Nautilus Bulletin #2

26

The Second Step

More than a century ago, by a study of the bones of men who spent their lives at manual labor, it was determined that the intensity of work is a factor of great importance; even the chemical composition of the bones is changed by hard work. How much you work – the actual "amount" of work – is a factor of only secondary importance, and usually in a negative sense. In effect, "hard work" is a desirable factor – and a large "amount of work" is an undesirable factor.

Even men who spend years working at a job that requires constant repetition of fairly light movements seldom if ever develop much if any more than average levels of size-strength; while men who work much less – but harder – usually develop above average muscular mass.

Hundreds of examples could be given to prove the relationship of hard work to muscular mass – and in previous chapters, a number of such examples have been outlined; but in this chapter I want to clearly define "hard" work, to describe it in a reasonably technical sense.

Given enough time, an ant could move the pyramids from Cairo to Capetown –and in the process he would perform an enormous amount of work; while the intensity of work would never be high enough to measure in meaningful terms. In effect, the "power production" would be extremely low. The mass – the actual size – of a muscle clearly indicates its "power potential", its ability to produce power; even a very small muscle is easily capable of performing a large amount of work, but its power will be limited by its size.

One "horsepower" is the ability to lift 550 pounds a vertical distance of one foot within a period of exactly one second; or, if you can lift 550 pounds a distance of six inches within one half of a second, you are still producing one horsepower – and, obviously, an infinite number of other possible combinations of weight, distance of movement and time would also indicate a power potential of one horsepower.

From the above it should be obvious that a muscle can perform almost any amount of work while its power potential remains very low – and that its ability to produce power can be determined only by careful consideration of at least three factors, the resistance, the vertical distance of movement, and the speed of movement. In the preceding chapter we established the need for increased activity as a means of stimulating growth – an increase in activity that forces the involved muscles to work inside their existing levels of reserve ability; but it should now be obvious that increasing the "amount" of activity will not force a muscle to work inside its existing level of reserve ability, since the muscle is already capable of almost any amount of work.

Demands for work inside the existing levels of reserve ability can only be produced by forcing a muscle to produce more power – by lifting more weight the same distance in the same length of time, or by lifting the same amount of weight a greater distance in the same length of time, or by lifting the same weight the same distance in less time. One of the three involved factors – resistance, distance, and speed – must be increased, while keeping the other two factors at least constant.

It should be obvious that "speed of movement" is of the utmost importance; ten slowly-performed repetitions with 100 pounds will NOT product the same result that ten rapidly-performed repetitions with the same weight will produce – while the amount of work would be exactly the same in both cases, the power production could easily vary from almost "none" to a very high level.

In general, speed of movement should always be as great as possible; but in practice, this does not mean that actual movement will be very fast –because, if resistance is as high as it should be, then maximum-possible speed of movement may in fact be quite slow.

In order to be sure that the above points are perfectly clear – and because they are of extreme importance – I will review them in yet another example, as follows; curling a 100 pound barbell at a very slow speed is NOT equal to curling the same barbell at a much higher speed – although the amount of work performed would be exactly the same in both cases, the power production would be higher in the faster curl. If the slow curl required ten seconds, and if the fast curl required only one second – then you would be producing TEN TIMES AS MUCH POWER in the fast curl as you were in the slow curl with the same amount of weight, and of course the distance of movement would be the same in both cases.

However, in practice, you might NOT be producing all of the power with the actual "curling muscles" in an extremely fast curl; the power production would be ten times as great – if the movement was ten times as fast – but a large part of the power production might come from muscles that you were not trying to work in that particular exercise. If the great speed of movement was partially created by body swing – by so-called cheating methods – then you would be working the muscles of the lower back, the shoulders and perhaps even the muscles of the legs; you WOULD BE generating the maximum amount of power under the circumstances – but you WOULD NOT be generating all of it with the muscles of the arms. And if the amount of body-swing was great enough, you might actually be generating NONE of the power with the arms – or very little of it.

So it is certainly important to generate as much power as possible – but it is just as important to be sure that you are doing so with the muscles that you are actually trying to exercise.

But for the purpose of stimulating muscle growth, it is NOT necessary to produce maximum-possible power with a fresh, well rested muscle – and because of safety considerations, it is not a good idea to do so. In practice, then, a muscle MUST BE worked as hard as possible – but only after it has been partially exhausted by the performance of several repetitions that are well below the momentarily-existing level of ability.

