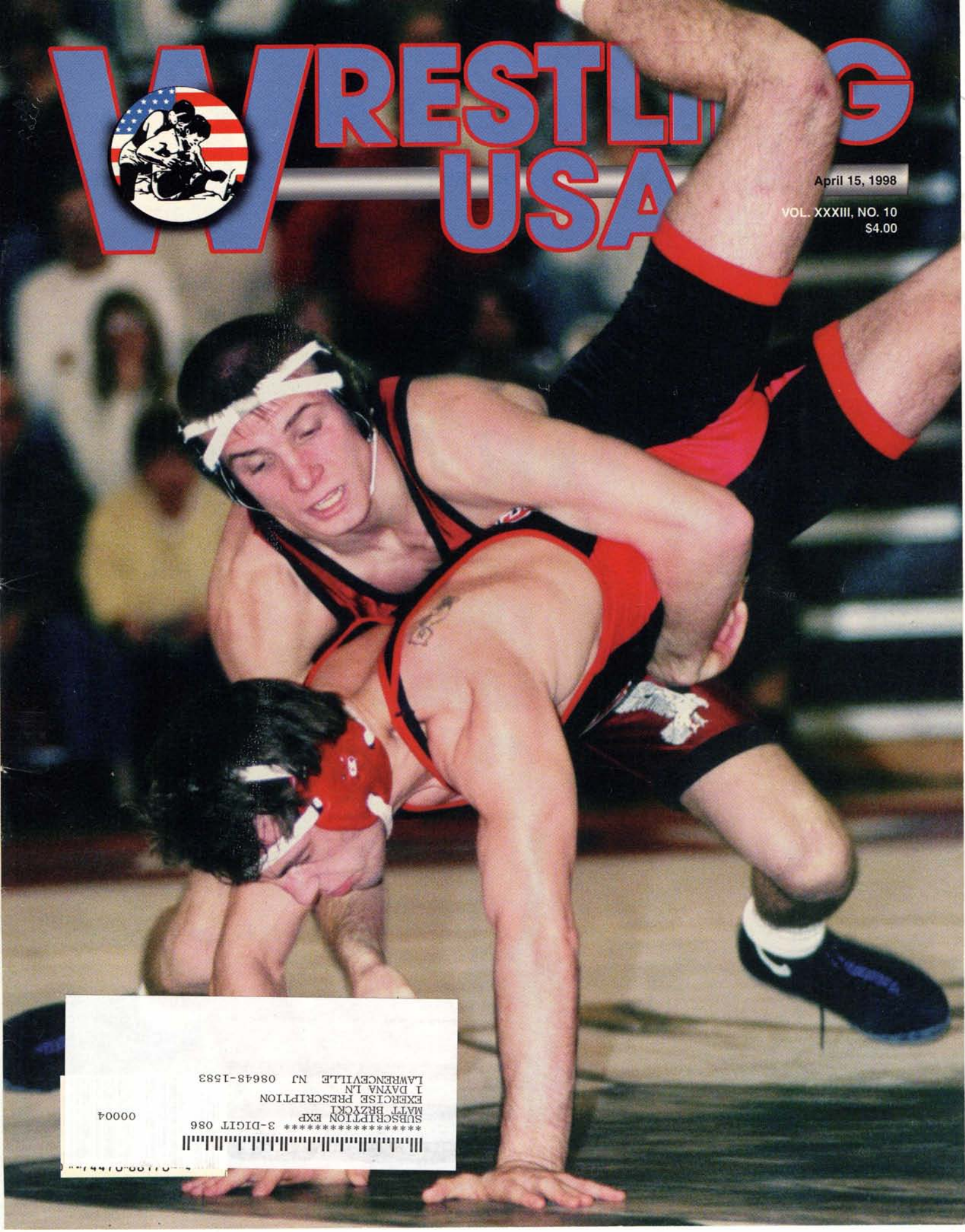
WRESTLING USA

April 15, 1998
VOL. XXXIII, NO. 10
$4.00



WEIGHT TRAINING IN WRESTLING

By Matt Brzycki
Coordinator of Health Fitness,
Strength and Conditioning
Princeton University

