

Imagery Content and Perspective and its
Effect on Development of Muscular Strength

by

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and

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INTRODUCTION

In the last fifteen years, the relationship between physical fitness and psychological health has become an emerging field of inquiry (Vanek & Cratty, 1970). Examination of this relationship is, no doubt, due in part to the increasing popularity of physical fitness activities such as running, aerobic dance, racquetball and weight lifting. Health psychology emphasizes that engaging in sport not only benefits physical health but psychological adjustment as well. For example, exercise is said to reduce the risk of heart disease, aid in weight control, alleviate stress, and improve one's self image. Indeed, a review of correlational and experimental studies (Folkins & Sime, 1981) supports these assertions. For instance, with regard to fitness training and work behavior, research demonstrates that fitness training is associated with reduced absenteeism, reduced errors, and higher output (Donaghue, 1977). Other studies also show a positive relationship between exercise, mood states, (deVries, 1968; Folkins, Lynch, & Gardner, 1972; McPherson et al., 1967) and self concept (Goldberg & Folkins, 1974; Zion, 1965). These studies, among others, give reason for optimism about exercise as a primary or secondary treatment modality to improve physical and psychological functioning in both normal and selected clinical populations. However, as Folkins and Sime (1981) point out, at the present time there is no integrated theoretical model that can explain these physical fitness training effects.

Furthermore, this is only half of what a theoretical model of physical fitness should explain. In the studies cited previously,

physical fitness activities were shown to effect certain psychological factors. Research by sports psychologists and exercise physiologists also attempts to understand how psychological factors can influence aspects of physical fitness. In a very broad sense, the purpose of this research is to gain a greater understanding of how psychological factors can influence the development of the body. More specifically two results are hypothesized to be achieved as a result of this project. First, previous research demonstrates that imagery along with physical practice is more beneficial than physical practice alone (Oxendine, 1968; Richardson, 1967a; Suinn, 1983; Weinberg, 1982). Therefore, this research will replicate this finding in relation to weight training effects.

Second, previous research is unclear whether the content and perspective of one's imagery technique is superior to other techniques. Results of Lang's (1979) 'bio-informational theory of emotional imagery' drawn from psychophysiological research and clinical literature relating to phobias and, tentative conclusions in the sports psychology literature (Hale, 1982; Mahoney & Avenier, 1977; Suinn, 1983), provide the basis for the second hypothesis. Specifically, individuals using an internal imagery technique (muscular response propositions) will show greater results than individuals using another external imagery technique (ocular response propositions) while weight training.

Imagery and Improvement of Physical Skills

Anecdotal evidence

Just as the popular press has expounded the benefits of exercise

to physical and psychological health, the sports media have also advocated imagery training (a.k.a., visualization) to improve sports skills. Anecdotal evidence is provided in the following example.

First, in the movie Pumping Iron Arnold Schwarzeneger said he would first plan the kind of physique he wanted, aiming for values like symmetry, definition, and elegance, then work to achieve the form he wanted. Like a sculptor he followed his artistic conception, but worked with his own living flesh. First, he saw what he wanted, then he maintained that image during his workouts, indeed, during each pump of his muscles (Murphy & White, 1978, p. 169).

In this example, Schwarzeneger is concerned with the contour of particular muscles. His imagery technique is one in which the individual attempts to maintain an image of that specific muscle from an external perspective. Another use of imagery is one in which the individual is concerned with the successful completion of a movement. The perspective is that of being inside the body (Garfield, 1984). An example is the internal imagery technique presented in Appendix A.

These examples provide anecdotal accounts for two types of imagery techniques as an important adjunct to physical performance. Further, these accounts are substantiated by recent experimental and correlational studies. However, before these studies can be adequately reviewed, it is necessary to make a distinction between mental practice and imagery, and to define imagery for the purpose of this research.

