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Athletic Journal
Articles

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The Colorado Experiment

Introduction

Properly conducted exercise is capable of producing a number of worthwhile results… (1) increased strength and muscular endurance… (2) improved cardiovascular ability, or "condition"… (3) greater speed-of-movement for any athletic activity… (4) increased range-of-movement, or "flexibility"… and a number of valuable results related to both the prevention and rehabilitation of athletic injuries.

The degree of results that can be produced in any particular case is dictated by a number of factors, individual potential for muscular mass, age, previous athletic injuries (if any), neurological ability, and several other factors… so the final degree of results would vary on an individual basis even if the program of exercises was perfect. But within the individual limits of POSSIBLE results, ACTUAL results would be produced both steadily and rapidly.

The Colorado Experiment was conducted for the purpose of clearly demonstrating that rapid large-scale increases in both muscular mass and strength can be produced from a very brief program of exercise. Long and frequent workouts are neither necessary nor desirable… on the contrary, best results will be produced in most cases with a program of exercise that involves less than an hour of weekly training. And a total of more than two hours of weekly training-time is never required in any case.

If a particular result is possible in an individual case, then one or two hours of weekly training-time is enough… additional training will never produce better results, and will usually reduce the production of worthwhile results.

Increased strength and muscular endurance is produced by high-intensity exercise… a level of work that forces muscles to work well inside their momentary level of reserve ability.

Cardiovascular ability is improved by exercise that raises the heart-rate to a level of at least 150 per minute… and keeps the pulse at or near that level for ten minutes or longer.

Speed-of-movement is increased by a type of exercise that increases strength while reducing the level of body-fat… thus improving the "power to weight" ratio.

Flexibility is improved by FULL RANGE exercise that pulls the muscles into a fully extended, "pre-stretched" position at the start of the movement… and also provides resistance in the fully-contracted finishing position of the movement.

Rehabilitation of injuries is better when an exercise can be applied selectively… when resistance can be used where it is needed, and avoided where it is not wanted.

Prevention of injury is most likely when the muscle have been strengthened in every position… over a full range of possible movement. AND… injury is far less likely when flexibility has been improved as much as possible; another result of full-range exercise.

NAUTILUS is the ONLY source of full-range exercise… and the ONLY source of balanced exercise. Resistance is provided over a full range of possible movement… flexibility is greatly improved, and the muscles are strengthened in every position.

"Function dictates design"… when you are training with any other type of equipment, you are literally attempting the impossible; trying to force the muscles and joints of the body to accommodate themselves to the limitations forced upon them by an imperfect tool. Nautilus equipment offers an entirely new approach to exercise… providing tools that are designed with the requirements and limitations of the human body clearly in mind.

Conventional training equipment forces you to train in a restricted manner, constantly limited by the functions of the barbell. Nautilus equipment permits you to work without restriction… providing exercise to match the functions of your muscular structures.

Nautilus… and ONLY NAUTILUS… provides all of your requirements for proper exercise, for any purpose, for all sports. UNLIMITED exercise by NAUTILUS.

The Experiment

Location… Dept. of Physical Education, Colorado State University.
Dates… May 1, 1973 through May 29, 1973.
Supervision… Dr. Elliott Plese, Director of Exercise Physiology Lab.

During a period of 28 days, Casey Viator gained a total of more than 45 pounds of bodyweight. But the actual gain in muscular tissue (lean body mass, or LBM) was in excess of 63 pounds… since the subject reduced his starting level of body-fat by approximately 18 pounds.

Measurements of the subject's body-fat were made at the start of the experiment, at the end of the experiment, and during the experiment. These tests were conducted by Dr. James e. Johnson of the Department of Radiology and Radiation Biology… and body-fat levels were determined by the computerized results of readings produced by the "Whole Body Counter."

By comparison to the body-fat levels of 16 university football players who were tested on the same dates, this subject's level of body-fat was below average at the start of the experiment… and additional tests conducted during the course of the four-week experiment clearly indicated a steady drop in body-fat. Secondary confirmation of this subject's loss of body-fat was provided by a careful record of his caloric intake during the experiment. Approximately 30% of the subject's calorie requirements were provided by a "burn-off" of existing body-fat… indicating that it is possible to produce rapid, large-scale increases in muscular tissue while simultaneously reducing the level of body-fat.