Fiber Types & Repetition Ranges

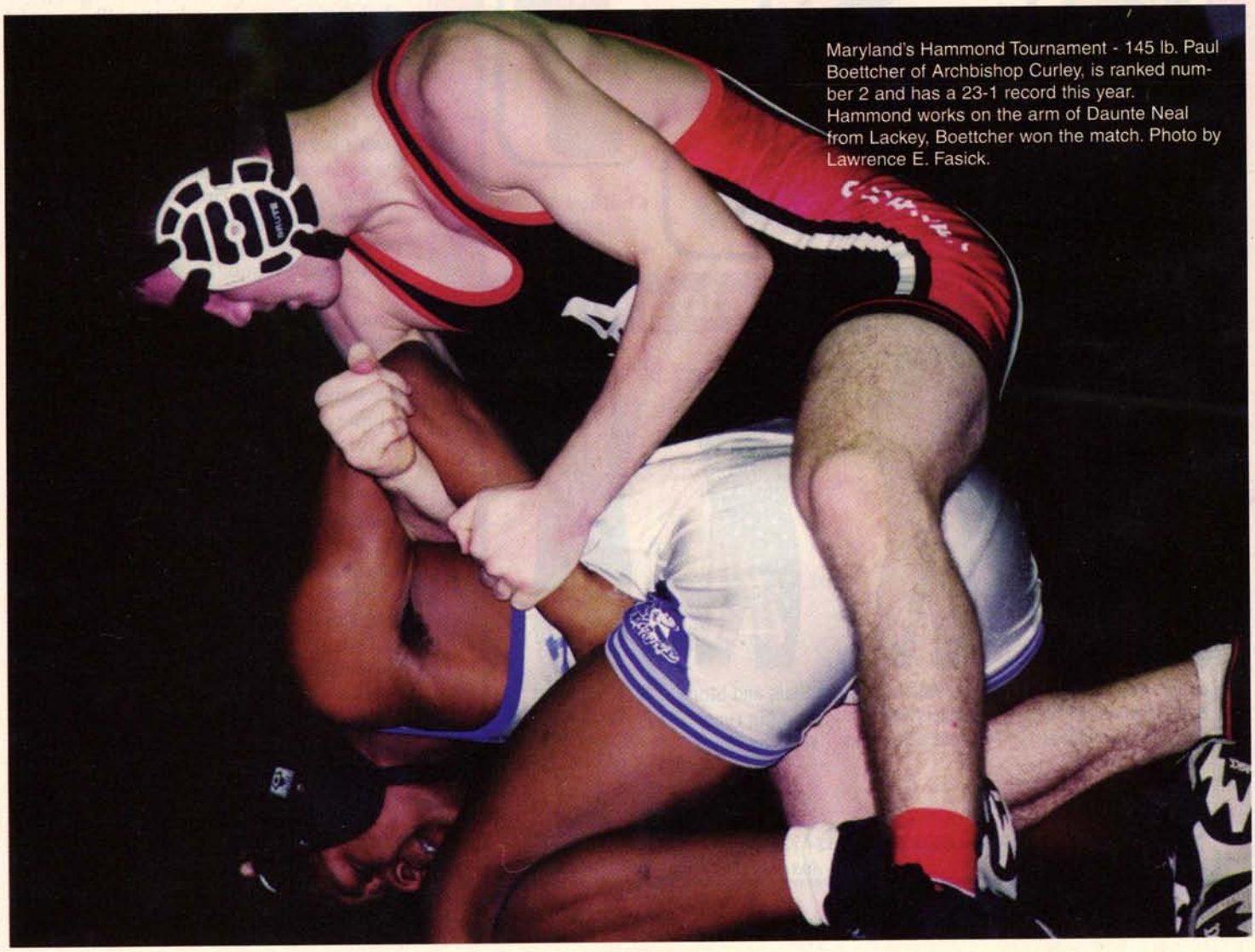
Your genetic makeup is the single most important ingredient in determining your response from strength training. One of the most influential of all your inherited characteristics is the distribution and composition of your muscle fibers.

Your muscle fiber type plays a major role in dictating your potential for improving your muscular size and physical strength. You can maximize your response to strength training by using repetition ranges that are most suited to your muscle fiber type.

