoskeletal trauma.

somehow change the chemical composition of the slow twitch fibers and/or preferentially recruit the fast twitch fibers. The truth is that there's no conclusive evidence in the scientific literature to firmly support the notion that muscle fibers can be changed from one type to another. In addition, the selective recruitment of muscle fibers is physiologically impossible. Muscle fibers are recruited in an orderly fashion according to the intensity or force requirements and not by the speed of movement. Demands of low muscular intensity are met by the slow twitch fibers.

Intermediate fibers are recruited once the slow twitch fibers are no longer able to continue the task. The fast twitch fibers are finally recruited only when the other fibers cannot meet the force requirements.

In short, there is absolutely no definitive proof that movements performed in an explosive or ballistic manner will bypass the slow twitch and intermediate fibers to specifically recruit the fast twitch fibers. In a nutshell, muscle fibers are recruited by need, not speed.

The Principle of Specificity

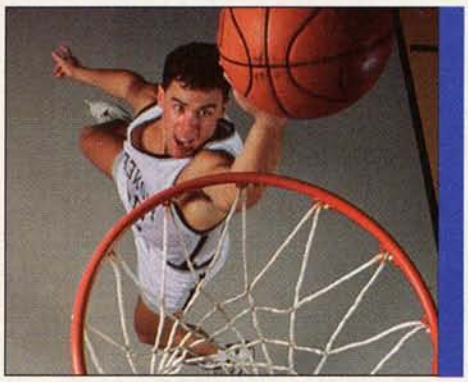
It is also believed that lifting weights explosively will "carry over" to explosive movements performed in the athletic arena. As such, those who favor explosive training are quick to offer "specificity" as a justification for their methods. For instance, power cleans have long been touted as being specific to an incredibly wide variety of skills from the breast stroke to the golf swing to the shot put. How is it possible for this one movement to be specific to such a broad range of differing skills? Answer: It can't.

The Principle of Specificity continues to be frequently misinterpreted and misused. The principle states that your activities must be specific to an intended skill for a maximal transfer of learning — or carryover — to occur. Specific means exact or identical, not similar or just like. So while power cleans may be similar to driving off the line of scrimmage, and lunges may be just like driving toward the basket, the truth is that power cleans will only help you get better at doing power cleans, and lunges will only help you get better at doing lunges.

Likewise, heaving medicine balls is great for improving your skill at heaving medicine balls and nothing else. There's simply no evidence in the motor learning literature to support the notion that explosive lifting in the weight room will contribute to improving explosive movements on the athletic field. Remember, it's the Principle of Specificity, not the Principle of Similarity.

Momentum

Aside from all the scientific facts concerning muscle physiology and specificity, lifting weights in a rapid, explosive fashion is not recommended for two reasons. First of all, explosive lifting introduces momentum into the movement, which makes the exercise less productive and less efficient. After the initial explosive movement, little or no resistance is encountered by the muscles throughout the remaining range of motion. In simple terms, the weight is practically moving under its own power.



To illustrate the effects of momentum on muscular tension, imagine that you pushed a 100-pound cart 50 yards at a steady, deliberate pace. In this instance, you maintained a constant tension on your muscles for the entire 50 yards. Now suppose that you were to push the same cart another 50 yards. This time, however, you accelerated your pace to the point that you were running as fast as possible. If you were to stop pushing the cart after 35 yards, the

cart would continue to move by itself because you gave it momentum. So your muscles had resistance for the first 35 yards . . . but not for the final 15 yards. The same effect occurs in the weight room. When weights are lifted explosively, there is tension on the muscles for the initial part of the movement, but not for the last. In effect, the requirement for muscular force is lessened, and the potential strength gains are reduced accordingly.

Secondly, explosive lifting can be dangerous. Dr. Fred Allman, a past president of the American College of Sports Medicine, has stated: "It is even possible that many injuries . . . may be the result of weakened connective tissue caused by explosive training in the weight room."

