

TRAINING

...To Provide Information and To Stimulate Thought On The Art of Strength Training
"Read Not To Believe... But To Weigh and Consider... —A.S.

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"...A PARTICIPATORY ART"

By Dr. Ken E. Leistner

There are many coaches in both the professional and collegiate ranks that I speak with on a regular basis. Some are football coaches, most are strength coaches. We share many things, a love for either of the activities aforementioned, and an enjoyment and enthusiasm for both talking about and trying new ideas. One local high school coach for example, stopped by last summer as I was training in the driveway and we spoke at length about the Wishbone offense. He was planning on switching over from a pro set and "back in the day," in the late 1960s and early 1970s, our Malverne High School team ran one of the most successful Wishbone offenses seen in the area. We most have been a sight to the neighbors, two middle aged men walking through the quarterback and full-back steps, mimicking the read of the defensive end and middle linebacker, and generally reviewing the positives and negatives of the offense. I lent him the coaches' game tapes of the entire 1969 University Of Texas season, an example of the most potent Wishbone offense ever devised (with apologies to any University Of Alabama fans reading this) and was very gratified when they won the County championship this past season using that very offense. It is the same for me with strength training. When I can make a suggestion that is helpful, it is satisfying and my suggestions come not from reading about training, but from decades of actually training and watching others train.

This point was brought home strongly in the past week. As I write this article, the storm of controversy over my videotaped 407x23 squat is still simmering. When I noted years ago that Kevin squatted 600x30, there was a backlash of naysaying that was revived on the Internet by many self proclaimed experts, experts who never met Kevin or me, never saw us train, and perhaps never themselves have attempted to train in a manner that would allow one to do deep knee bends with extremely heavy weight for many reps. Interestingly, there were almost no comments such as

"he must have faked it. Yeah, you could hear the metal on metal as the plates were put on the bar, but the weights must have been Styrofoam or something, no one could squat 407x23." No, the comments were, "His form was horrific, he could have been killed or injured going down so fast"; "that's ballistic training, not controlled lifting"; "it would have been harder and more productive and he would have become stronger if he would have used less weight and moved more slowly." I addressed these points in an article posted on www.cyberpump.com a wonderful site that exhorts trainees to train hard and in a limited fashion. That is after all, what I believe high intensity training is all about. I also posted on the only "personal type" Internet site I enjoy, Jay Trigg's Garage Board (<http://net1.net/users/trigg>) where I in summary stated that I don't believe one can squat slowly and do so safely, not with the types of weight that will stimulate significant changes in one's physiology, and that I was at all times, working hard and safely. More important is what wasn't said.

I enjoy speaking to Kim Wood, the long time strength coach of the Cincinnati Bengals. He is the one person who introduced and propagated high intensity training in the NFL and continues to innovate. I also enjoy speaking to Jeff Watson, the strength coach at Villanova University. I enjoy talking philosophy and interpretations of cultural trends with them and because they are a generation apart, it gives me a very good perspective from two points of view on similar subjects, many of which have nothing to do with strength training. That both men are very bright, very aware, and very "plugged into" the general culture we live in, much more so than my self imposed isolate stance, I get a very good understanding of the Internet and its effect on individuals. Allow me please to enhance this statement.

Kim made a stimulating statement today; "Strength training is above all else, a participatory art. It is not a

tion. Note that none of this money came from the university. In fact, one could easily get the impression that had it not been for Father Lange's extraordinary academic credentials and larger than life shadow he cast, weight training could have easily vanished off the landscape at Notre Dame.

As established previously, by 1960s weight training was starting to receive scholarly credence. Finally, Notre Dame formally recognized the value of progressive resistance exercise by adding it to their existing physical education curriculum, and they gave Father Lange a new facility to serve as the weight training "nerve center."

Between 1935 and 1960, Lange estimated that more than 6000 regular trainees had passed through the door of his personal muscle den. To reiterate, that was without any endorsement whatsoever from the university. Included in this number were, over time, athletes from a wide range of varsity sports who were directed to Lange even though his facility was not formally part of the athletic department.

Those desiring to read more about Father Lange are directed to a wonderful feature on him in the September, 1998 issue of "Milo". Likewise actual instructional articles authored by Lange can be found in "Strength & Health" magazines between the years of 1947 to 1949. Lastly, much of the history of weight training at Notre Dame can be found in the April, 1960 issue of "Strength & Health".