Definitions of mental practice and imagery

Until 1983, the literature on mental practice and its relation to motor performance did not differentiate mental practice from imagery rehearsal. A 1982 review of mental performance strategies and motor

performance illustrates this point (Weinberg, 1982). In this review the author states:

"Although mental practice has been the term most frequently used in the literature, this topic has been investigated under a variety of names such as imagery rehearsal, symbolic rehearsal, and conceptualizing practice... methods have included the following techniques: (a) having the subject read a description of the task, (b) memorization of descriptions and thinking through them at regular intervals, (c) viewing a demonstration or film of the proper execution of a skill, (d) having a teacher read a description to the students, and (e) having subjects imagine themselves correctly performing the skill" (Weinberg, 1982, p. 196).

Looking at these diverse methodologies, it is no wonder that results from mental practice research are inconsistent. For this reason it becomes important to define: first what is meant by mental practice; second, to understand how it might be distinguished from imagery, and; third, to define imagery.

Two definitions of mental practice have been widely used in the literature. One, by Richardson (1967a) states, "mental practice is the symbolic rehearsal of a physical activity in the absence of any gross muscular movements" (p. 95). The second, by Corbin (1972) says, "mental practice is the repetition of a task, without observable movement, with the specific intent of learning" (p. 94). The commonality between both definitions is that mental rehearsal is a covert experience. Imagery is also a covert experience and considered to be one technique of many that could be used for mental practice. What distinguishes imagery from other techniques of mental rehearsal (such as viewing a film), is that there is evidence of motor, emotional and

physiological involvement (Hale, 1982; Jacobson, 1930, 1931; Lang, 1979; Lang, Melamed & Hart, 1970; Richardson & Taylor, 1982).

For example, in the pioneering studies by Jacobson (1930, 1931) when subjects were asked to visually imagine scenes such as "the Eiffel Tower," ocular patterns were observed that seemed to be similar to the content of the verbal instruction. Furthermore, follow up studies showed when subjects were asked to "visually" imagine or "muscularly" imagine bending the right arm EOG and EMG responses were consonant with the request. These studies are representative of early research that demonstrate various imagery instructions produce corresponding patterns of efferent activity. Later studies by Richardson and Taylor (1982), and White, Sheehan, and Ashton (1977) have demonstrated that not only could subjects generate efferent activity consonant to the verbal instructions, but that physiological activity could be generated which was similar to the actual stimulus situation (Richardson, 1983).

An example of this is demonstrated in a number of experiments reported by White et al. (1977). In a series of experiments, moderate and weak imagers were asked to rank their liking of a list of food substances from most to least. The hypothesis was that Pavlov's law of strength would hold for the images just as the actual stimuli depending on the subject's imaging ability. The results confirmed the hypothesis. Vivid imagers produced progressively reduced saliva to the first, fourth, seventh and tenth food preference. Weak visualizers showed no difference in salivation response to the same set of preferences. This research shows that if one can construct vivid images, the physiological

consequence is similar to that of the original perceptual motor response.

These examples demonstrate the importance of distinguishing the functional characteristics of imagery when used as a tool for mental practice. Therefore, for the purpose of this research, imagery will be defined as a covert activity that "includes a motor program, and...is a prototype of overt behavioral expression" (Lang, 1979, p. 495; Suinn, 1983).

Now that mental practice and imagery have been defined and differentiated, it is possible to review the experimental and correlational studies which substantiate the anecdotal evidence.

Imagery and Sports: Correlational and experimental studies

Review of the research will be limited to imagery as currently defined and its relation to sports. It was noted earlier that the literature on mental practice and its relationship to physical performance includes a diverse number of methodologies which have not always been appropriate to the study of imagery and its effect on sports performance. However, even though there has been a lack of consistency in studies of mental rehearsal, the reviews (Corbin, 1972; Oxendine, 1968; Richardson, 1967a&b; Weinberg, 1982) indicate important trends and highlight the need for greater specificity and controls in future research. Before specific imagery studies will be discussed, it is valuable to understand the general conclusions that have been agreed upon for the relationship between mental practice and physical practice. Review of the literature warrants the following three