Here's why: Using momentum to lift a weight increases the internal forces encountered by a given joint; the faster a weight is lifted, the greater these forces are amplified. An injury occurs when the forces exceed the structural limits of a muscle, bone or connective tissue. No one knows the exact tensile strength of muscles, bones and connective tissue at any given moment. And unfortunately, the point of discovery is often too late.

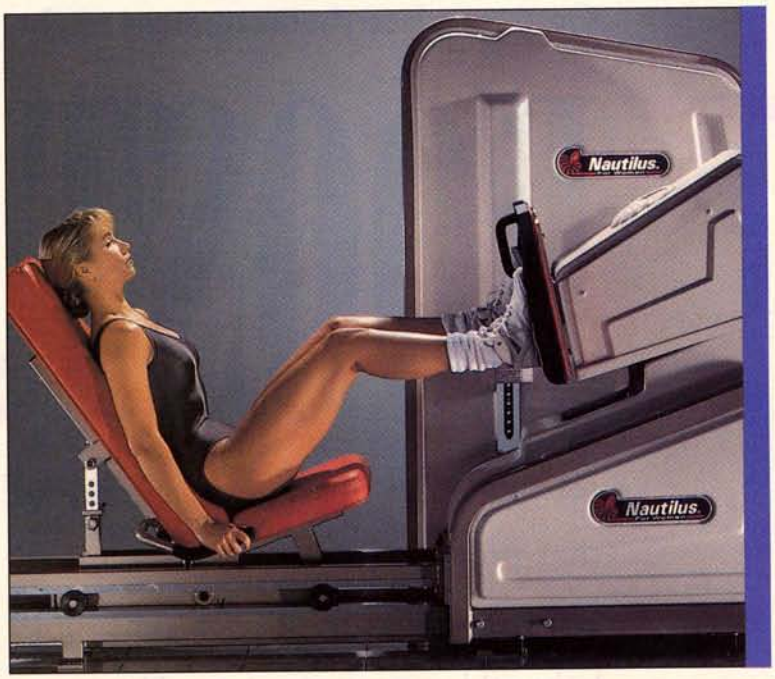
Assuming that an object's mass (or weight) does not change, the amount of potential force is directly related to the object's acceleration. In other words, as the speed of movement increases, so does its potential force. This isn't merely an opinion or observation — it's a fundamental law of physics called Newton's Second Law of Motion.

So if slower speeds of movement are safer, doesn't it follow that faster speeds of movement are more dangerous? Proponents of explosive training sometimes counter that many sports, football and wrestling, for example, pose inherent risks to its participants anyway. However, using potentially dangerous techniques in the weight room to prepare for potentially dangerous activities is like banging your head against the wall to prepare for a concussion.

Indeed, encouraging anyone to explode with a weight is inviting musculoskeletal trauma. The only thing that might explode is the biological tissue from its point of insertion.

Understanding Explosiveness

When someone is described as being "explosive" on an athletic field, we are essentially saying that the athlete performs, moves or reacts quickly and forcefully. This is primarily due to the fact that the athlete's movement patterns for a particular skill are so firmly ingrained in his or her "motor memory" that there is little or no wasted effort. In other words, it's because the athlete is highly efficient at performing the intended sports skill — not because the athlete practiced explosive movements with barbells, medicine balls or other stage props.



Resistance should be met without jerking or explosive movements and then lowered under control.

A Safer Way

Absolutely no one knows exactly how fast a repetition should be performed, nor will this ever become a firm rule. Regardless, one thing is certain. It is far safer and efficient to lift weights in a controlled manner.

Whether you're using machines or barbells, the weight should be raised without any jerking or explosive movements and then lowered under control. Raising the weight in about one to two seconds and lowering it in about three to four seconds will ensure that speeds of movement are not ballistic in nature and that momentum does not play a significant role in the efficiency of the exercise.

Matt Brzycki is the strength coach and health fitness coordinator at Princeton University. He has authored more than 100 articles on strength and fitness and a book, "A Practical Approach to Strength Training." He has also co-authored the book "Conditioning for Basketball."