The huge contributions of men like McCloy, Karpovich, McLean, Lange and Roy toward the universal acceptance of strength training in our culture were varied but still landmark. The anecdotal information about each is meant to showcase his contribution against the tone of the time he lived, thereby heightening his significance. Yet, let it quickly be added that the aforementioned "fabulous five" are by no means a complete listing of persons, even from academia, who helped put weight training on the map. Having said that, regardless of your personal training or strength coaching philosophy, what kind of program you prefer, whether you are a strict free weight or machine advocate, the names of the men previously mentioned deserve to be respected, recognized and remembered.

FLAWS IN RESEARCH DESIGN AND INTERPRETATION - PART II

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Two studies frequently cited by HIT antagonists have a puzzling lack of supportive data. This absence of critical data makes the research open to different interpretations.

THE STOWERS AND KRAEMER STUDIES

What follows is a closer examination of the studies by Stowers and his co-workers (1983) and Kraemer and his co-workers (1997):

Periodization Produces "Superior Results"?

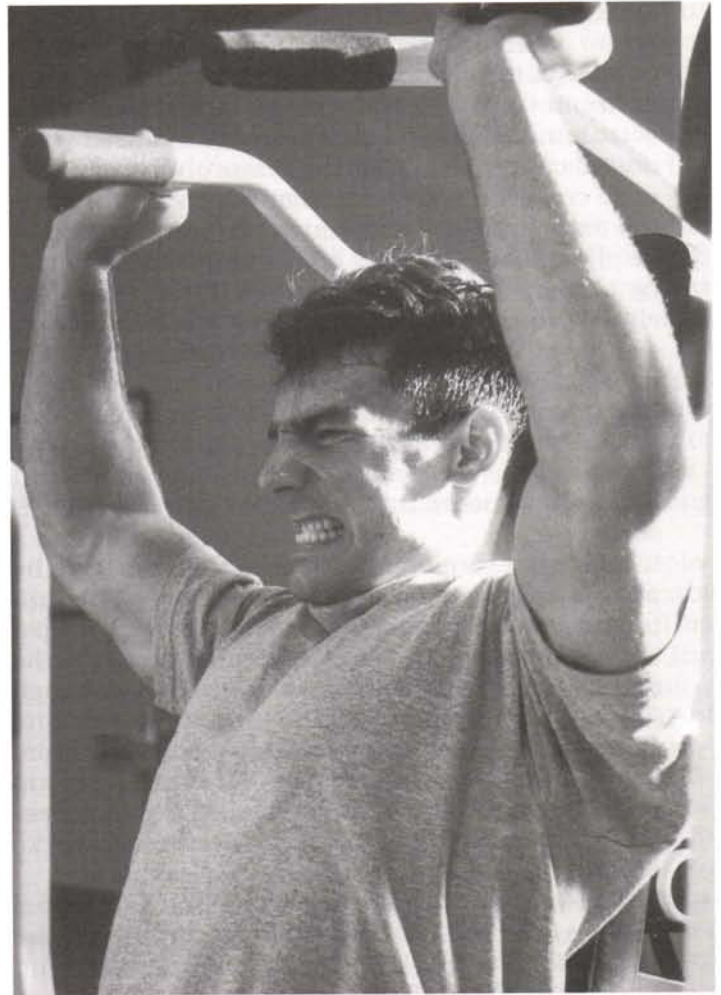
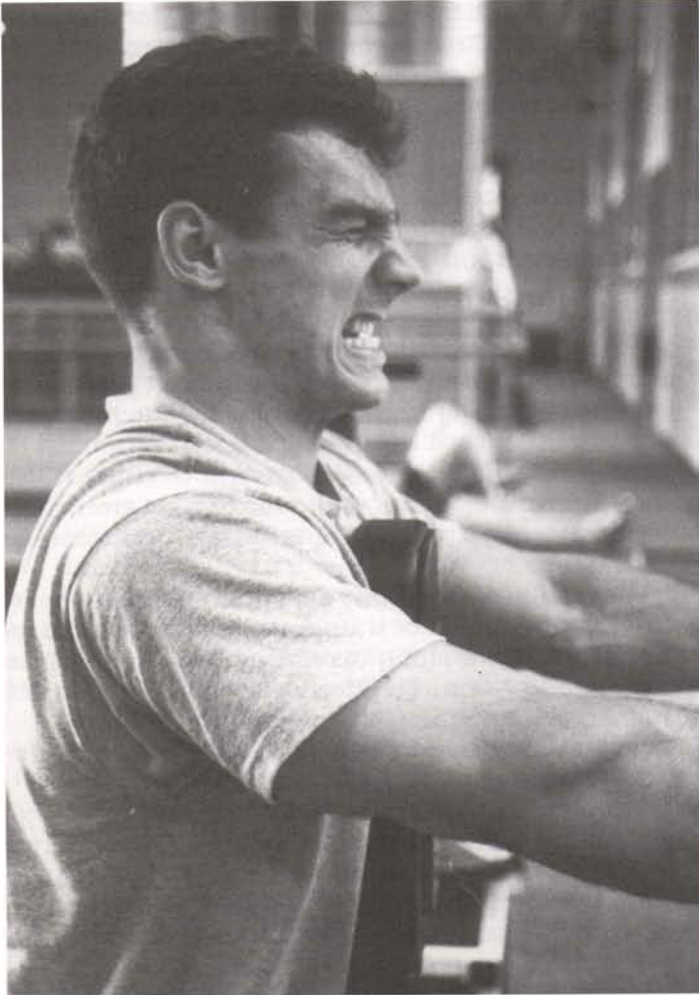
In this seven-week study, Stowers and his co-workers (1983) concluded that a group who used a periodized protocol — that is, one in which the sets and repetitions are varied throughout the course of training — produced better improvement in strength and power than two non-periodized groups.