conclusions: (1) When mental practice is combined with physical practice, it is better than either performed alone. Because physical practice is better than mental practice, mental practice should only be used as a valuable adjunct, not as a substitute for physical practice; (2) Mental practice is most effective during early and late stages of learning. However, in regard to early stages, some minimal level of the motor skill must be learned prior to implementation of mental practice, and; (3) Mental practice seems to be more effective with simple motor tasks than complex tasks. However, if a person is trained in the complex task, mental practice can further enhance performance (Suinn, 1983; Weinberg, 1982).

Results on the relationship between imagery and sports, have also been inconsistent for a variety of reasons. In the experimental studies, the number of subjects is typically small, there usually is no adequate control group, the time period for the imagery rehearsal varies from 15 weeks to 1 hour and, target behaviors are diverse as are methods of imagery training. These studies are summarized in Table 1.

 Insert Table 1 Here

However, it is noteworthy that imagery studies exercising the greatest controls have demonstrated significant results. For example, in the most rigidly controlled study, Kolonay (1977) used a large number of subjects, (n=72), and three types of control groups. The three control groups were: (1) relaxation only; (2) imagery only, and;

Table 1

Summary of Experimental Studies

Researcher	Subjects	Comparison	Time period	Target behavior	Results
1. Kolonay (1977)	72 male basketball players (8 college teams)	Group 1-VMBR 2-relaxation 3-imagery 4-no training	6 weeks 15 practice sessions	freethrow	1-7% improvement - significant 2-no change 3-no change 4-no change
2. Nideffer (1971)	competitive divers	1 group - (no imagery) previous year to present year (imagery)	1 month	total number of dives	increase in total dives executed, increase in new dives attempted, decrease in reported anxiety
3. Kirchenbaum & Bale (1980)	3 varsity golfers	S1-BPT after 1 round S2-BPT after 2 rounds S3-no training	2 periods - 6 round golf	decreased overall score	S1 decreased 2 strokes after period 1 S2 decreased 0 strokes after period 1 and 1 stroke after period 2 S3 decreased 1 stroke after period 1 and 0 strokes after period 2
4. Noel (1980)	14 male tennis players	Group 1-VMBR 2-control	7 sessions	winning points	High tennis ability - VMBR improved Low tennis ability - VMBR worsened Control - no change
5. Schlesser et al. (1980)	2 female college basketball players	S1-free throws VMBR field no treatment S2-free throws no treatment field goals VMBR	unstated	S1-free throws S2-field goals	VMBR No Treatment 41.3%v.54.8% 48.9%v.47.8% 36.7%v.52.2% 67.9%v.68.0%
6. Suinn et al. (1980)	16 cross country track team	Group 1-VMBR 2-Controls	8 sessions	aerobic	controls became unavailable therefore between groups comparison was not possible, VMBR athletes showed gains pre to post

(table continues)

Researcher	Subjects	Comparison	Time period	Target behavior	Results
7. Lane (1978, 1980)	16 male basketball players (1 team)	Group 1-VMBR 2-Relaxation	3 weeks, 6 sessions	freethrows	no statistically significant results; trend in favor of VMBR
	6 male basketball players	Group 1-VMBR 2-None	through the competitive season	freethrows	not statistically significant between groups; within groups from previous session showed significant improvement for VMBR, but not control
8. Epstein (1980)	60 dart throwing	Group 1-internal mental rehearsal 2-external mental rehearsal	1 trial	improved performance	not significant when compared to control

NOTE: BPT is broad based psychological training that includes relaxation, imagery rehearsal, self-monitoring and the use of positive self-instruction.