During the 28 days of the Colorado Experiment, this subject performed a total of only 14 workouts… using Nautilus training equipment. Total "training time" was seven hours, fifty and one-half minutes… an average of 33 minutes and 36 seconds for each of fourteen workouts. Clearly proving that rapid increases in muscular strength can be produced by very brief training… longer and more involved workouts are neither necessary nor desirable.

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PURPOSE OF THE EXPERIMENT… it is the author's contention that the growth of human muscular tissue is related to the intensity of exercise; increases in strength and muscle-mass are rapidly produced by very brief and infrequent training… if the intensity of exercise is high enough.

It is the author's second contention that increasing the amount of training is neither necessary nor desirable… on the contrary, a large amount of high-intensity training will actually reduce the production of strength and muscle-mass increases.

It is the author's third contention that "negative work" (eccentric contraction) is one of the most important factors involved in exercise performance for the purpose of increasing strength and muscle-mass.

It is the author's fourth contention that nothing in the way of a special diet is required… so long as a reasonable well-balanced diet is provided.

It is the author's fifth contention that the use of the so-called "growth drugs" (androgenic-anabolic steroids) is neither necessary nor desirable… on the contrary, repeated tests with animals and double-blind tests with human subjects have clearly demonstrated that the use of such drugs is strongly contraindicated.

It is the author's sixth contention that maximum-possible increases in strength and muscle-mass can be produced only by the use of full-range, rotary form, automatically variable, direct resistance.

FULL-RANGE resistance is provided only when the involved body-part is moved through a full range of possible movement against constant resistance… from a starting position of full muscular extension (a "pre-stretched" position) to a finishing position of full muscular contraction.

ROTARY-FORM resistance is an absolute requirement for full-range exercise… since muscular contraction produces a rotary-form movement of the related body-part, it is necessary for the resistance and the body-part to rotate on a common axis.

AUTOMATICALLY-VARIABLE resistance is an absolute requirement for high intensity exercise… since movement produces changes in useable strength, it is necessary for the resistance to vary in proportion to the resulting changes in strength.

DIRECT resistance is also required in order to avoid the limitations imposed by the involvement of smaller, weaker, muscular structures. The resistance must be "directly" imposed against the body-part moved by the muscles being exercised.

Conventional forms of exercise provide none of these requirements; the results being that… muscles are not worked throughout a full range of possible movement… resistance is limited to an amount that can be moved in the weakest position… little or nothing is done in the way of improving flexibility, since there is no resistance in the fully extended position… and no resistance is provided in the fully contracted position.

Only Nautilus equipment was used in the Colorado Experiment; equipment designed to provide all of the requirements for full range, rotary form, automatically variable, direct resistance.

Results

First subject (Casey Viator), 28 days
Increased in body weight… 45.28 pounds
Loss in body-fat… 17.93 pounds
Muscular gain… 63.21 pounds

Second subject (Arthur Jones), 22 days
Increase in body weight… 13.62 pounds
Loss of body-fat… 01.82 pounds
Muscular gain… 15.44 pounds

It should be clearly understood that neither of the subjects was a typical subject, and there is no implication that subjects of average potential will all produce equal results from a similar program of exercises.

Casey Viator has trained on a fairly regular basis for a period of several years; with barbells and other conventional training equipment until June of 1970 at which time he placed third in the Mr. America contest… and with both barbells and Nautilus equipment until June of 1971, when he won the Mr. America contest.