The study involved 84 "untrained" male college students. In the study, the students were "randomly assigned to one of three experimental groups" designated as "increasing intensity," "one set to exhaustion" and "three sets to exhaustion." The experimental groups trained three times per week for seven weeks. All groups performed the same workouts that consisted of the following exercises: squat, leg curl, bench press and sit-up on Mondays and Fridays; deadlift, behind neck press, "lat work" and sit-up on Wednesdays. However, the groups did different sets and repetitions. For each exercise, the periodized group ("increasing intensity") did 1 x 10 with a "light" weight and 1 x 10 with a "medium" weight followed by varying sets and repetitions (a "heavy" weight for 5 x 10 in weeks 0 - 2, 3 x 5 in weeks 3 - 5 and 3 x 3 in weeks 6 - 7). The one-set group did 1 x 10 with a "light" weight followed by 1 x 10 - 12 to exhaustion for all seven weeks. The three-set group did 1 x 10 with a "light" weight followed by 3 x 10 - 12 to exhaustion for all seven weeks.

The groups were tested in their body weight, 1-RM bench press, 1-RM squat, vertical jump and leg and hip power (using an equation based upon vertical jump and body weight). Testing occurred four times during the study: at 0, 2, 5 and 7 weeks. The researchers concluded: "Within the confines of the experimental protocol, 'periodization' produced superior results in leg and hip strength and power compared to 1 and 3 sets to exhaustion."

Some comments about the design and administration of this study:

- The length of the study — seven weeks — was relatively short.
- The experimental groups were not equated for strength before training began which could have spoiled the results of the research.
- The researchers stated that the subjects were "randomly assigned to one of three experimental groups." A random assignment of subjects suggests that the size of each group is equal or nearly equal. Yet, the groups inexplicably differed in size by as much as 52.17% with 23 in the periodized group, 35 in the one-set group and 26 in the three-set group. This unequal distribution of the subjects is quite puzzling and may have influenced the results of the research.
- The researchers noted that "An experimenter was present at all times to insure that proper tech-



Ryan Bonfiglio a 165 lb. wrestler and team captain at Princeton University trains intensely at the Princeton strength facility under the supervision of Matt Brzycki.

nique and safety precautions were used." ("Proper technique" was not specified.) Having an experimenter "present" does not necessarily mean that the workouts were supervised in such a way that the groups who were asked to train "to exhaustion" — namely the one-set and three-set groups — actually did so.

- Technically, the one-set group did two sets of each exercise (one being with a "light" weight) and the three-set group did four sets of each exercise (one being with a "light" weight).
- The periodized group did 3 x 5 for three weeks (3, 4 and 5) and 3 x 3 for two weeks (6 and 7) while the one-set and three-set groups never did less than ten repetitions. The fact that the periodized group did five weeks of training using lower repetitions — 70% of the total training period doing sets of 5 repetitions or less — certainly favored them when it came to tests of a 1-RM bench press and 1-RM squat and, arguably, the vertical jump (which was also used to calculate leg and hip power). This extremely poor experimental design stacked the deck against the non-periodized groups (i.e., the one-set and three-set groups).