(3) no training. The type of imagery training used in this study is termed visuomotor behavior rehearsal (VMBR). VMBR was originated by Suinn (1972) and is defined as "a covert activity whereby a person experiences sensory-motor sensations that reintegrate reality experiences" (Suinn, 1983, p. 512). This technique not only includes imagery but relaxation and negative thought stopping. In Kolonay's study (1977), VMBR subjects demonstrated a significant improvement in free throw shooting compared to the three control groups. On the surface, it might seem that these results cannot be directly attributed to imagery, because VMBR utilizes a combination of techniques. However, when imagery methods are examined in more detail, most techniques instruct the individual to first relax and then to image. In fact, relaxation is integral to the imaging method. Kolonay's results merely indicate that each component alone is not sufficient to improve performance. Thus, it is possible to conclude Kolonay's study is a good demonstration that imagery can enhance performance for experienced basketball players.

Other studies with divers (Nidiffer, 1971), golfers (Kirchenbaum & Bale, 1980), tennis players (Noel, 1980), female basketball players (Schleser, Meyers & Montgomery, 1980) and a cross-country track team (Suinn, 1980) provide support that imagery rehearsal can lead to improvements in performance. However, one exception showed that imagery led to a decrement in performance. In this study (Noel, 1980) fourteen tennis players were divided into groups of high tennis playing ability and low tennis playing ability. With VMBR training, high ability

subjects showed an improvement, whereas, low ability subjects showed a decrement in performance. Though this finding may seem to be non-supportive of imagery, it is consistent with the trends outlined earlier in regard to mental practice. For mental practice to be an effective adjunct for a complex task, some proficiency in the skill is a prerequisite. With this exception, all other studies noted used athletes with a high level of skill.

Several studies did not achieve significant results. It is this author's opinion that the number of sessions conducted was not adequate for the athletes to become skilled in the use of the visualization technique. For example, in one study (Lane 1978) with 16 male basketball players, VMBR was compared to relaxation. Six sessions were held in three weeks, and although results for VMBR were not significant, a trend was indicated in favor of VMBR.

Another example: In a study conducted by Epstein (1980) that used imagery to enhance dart throwing performance, the imagery session was conducted one time only, for one hour.

A further reason that some studies may not show statistical significance is the small number of subjects typically used. For instance, a study conducted by Lane (1980) with basketball players did not yield a significant difference between groups when VMBR and a control was used. However, there were only three subjects in each group. It should be noted that when a within groups analysis was conducted, significance was achieved for the VMBR group but not the control.

The group of studies reporting insignificant results does not discount the performance enhancing ability of imagery techniques. However, they do raise some important questions with regard to utilizing the technique. First, can imagery techniques work with beginning athletes engaged in simple sport skills such as weight lifting? For instance, even though lifting a weight requires balance and coordination, the cognitive demands of the task are not as complex as playing tennis which requires taking in a greater number of details with regard to physical technique. Further, the general trends derived from the practice literature indicate that mental practice can be effective during early stages of learning with simple motor tasks. Together, the data from these studies raise certain questions. One is whether less skilled athletes engaged in simple sport skills should be able to benefit from imagery techniques, unlike the low ability tennis players who experienced performance decrements with VMBR training.

A second question raised by the of studies Lane (1978) and Epstein (1980) and one that has been raised by other researchers as well (Lang, 1979; Suinn, 1983), concerns the idea that imagery technique is a skill to be learned just as physical techniques constitutes a learned skill. Therefore, one may assume the same laws of learning apply to imagery training as to other types of skills. Proficiency in imagery is probably gained over a number of trials, not just a single trial as Epstein's (1980) research seems to indicate. Taking this into account, future research should allow for adequate training trials to try to insure acquisition of the imagery skill.

In conclusion, the experimental studies reviewed in this section seem to indicate that imagery is a technique which can be used to enhance sports performance given adequate training time. However, important questions are raised with regard to the relationship between the use of imagery, the complexity of the sport, and the skill level of the athlete.