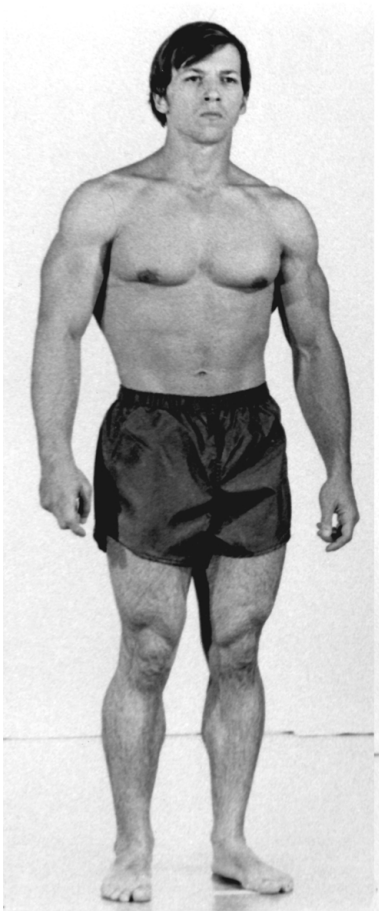
From September of 1971 until September of 1972, he trained primarily with Nautilus equipment… with limited use of a barbell, primarily the performance of barbell squats.

From September of 1972 until December 23, 1972, he trained exclusively with Nautilus equipment… limiting his exercises to "negative only" movements. At the end of that period of training he weighted 200.5 pounds.

In early January of 1973, he was involved in a serious accident at work and lost most of one finger as a result… and almost died from an allergic reaction to an antitetanus injection.

For approximately four months, most of January through April of 1973, he did not train at all; and since his level of activity was low, his diet was reduced accordingly. During that period of approximately four months, he lost 33.63 pounds… but 18.75 pounds were lost as a result of the near-fatal injection. So his loss from nearly four months out of training was only 14.88 pounds… less than a pound a week.

The second subject (the author, Arthur Jones) has trained on a very irregular basis for a period of thirty-four years… and reached a bodyweight of 205 pounds at one time, nineteen years ago. The author did no training of any kind for a period of approximately four years until late November of 1972… and then trained on a fairly regular basis in the



"negative only" fashion for a period of approximately six weeks. Training was ceased entirely in early January of 1973… and no training was done again until the start of the Colorado Experiment.

The author's bodyweight has varied from approximately 145 to 160 for the last ten years… briefly reaching a level of 180 pounds at the end of approximately six months of steady training that was concluded four years prior to the start of the Colorado Experiment.

So both subjects have demonstrated the potential for greater than average muscular mass… and both subjects were rebuilding previously-existing levels of muscular size.

A certain percentage of a group of random subjects would undoubtedly produce equal results… a very low percentage might produce better results… a few subjects would produce little or nothing in the way of results… but average results would probably be less than those produced by the two subjects of this experiment. The primary determining factors being (1) individual potential for muscular size, (2) age, (3) general health, and (4) the intensity devoted to training.

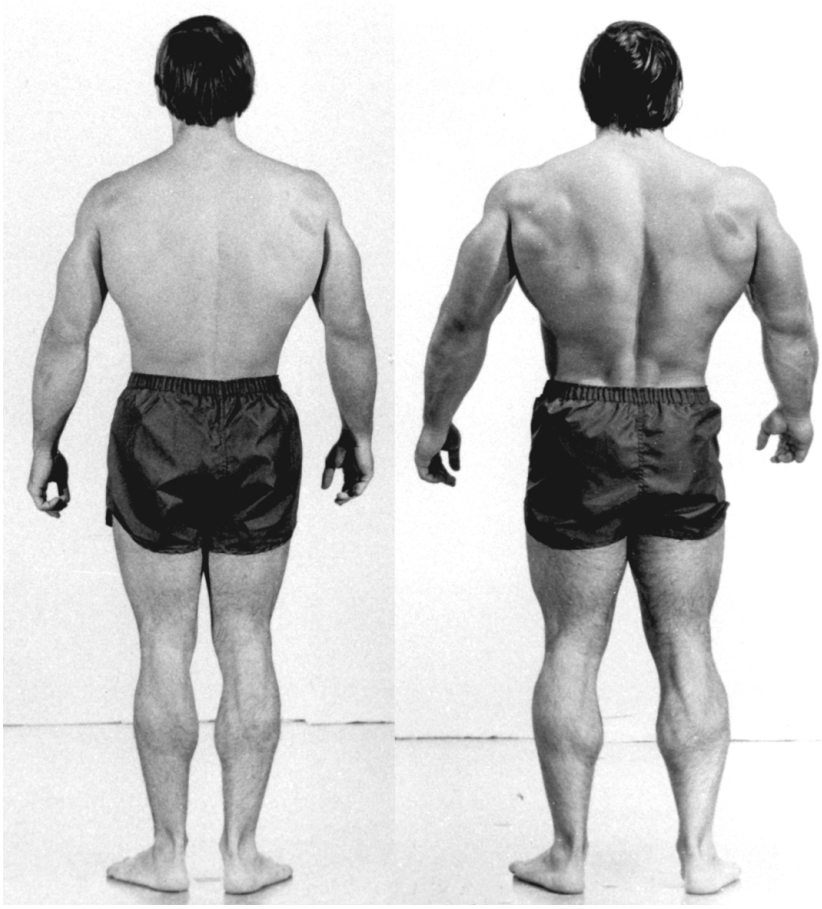
Actually, high-intensity training is not easy… the training sessions are brief, indeed they must be brief, but there is an apparently natural inclination on the part of most subjects to "hold back." Most exercises are terminated at a point well below an actual point of muscular failure… then, in an effort to compensate for the reduced intensity, the usual practice is to add more exercise to the program.