Some comments about the test results and conclusions:

- The researchers only reported the net changes between the pre-test (the first test) and the post-test (the fourth test). This omission of critical data — specifically, absolute values for test performances (rather than "net changes") — makes the results of the research open to different interpretations.
- The researchers found no significant changes in body weight over time or between groups ($p < 0.01$). If body weight changes are to be evaluated, the experimental groups should receive direction in the area of caloric intake and expenditure. Ideally, these nutritional variables should be controlled. There was no indication that any of this was done, however. (Unfortunately, body composition was not analyzed.)
- In the 1-RM bench press, all three experimental groups improved significantly over the seven-week training period. There was no significant difference between the groups. Interestingly, the non-periodized three-set group had a greater improvement than the periodized group.
- In the 1-RM squat, all three experimental groups improved significantly over the seven-week training period. The periodized group showed a significantly greater improvement than the one-set and three-set groups; there was no significant differ-

ence between the one-set group and the three-set group. Interestingly, the one-set group had a greater rate of improvement than the three-set group in the 1-RM squat over the last two weeks of training. It should also be noted that there was no indication as to how the researchers managed to be consistent in their judgment of depth during the testing of the 1-RM squat. Judging a squat to be of sufficient depth is highly subjective and can be extremely inconsistent. For this reason, any claims, comments or conclusions made by the researchers that are related to the test results of the squat are highly questionable.

- In the vertical jump, the periodized group showed a significantly greater improvement than the one-set and three-set groups; there was no significant difference between the one-set group and the three-set group.
- In the assessment of leg and hip power, the periodized group showed a significantly greater improvement than the one-set and three-set groups; there was no significant difference between the one-set group and the three-set group. Although five figures were shown in the report, no absolute values for any test performances were given. From Figure 5, however, it appears as if the one-set group had a greater rate of improvement than the three-set group in leg and hip power after seven weeks of training.
- The researchers found no significant differences between the one-set and three-set groups at the end of the study. In effect, the three-set group performed three times as many “work” sets (or 200% more) than the one-set group without experiencing a significantly greater increase in any of the measures.
- The researchers speculated that the one-set and three-set groups failure “to continue producing meaningful gains over time is indicative of program’s [sic] using little variation in volume and/or intensity.” As support for this statement, the researchers cited four references: The first was previously co-authored by one of the researchers (Stone); the second was previously co-authored by two of the researchers (Stone and McMillan); the third was a paper presented at a conference in Canada; and the fourth was a book published in Budapest, Hungary.
- Although body composition was not analyzed, the researchers somehow speculated that the one-set group “realized the smallest gains in LBM [lean body mass].” Besides being highly speculative, this curious statement seems to selectively target the one-set group thereby suggesting researcher bias.
- It was noted that “each subject was allowed to . . . progress (add weight) at his own rate.” This statement raises concerns as to whether or not the 84 “untrained” subjects were equally prepared to make systemic progressions in their resistance and repetitions.
- The researchers noted that the one-set group had

“consistently inferior gains in the performance measures.” This comment is inconsistent with the results of their research and, once again, smacks of researcher bias. The fact of the matter is that the one-set group had a greater rate of improvement than the other two groups in the 1-RM bench press from weeks 3 - 5. In addition, the one-set group had a greater rate of improvement than the three-set group in the 1-RM squat over the last two weeks of training. The one-set group also had a greater rate of improvement than the three-set group in the vertical jump from weeks 1 - 2 and 3 - 5. Finally, it appears as if the one-set group had a greater rate of improvement than the three-set group in leg and hip power after seven weeks of training. These facts do not seem to support the researchers’ contention that the one-set group had “consistently inferior gains in the performance measures.”

- The results of this study demonstrated that a relatively low volume of training — that is, as little as one “work” set of four exercises done three times per week — can be effective in improving 1-RM strength in the bench press and squat.

The Superiority of “Varied Multiple Set Resistance Training”?