Review of correlational studies and imagery type

Correlational studies of imagery have shown that most skilled athletes use imagery to enhance performance (Doyle & Landers, 1980; Mahoney & Avenier, 1977; Meyers, Cooke, Cullen & Liles, 1979). However results concerning which type (or types) is at best equivocal (Hale, 1982). These inconclusive results are probably due, in part, to confusion about the relationship between imagery ability and imagery styles. For example, in a study of imagery ability, Start and Richardson (1964) classified gymnasts into four groups using "the Betts QMI Vividness of Imagery Scale" and "The Gordon Test of Visual Control of Imagery" (Richardson, 1967). The four groups were: (1) vivid-controlled imagers; (2) vivid-uncontrolled imagers; (3) less-vivid-uncontrolled imagers, and; (4) less-vivid-controlled imagers. The results showed a significant correlation between the vivid-controlled imagers and the better gymnasts.

In a subsequent study of gymnasts and imagery style (Mahoney & Avenier, 1977), the results demonstrated that athletes who successfully made the Olympic team reported a higher frequency of "internal" rather

than "external" images. Mahoney and Avenier define internal imagery as "requiring an approximation of the real-life phenomenology such that a person actually images being inside his/her body and experiencing those sensations which might be expected in the actual situation" (p. 137). External imagery is defined as "a person views himself from the perspective of an observer (much like in home movies)" (p. 137).

On the basis of these two sets of results and others with similar outcomes, researchers theorized that the greater the vividness and control one has over an image, the more it is highly correlated with the internal perspective than the external perspective (Mahoney & Avenier, 1977; Start & Richardson, 1964). (See Table 2 for a summary of these studies). Indeed an early finding by Shaw (1940) seems to support this. Recall that Jacobson (1931) demonstrated an increase in electrical activity in the biceps when subjects were asked to "imagine bending the right arm." This electrical activity was not present in the biceps when subjects were asked to "visualize bending the right arm." Instead electrical activity increased in the ocular muscles. When Shaw's subjects were asked to imagine lifting a weight there was also greater arm muscle response. Furthermore, the degree of EMG amplitude was reported to be linked to reports of "vivid" images more than "fair" images.

However, more recent evidence (Hale, 1982) disputes this finding. Using the Betts subscales of kinesthetic and visual imagery vividness, Hale (1982) found that: (1) "kinesthetic imagery clarity was not a good predictor of biceps response amplitude during internal imagery" (p.

384) and; (2) visual imagery ability was not associated with degree of ocular amplitude during external imagery" (p. 384).

These conflicting studies raise questions regarding imaging ability (vividness and control) and the relationship to imaging style (content and perspective). Lang's (1979) 'bio-informational theory of emotional imagery' begins to provide explanation of how this discrepancy might be resolved.

 Insert Table 2 Here

Lang's 'bio-informational theory of emotional imagery'

Lang's 'bio-informational theory of emotional imagery' is derived from propositional theories which have been developed to explain how knowledge is represented in the brain (Anderson & Bower, 1973; Kintsch, 1974; Pylshyn, 1973). According to Lang, what makes a stored description an image is that the propositional network of an image contains modality specific information. Furthermore, image networks contain a large number of stimulus propositions which are descriptions about stimuli. For example if one is asked to imagine a cat one might think of fur, claws, and paws.

Image networks not only contain propositions about stimuli, but, even more fundamentally, propositions about responses. As Lang points out an "image is not a stimulus in the head to which we respond; it is itself an active response process. As the psychophysiological studies

Table 2

Summary of Correlational Studies of Imagery Ability and Imagery Style

Researcher	Subjects	Results
1. Start and Richardson (1964)	gymnasts	better performance correlates, highest to lowest, with (1) vivid-controlled (2) vivid-uncontrolled, (3) less vivid-controlled, (4) less vivid-uncontrolled
2. Suinn and Andrews (1981)	alpine skiers	vivid-clear imagers performed better
3. Meyers et al. (1979)	racquetball players	better players had better imagery, clarity, control
4. Doyle and Landers (1980)	rifle and pistol shooters	elite shooters used internal imagery while sub-elite used external imagery
5. Mahoney and Avenier (1977)	gymnasts	qualifiers used more internal than external imagery
6. Morgan (1978)	runners	elite runners used associative strategy (similar to internal) while sub-elite runners used disassociative strategy
7. Bale (1982)	weight lifters	internal imagers produced significantly more EMG activity