However, in fact, no amount of additional exercise will compensate for a reduction in the intensity of exercise… and if carried to extremes, which such training frequently is, the subject may actually prevent growth by exceeding the recovery ability of the system.

It is the author's contention that very steady and large-scale increases will be produced in strength and muscular mass by a very brief program of high-intensity exercise; and it was the purpose of this experiment to demonstrate that such results can be produced in practice as well as theory.

For example, during the first 14 days, Viator gained 28.93 pounds, a daily average of 2.06 pounds. During the next 3 days, he gained 3.92 pounds, a daily average of 1.3 pounds. During the following 5 days, he gained 6.09 pounds, a daily average of 1.2 pounds. And during the final 6 days, he gained 6.34 pounds, a daily average of 1.05 pounds.

So it is clear that his "rate of gaining" was slowing down at the end of the experiement… but it is equally clear that his actual growth was very steady.



In the author's case, the pattern was much the same. During the first 7 days, 4.08 pounds were gained, a daily average of .58 pounds. During the next 7 days, 4.95 pounds were gained, a daily average of .7 pounds. And during the final 8 days, 4.6 pounds were gained, a daily average of .57 pounds.

There were no "sudden spurts" of growth in either case… so we obviously were not putting back weight from dehydration; instead, growth was very steady throughout the periods of training.

During a period of 22 days, the author trained a total of 12 times. Three workouts in a row during the first three days in order to get over any resulting muscular soreness, then workouts spaced approximately 48 hours apart. Total "training time" (in and out of the gym) was exactly 298 minutes… 4 hours and 58 minutes, an average of 24.8 minutes per workout. 122 "sets" were performed during the 12 workouts… an average of just over 10 sets per workout. Out of the total of 122 sets, 54 were performed in a "negative only" fashion… 14 were performed in a "negative accentuated" fashion… and 54 were performed in a normal (negative-positive) style.

NEGATIVE ONLY means that the resistance was "lowered" only, involving eccentric contraction. NEGATIVE ACCENTUATED means that the resistance was raised with both arms (or both legs), and then lowered with only one arm (or leg). NORMAL means that the resistance was raised with both arms (or legs) and lowered in the same fashion.

Only one "set" of each exercise was performed in almost all workouts, and when two sets of an exercise were performed they were never performed in sequence.

The author's gains from this very brief program were as follow… an average of 1.28 pounds per workouts… an average of .126 pounds per set… an average of 3.06 pounds per hour of training. The other, much younger, subject's gains were much greater. During a period of 28 days, as a result of 14 workouts involving a total training-time of 7 hours, 50.5 minutes, an average of 33.6 minutes per workout, his gains were as follow… an average muscle mass increase of 4.51 pounds per workout… or .36 pounds per set… an average gain of 8.04 pounds from each hour of training.

But what about strength gains? Prior to the start of the experiment (approximately an hour before the first workout), initial strength tests to a point of failure were performed on a Universal Machine. And at the end of the experiment (three days after the last workout), a final strength test was again performed on a Universal Machine.