MUSCLE FIBER TYPES

Fiber types may be grouped into two major categories: slow twitch (ST) or Type I and fast twitch (FT) or Type II. These two major fiber types differ in several areas including speed of contraction, force of contraction and endurance capacity. FT fibers can contract quickly and generate large amounts of force, but they fatigue rather easily. Relative to FT muscle fibers, ST fibers contract slower and produce less force, but they have greater endurance. (Some researchers also recognize one or more intermediate fiber types that possess characteristics of both FT and ST fibers.)

Your muscles are composed of both fiber types and the different types are intermingled throughout each muscle. However, the distribution of FT and ST fibers within each muscle is genetically determined. In fact, studies of twins indicate that muscle fiber composition is determined almost entirely by hereditary factors. Some athletes have inherited a predominant fiber type that allows them to be successful during efforts of varying durations. For example, a wrestler who has inherited a high percentage of FT fibers has the genetic potential to generate tremendous amounts of force in a rather short period of time and, therefore, will excel during short-term, high intensity efforts; on the other hand, a wrestler who has inherited a high percentage of ST fibers has the genetic potential to display large amounts of muscular endurance and,



Maryland's Hammond Tournament - 145 lb. Paul Boettcher of Archbishop Curley, is ranked number 2 and has a 23-1 record this year. Hammond works on the arm of Daunte Neal from Lackey, Boettcher won the match. Photo by Lawrence E. Fasick.

therefore, will excel during long-term, low-intensity efforts. It should also be noted that your fiber-type mixture will likely differ from one muscle to another and may even vary from one side of your body to the other.

IMPLICATIONS

The technical term for an increase in muscular size is hypertrophy. (Its inverse — a decrease in muscular size — is called atrophy.) Both FT and ST muscle fibers have the potential for hypertrophy. However, FT fibers display a much greater capacity for hypertrophy than ST fibers. In other words, wrestlers who have inherited a high percentage of FT fibers will have a greater potential to increase the size of their muscles. Because FT fibers can produce greater force than ST fibers, these wrestlers will also exhibit a higher potential for improvements in muscular strength.

Your potential for muscular endurance is also based upon your inherited fiber-type mixture. For example, if you have a high percentage of ST fibers, you'll have greater muscular endurance than someone who has a high percentage of FT fibers. Researchers tested an individual who could only perform one repetition with 80 percent of his maximum strength. Another person was able to execute 34 repetitions with 83 percent of her maximum strength before reaching muscular failure. She had an identical twin sister who also performed 34 repetitions with 83 percent of her maximum strength. Interestingly, neither woman was present while the other was being tested, and neither knew the results until after both had been tested.

Incidentally, there's no definitive proof that strength training increases the number of muscle fibers in humans. An increase in the number of muscle fibers — known as hyperplasia — has been demonstrated in animals but not in humans. In addition, no conclusive evidence exists to suggest that strength training will change your ST fibers to FT fibers or vice versa. Though one type of muscle fiber may take on certain metabolic characteristics of the other type of fiber, actual conversion appears to be impossible. In other words, you cannot convert one fiber type into another any more than you can make a racehorse out of a mule. So, if you were to take a mule and train it like a racehorse, you might get a slightly faster mule . . . but you'll never get a racehorse.

WHAT'S YOUR TYPE?

The only way to positively determine your fiber-type distribution is by removing a small section of your muscle by way of a biopsy and analyzing the tissue sample under a microscope. Needless to say, most people are reluctant to part with samples of their muscle tissue.

One way of guesstimating muscle-fiber type in a far less painful way is by testing muscular endurance. This is a crude but reasonably effective way of assessing muscle-fiber types based upon fatigue characteristics. Because a muscular endurance test involves determining a one-repetition maximum (1-RM), this test is not recommended for use with conventional equipment. Nevertheless, endurance testing is still quite interesting and deserves special note. Suppose your 1-RM in the leg extension is 200 pounds. An endurance test is performed with 80 percent of maximal strength or, in this case, 160 pounds. If you can do a relatively high number of repetitions with 160 pounds (more than about 15), you can assume that your quadriceps are composed primarily of ST fibers; if you perform a rather low number of repetitions with 160 pounds (less than about 5), it's likely that your quadriceps have a high percentage of FT fibers. Because the distribution of fiber types varies from muscle to muscle, an endurance test would have to be performed for each muscle group.