amply demonstrate...during active imagery the pattern of effector activity is determined by the response propositions which are included in the image structure...In addition, the extent to which perceptual response operations are represented in the image provides an estimate of image vividness which is independent of the interpretive bias which affects post-image verbal reports" (Lang, 1979, p. 500 & 501).

In other words, before imagery vividness and physiological responses (imagery perspective) can be correlated, subjects must be able to use the correct response propositions. In order to accomplish this, Lang has developed a behavioral training program using verbal reinforcement for executing specified response propositions. Subsequent research (Lang, 1979; Lang, Kazak, Miller, Levin & McLean, Jr., 1980) demonstrated that response-trained subjects compared to stimulus trained subjects showed substantial physiological activity and generally rated their imagery as more vivid.

For example, in the stimulus trained group, subjects were asked to attend to stimulus details in scenes which had been categorized as fearful, neutral or action oriented. After reading a description they were then asked to imagine the scene. Upon completion of the imagination exercise, subjects were requested to describe their image and were verbally reinforced for describing specific stimulus details. The procedure was the same for response trained subjects except that reinforcement was contingent on reports of physiological involvement. (An example of stimulus and response scripts for an action scene is presented in Appendix B).

With the use of this procedure, Lang, et al. (1980) have found that both training as well as the type of script modified the vividness rating of the image. Results indicated that: (1) response trained subjects reported more vivid, realistic imagery than stimulus trained subjects, and; (2) when response propositions were included in a script, arousal ratings were significantly higher (Lang, et al., 1981).

The issues between internal-external perspective and imagery vividness are quite similar to those discussed by Lang. Internal images are made up of muscular activity response propositions and external images are made up of ocular activity response propositions. Furthermore, in order for the two types to be compared, the quantity and quality of each of the response propositions in the image script must be equated (Hale, 1982). Additionally, in order for imagery vividness to become correlated with imagery style, subjects must be trained to evoke the specified response propositions.

Verbal reinforcement of both muscular and ocular response propositions could lead to enhanced imagery vividness in their respective sense modalities. In other words, muscular reinforced propositions should lead to increased vividness in the kinesthetic imagery subscale and ocular reinforced propositions should lead to increased vividness in the visual imagery subscale.

How weight lifting can be integrated with the study of imagery

Weight lifting is a sport skill that lends itself readily to the study of the relationship between physical fitness and psychological factors.

First, as previously mentioned, the task of weight lifting is not as cognitively complex as many other sport skills. This means that some degree of proficiency can be developed within a relatively short period of time. For example, strength differences in beginning weight lifters can be demonstrated after training consistently for three to five weeks (Moritani & deVries, 1979).

Second, improvement in the skill, in terms of strength differences, can be measured in many reliable ways depending on the mode and goals of the weight lifting program. This is because there is now a generally agreed upon definition of strength. It is: "the amount of force that can be applied against an external object" (p. 59, Hatfield, 1985). The change in the amount of force is used to measure strength.

Assessment of that change can be measured by a variety of simple and/or sophisticated techniques depending on whether the mode of strength training is static (isometric) or dynamic (isotonic). For instance, one of the simpler ways to measure strength is by having a subject perform "one repetition maximum" (1-RM) in one or more weight lifting movements such as the bench press and squat. "One repetition maximum" is defined as the maximum weight a person can lift for one complete repetition (O'Shea, 1976). On the other hand, a more sophisticated way to measure strength is the Cybex II dynamometer. This "is an isokinetic device that measures muscle force both isometrically and isotonicly. In testing strength isotonicly, the Cybex measures muscle force at a set velocity in both extension and

flexion in degrees per second" (O'Shea, 1976, p. 21).