During the first test, Viator performed 32 repetitions in the leg-press with 400 pounds… 28 days later, having done nothing even close to a leg-press in the meantime, he performed 45 repetitions with 840 pounds. And was forced to quit at that point because of pain, rather than muscular failure.

So his leg strength more than doubled in the leg-press… even though he did not perform that exercise during the experiment. His other strength increases were also of a very high order… clearly proving that his increased muscular mass was functional.

Flexibility? Near the end of the experiment, at a bodyweight of well over 200 pounds, this subject clearly demonstrated a range of movement far in excess of that possible by any member of the Colorado State University wrestling team… clearly proving that great muscle size does not have to limit flexibility, if it is produced by exercises that provide full-range movement.

The "pace" of the workouts was very fast… but not continuous throughout the workouts, some brief rest-periods were involved between some exercises. And these rest-periods are INCLUDED in the listed times of the workouts. Times were measured from the start of the workouts to the end of the workouts.

All exercises were carried to a point of momentary failure… except in the cases of "negative only" exercises, which were terminated when it was no longer possible to control the downwards movement of the resistance.

In general, approximately ten repetitions were performed in each set; but in all cases, the maximum possible number of repetitions were performed… stopping only when it was impossible to perform another repetition in good form. The "form" or style of performance was as strict as possible, the resistance was moved in a smooth fashion, and was briefly stopped in the position of full muscular contraction. Jerking and sudden movements were totally avoided.

Several members of the Denver Broncos Professional Football Team visited the lab for the purposes of observing the workouts, and then started training in an identical fashion during the last two weeks of the experiment… after the experiment, the Broncos placed an order for several Nautilus machines and drastically reduced their previous training schedule.

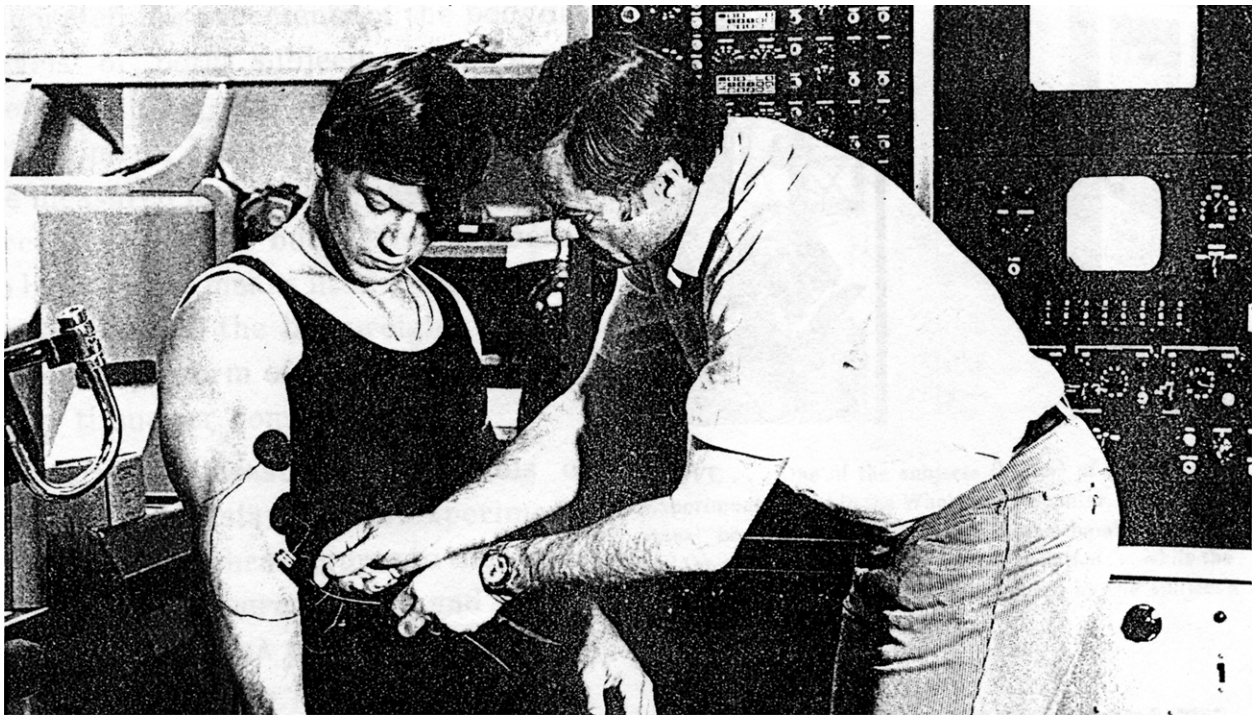
And while we were training in Colorado, members of several other professional football teams were training in Florida… in an identical fashion, three brief weekly workouts involving only one set of approximately a dozen exercises, with a much emphasis on the "negative" part of the work as possible.