In practical terms – in a curl – this means that you should select an amount of weight that you can curl in perfect form for at least six repetitions; the first repetition should NOT be performed at maximum-possible speed, because at that point in the exercise your strength is at its highest level, and if you actually generate as much power as you are capable of doing at that moment you may damage the connections of the muscles. Instead of moving as fast as possible in the first repetition, you should limit the actual speed of movement to a speed that will result in a steady, smooth movement – "jerking" should be avoided. The second and third repetitions should be performed at a similar speed – and up to that point in the set, you will not be producing as much power as you are capable of doing: but by the time you reach the forth or fifth repetition, you should be moving as fast as possible – which speed, in fact, will be quite slow. Having exhausted your muscles to some degree by the first three or four repetitions – and having thus reduced your momentary power potential – you should then work at the greatest speed possible; by that point in the set you WILL BE producing as much power as possible – but you will have reduced your momentary ability to such a degree that the actual power production will not be very high.

The fourth or fifth repetition – the first repetition in the set that is actually performed as fast as possible – will result in the momentarily maximum-possible production of power, and each following repetition will also produce maximum-possible power; thus, in a set of ten repetitions, each of the last six or seven repetitions will involve the production of maximum-possible power – but the actual amount of power being produced will decline steadily, repetition by repetition. You might produce 100 "units of power" in the fourth repetition, only 90 units in the fifth repetition, 80 units in the sixth repetition, 70 units in the seventh repetition, 60 units in the eighth repetition, and so on – but in each of the last several repetitions, you would be producing as much power as you were capable of doing AT THAT MOMENT.

By training in that fashion, each of the last several repetitions will force the curling muscles to work well inside their momentary level of reserve ability – all of the last several repetitions are maximum-possible efforts.

During the first three or four repetitions you are NOT moving as fast as possible, and the actual speed of movement will be about the same in each of these first few repetitions – but starting about the fourth or fifth repetition, speed of movement should be as fast as possible; and from that point until the end of the set, the actual speed of movement will become slower, repetition by repetition – until, at the end of the set, movement is literally impossible at any speed.

One or two such properly performed sets of an exercise – and never more than three such sets – are all that are required in order to produce maximum-possible growth stimulation; fifty, or a hundred, or any other number of improperly performed sets will NOT produce the same result, will NOT stimulate growth to the same degree – because a muscle is capable of almost any "amount" of work regardless of its size, and will respond (by growing) only when demands for more power are placed upon it. In order to produce more power, a muscle must increase its strength – and in order to increase its strength, a muscle must grow larger.

But while the "amount" of work has little or nothing to do with the production of results from exercise in a positive sense, it should not be assumed that the amount of work is of no importance; on the contrary, in a negative sense the amount of work is of very great importance – because the amount of work has a direct bearing upon the recovery ability – the system can repair only so much damage within a given period of time, can restore only so much energy; and if the amount of exercise is such that the entire recovery ability is exhausted, then growth becomes impossible, regardless of the degree of growth-stimulation that may have been induced.

From the above it should now be clear that exercise must be as hard as possible in order to induce growth-stimulation – and as brief as possible in order to disturb the recovery ability to the least practical degree.

Momentarily-exhausted power potential is replaced very quickly – but the resulting drain on the overall recovery ability is not compensated for quickly; restoring most of the power potential is a matter of seconds – but restoring the recovery ability is a matter of days. A muscle can be worked to the point where it is momentarily incapable of producing more than 10 per cent of its normal power potential – and three seconds later it will be restored to a level of about 55 per cent of maximum-power potential; and three minutes later it will probably be capable of performing at a level of very close to 100 percent of its maximum-possible power potential.

But such rapid recovery of power potential makes demands upon the overall recovery ability that cannot be compensated for quickly – in most cases, at least forty-eight hours are required for fully restoring the previously-existing overall recovery ability; and in many cases, full recovery will take as much as seventy-two hours.

So now we have established two more basic points . . .

5. Maximum-possible power production is required to stimulate maximum-possible muscle-mass increases; the "intensity of effort" should be as high as possible.

6. The actual "amount" of exercise should be as limited as possible in line with other considerations.