Again, this test is not recommended for use with conventional equipment because it involves obtaining a potentially dangerous 1-RM.

You can also make a logical guesstimate of your fiber-type make-up based upon performance variables. If you excel in efforts that require muscular endurance, you've probably inherited a high percentage of ST muscle fibers; similarly, if you excel in efforts that require speed, strength and/or power, you've likely inherited a high percentage of FT muscle fibers and should perform slightly lower repetitions.

Another way of making a reasonable assessment of your muscle-fiber type is by evaluating your muscular development. Remember, FT fibers have a much greater capacity for hypertrophy than ST fibers. Therefore, if you have well-developed muscles you probably have a high percentage of FT fibers; conversely, if you have slight muscular development you probably have a high percentage of ST fibers.

REPETITION RANGES

Once you have a general idea of your fiber type, you can use this to customize your repetition ranges thereby maximizing your response to strength training. Your muscles must be exercised for a certain amount of time with an appropriate level of intensity in order for them to increase in size and strength. In general, optimal time frames are about 90 - 120 seconds for your hips/buttocks, 60 - 90 seconds for your legs and 40 - 70 seconds for your upper torso. (The muscles of your lower body should be exercised for a slightly longer duration because of their greater size and work capacity.)

It's usually not practical for you to perform a set for a precise amount of time. However, you can use these optimal time frames to formulate repetition ranges. For instance, if you raise a weight in about 2 seconds and lower it in about 4 seconds, each repetition would be approximately 6 seconds long. Dividing 6 seconds into the time frames that were previously noted yields the following repetition ranges: 15 - 20 for your hips/buttocks, 10 - 15 for your legs and about 8 - 12 for your upper body. Remember, these repetition ranges are based upon a 6-second repetition. If you did negative-only repetitions that were 8 seconds long, the time frames mentioned earlier would be divided by 8 seconds and result in the following repetition ranges: 11 - 15 for your hips/buttocks, 8 - 11 for your legs and 5 - 8 for your upper torso.

So, repetition ranges are not as important as the length of time that a muscle is exercised. However, it's usually much more practical to count repetitions during a workout than to be followed around by someone with a stopwatch. It should be noted that attempting a one-repetition maximum (1-RM) or performing low-repetition movements that are considerably less than those dictated by the optimal time frames increases your risk of injury. Likewise, as an exercise exceeds the recommended time frames, it becomes a greater test of your aerobic endurance rather than your muscular strength.

Some wrestlers — because of a predominant muscle fiber type — may require a slightly higher or slightly lower repetition ranges than previously suggested in order to maximize their response to strength training. For example, wrestlers who have inherited a high percentage of ST muscle fibers would probably benefit more from strength training by performing slightly higher repetitions because their high percentage of ST fibers are more suited for muscular endurance. Slightly higher ranges of perhaps 20 - 25 for the hips/buttocks, 15 - 20 for the legs and 10 - 15 for the upper body would probably produce a better response for someone with a predominance of ST fibers in those bodyparts. Conversely, wrestlers who have inherited a high percentage of FT muscle fibers would probably benefit more from strength training by performing slightly lower repetitions because their high percentage of FT fibers limit their muscular endurance. Slightly lower repetition ranges of perhaps 10 - 15 for the hips/buttocks, 9 - 12 for the legs and 6 - 8 for the upper body would probably produce a better response for someone with a predominance of FT fibers in those bodyparts. In a 1987 study, sprinters trained with low repetitions, middle-distance runners with medium repetitions and long-distance runners with high repetitions. The study revealed excellent and equal strength gains in all three groups. (Successful sprinters likely inherit a high percentage of FT fibers and successful distance runners likely inherit a high percentage of ST fibers.)

THE BOTTOM LINE

One final point about FT and ST fibers: The use of lower repetitions isn't recommended to convert ST fibers to FT fibers. Likewise, the use of higher repetitions isn't suggested to convert FT fibers to ST fibers. Performing higher or lower repetition ranges is done to maximize your response based upon your already-established predominant muscle fiber type.