Results? One member of a Canadian professional team became so strong in the pullover exercise that he was using 675 pounds for several repetitions in good form… having started two months earlier with 275 pounds.

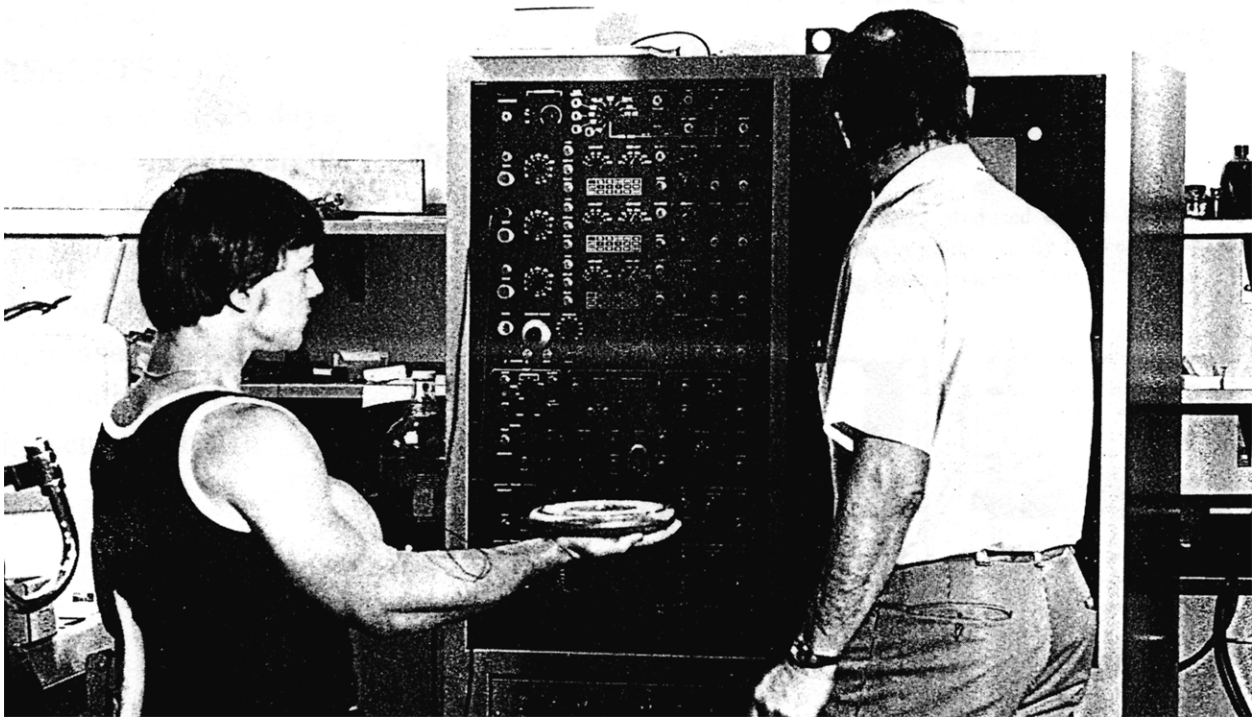
Lou Ross of the Buffalo Bills added 20 pounds to his 6 foot, 7 inch frame… cut a full two-tenths from his already fast time in the 40 yard dash… added five and one-half inches to his vertical jump… and doubled his strength in many areas of movement. These figures having been provided by the Buffalo Bills coaching staff, who tested Lou before and after a two month Nautilus training program in Florida.