A nine-month study by Kraemer and his associates (1995) concluded that multiple sets were better than single sets. Their research has been cited and glorified numerous times in support of multiple sets. This study — which has never been published in a peer-reviewed journal in any form other than as a one-paragraph abstract — involved 24 females who were collegiate tennis players (aged 19 - 23). According to the abstract, the subjects were matched and randomly assigned into one of three groups: a control group, a varied multiple-set group or a single-set group. The two training groups — that is, the multiple- and single-set groups — exercised 2 - 3 times per week for nine months. Both training groups used the same exercises (which were not specified) but different sets and repetitions. The multiple-set group did 2 - 5 sets and varied their repetitions between 3 - 5-RM, 8 - 10-RM and 12 - 15-RM on different training days while the single-set group did one set of 8 - 10-RM for all exercises. The groups were tested in their 1-RM bench press, 1-RM military press, 1-RM leg press, anaerobic power (using a Wingate test) and body composition. Testing occurred four times during the study: at 0, 4, 6 and 9 months. Because the information in this abstract is so sketchy and incomplete, it raises more questions than comments. But one brief sidebar: Studies are often criticized for being too short in length. So at first glance, the length of this study sounds very compelling but think about it: This was a nine-month study involving 24 collegiate student-athletes. Actually, if there were three groups — two training groups and one control group — and the 24 subjects were randomly assigned, there would have been eight subjects in each group. If true — and much of the following is speculative since a detailed version of the brief

abstract has never appeared in public view — 16 student-athletes engaged in some form of resistance training and 8 acted as controls. The length of an academic calendar at a university just happens to be approximately nine months. As such, it is safe to theorize that the study was done during the school year — basically from the beginning of September through the end of May.

Some questions about the design and administration of this study:

- Since they were student-athletes, what effect did their competitive season — which apparently occurred during the study — have upon the results of the research?
- Did each of the 16 student-athletes in the two training groups participate in the same volume of tennis competition during the season? If it was a different amount of physical activity, how did this uncontrolled variable affect the results of the research?
- Did all 16 student-athletes in the two training groups remain on campus for the entire nine months? Specifically, did the two training groups continue their respective programs during spring break, holidays and intersessions?
- If the students went home or somewhere else and were told to continue their respective programs during these periods — using either multiple sets or single sets — is it possible that they did either nothing at all or whatever they wanted? If so, how would this uncontrolled variable affect the results of the research?
- If there were layoffs or other periods of inactivity, how were they accounted for in the study? And how would this uncontrolled variable affect the results of the research?
- Did all 16 student-athletes in the two training groups somehow manage to get through nine months without illnesses or injuries? If illnesses and/or injuries did occur, how were they accounted for in the study?
- Since it was not noted in the abstract, did both training groups receive instructions as to when they should make progressions in resistance? Along these lines, did either group receive preferential assistance from the researchers in making progressions in resistance?
- To assure that all 16 student-athletes in the two training groups did as directed, how were their workouts supervised?
- If all workouts were not adequately supervised, how do we know that the single-set group was really training with an appropriate level of intensity?

These last two questions are of special importance. Doing 2 - 3 workouts per week for 39 weeks (nine months) is 78 - 117 workouts multiplied by 16 student-athletes is 1,248 - 1,872 workouts. This was an enormous number of workouts that needed to be closely supervised in order to assure the scientific purity of the study. It is hoped that the student-athletes were not simply expected to follow directions

exactly as intended without the six researchers supervising each and every repetition of each and every set of each and every workout. Remember, researchers cannot just distribute sheets of paper describing pre-planned workouts and expect that the subjects will do them exactly as specified. Some comments about the test results and conclusions:

- The abstract reported that the “total work (J) was significantly ($p < 0.05$) higher in the [multiple-set] program.” This is not surprising considering that the multiple-set group was assigned more sets and repetitions than the single-set group.
- After four months, the two training groups increased their 1-RMs in the bench press, military press and leg press. There was no indication of whether or not there were any significant differences in 1-RM strength between the two training groups for any exercise.
- The researchers stated that “only the [multiple-set] program continued to show further significant increases in all strength measures over time.” This statement cannot be verified, however, since the abstract did not report the results for the testing done at the end of the sixth and ninth months of training. In fact, nothing was stated in the abstract as to whether or not there were any significant differences in strength at any time during the study. No absolute values or percent changes in strength were reported. No tables. No figures. No charts. No statistics. No numbers. No nothing. This abstract — which caused many single-set naysayers to wildly proclaim it as the Holy Grail of irrefutable proof that multiple sets are better than single sets — contained no supportive data whatsoever. For this reason, any claims, comments or conclusions made by the researchers concerning changes in strength, anaerobic power, body composition or anything else are unsubstantiated.
- Despite the glaring absence of supportive data, the researchers inexplicably concluded that “These data suggest that in active young women higher volumes of varied resistance exercise are associated with more than just initial neural alterations in strength performance.”

IN PART III

The third part of this investigation into flaws in research design and interpretation will examine a “series” of five experiments by Kraemer (1997).

References:

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