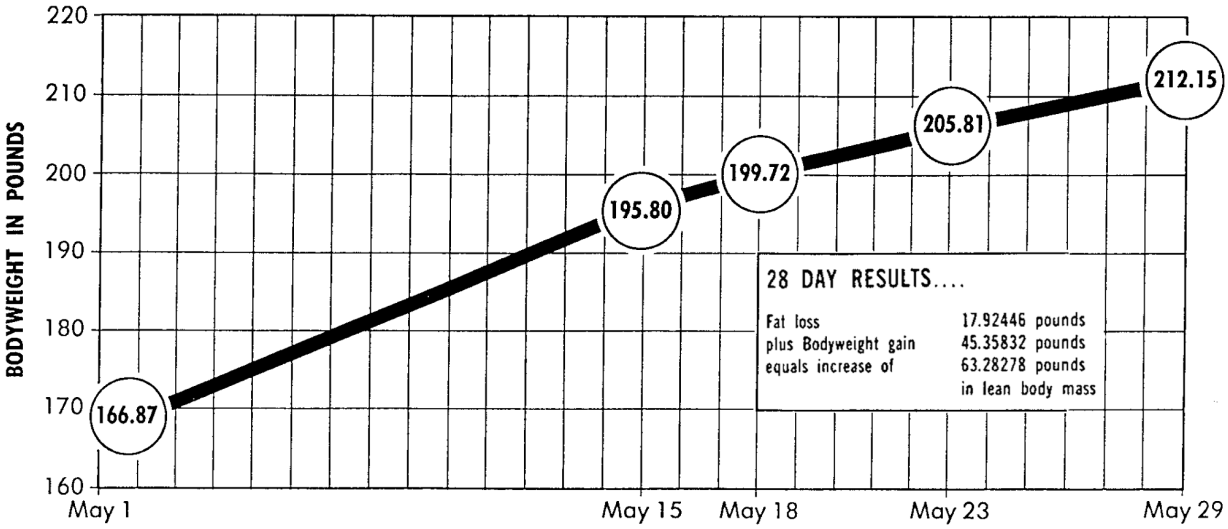
Mercury Morris of the World Champion Dolphins weighed-in 7 pounds above his previous highest weight and still ran the fastest 40 yard dash of his life when he was tested… following two months of Nautilus high-intensity training.

Altogether, twelve professional football teams and hundreds of professional athletes are now training with Nautilus equipment… having learned that they can produce far better results from much less training. Proper training will produce rapid but very steady increases in both strength and muscular mass… and this was very clearly demonstrated by the results of the Colorado Experiment.



Electromyographic (EMG) tests were conducted for the purpose of comparing the electrical activity that occurs inside muscles during various types of exercise. "Negative only" exercise was compared to "positive only" exercise... high-intensity repetitions were performed to low-intensity movements... and static muscular contractions were compared to normal movements.





Results Produced by 28 Days of High-Intensity Strength Training

Subject, Casey Viator

Date	Bodyweight	Gain	Average Gain
5/01/73	166.87	Start	Start
5/15/73	195.80	28.93	2.06 lbs. per day
5/18/73	199.72	3.92	1.30 lbs. per day
5/23/73	205.81	6.09	1.21 lbs. per day
5/29/73	212.15	6.34	1.05 lbs. per day

The rate-of-gaining was very steady throughout the entire period of the experiment.. and the subject was still gaining at a rate of more than one pound per day at the end of the experiment.

Resulting strength increases determined by carefully conducted pre-experiment and post-experiment strength tests were as follows...

Leg Press... 32 repetitions with 400 pounds increased to 45 repetitions with 840 pounds.

Chinning... 7 repetitions with 217 pounds (including bodywt.), increased to 11 repetitions with 287 pounds (including bodywt.).

Standing Press... 8 repetitions with 160 pounds, increased to 11 repetitions with 200 pounds.

Parallel Dipping... 12 repetitions with 217 pounds (including bodywt.), increased to 16 repetitions with 312 pounds (including bodywt.)