A third reason that weight lifting is easily integrated into the purposes of this research is that strength does not depend solely on physiology. For example, Hatfield says there are at least nine different components ranging from neurological to chemical to physical and even psychosocial that contribute to overall strength. These are: (1) the length of the muscle-joint leverage; (2) the arrangement of the individual muscle cells; (3) how many muscle cells one can cause to synapse; (4) the balance of enzymes within each of the muscle cells; (5) the amount of stretch that one can learn to tolerate before telling the brain to stop the muscle contraction; (6) the ratio of "fast twitch" to "slow twitch" muscle fibers. While "fast twitch" muscles are stronger, "slow twitch" are more enduring. The balance between the two can be affected by the type of training one chooses; (7) the number of myofibrils within each muscle cell (Myofibrils are involved in muscle contraction and theoretically the more one has, the greater the strength); (8) The coordination of muscles, and; (9) the level of mental involvement (Hatfield, 1985).

Of all these elements, only the first two, the muscle-joint leverage factor and the physical arrangement of muscle fibers are determined by genetics. All of the other factors can be modified in some way by the individual (Hatfield, 1985). In other words, an individual using a proven method of strength training can effectively make improvement by altering the functional relationship between the muscle and the brain (Dishman, 1985). This implies that similar groups

using the same physical methods of training, but different mental training techniques could theoretically demonstrate different strength gains.

This leads to the fourth and final reason that weight lifting lends itself to the study of mental training. There are several tested and recommended models of strength training from which to choose. Some sport scientists recommend three sets of six repetitions maximum as an optimum method of strength training (Clarke, 1973). Still others recommend one set (Darden, 1973; Jones, 1976) or multiple sets to exhaustion (Silvester, Stiggins, McGown & Bryce, 1982). However, a strength training model based on the concept of periodization has been shown to be more effective in producing leg and hip strength gains as well as superior gains in upper body strength when compared to the previously mentioned methods. These results have been demonstrated in ten of eleven studies lasting from six to fifteen weeks (Stone, O'Bryant, Garhammer, McMillan & Rozenek, 1982).

The concept of 'periodization' is theoretically based on applying training stresses consistent with Selye's model of the General Adaptation Syndrome. The idea is to vary the volume and intensity of work within the training cycle in order to prevent overtraining (Stone, et. al., 1982). During the first phase, called 'hypertrophy', two important changes are expected. First is a positive change in body composition. Decreases in body fat and increases in lean body mass (LBM) (hypertrophy) result in the potential of the athlete to gain strength. Second, an increase in short term endurance occurs. This may be of

great importance in the reduction of fatigue during later phases of high intensity work. In this phase, the intensity is low but the volume is high. After the hypertrophy stage, the next phase is the 'basic strength phase' in which the intensity of the work increases and the volume is moderate to high. Strength is expected to increase sharply during this phase.

Finally, during the 'strength and power phase', the intensity is very high to low and the volume is low. Strength and power are expected to continue to increase during this phase. This increase is thought to be due not only to the accelerated intensity, but also due to fatigue reduction because of the decreased workload.

An example of the periodization concept for an eight-week workout program can be seen in Table 3 (Sebolt, Personal Communication, December, 1984).

 Insert Table 3 Here

For the following reasons it is reasonable to assume that beginners can show performance differences in a matter of weeks. First, the method provides tested and recommended models of strength training. More specifically, the periodization concept has been shown to be effective in achieving strength. Second, weight lifting skills can be developed in a short period of time. Third, strength can be easily measured. Furthermore, because the elements of strength are not only physical but also psychological, it is also reasonable to assume that differences

Table 3

Eight-Week Periodization Program

PHASE	SETS	REPS (volume)	LOADING (intensity)	WEEKS
1. Hypertrophy	3-5	8-20	65-75% 1-RM	2
2. Strength	3-5	3- 6	75-85% 1-RM	3(4)
3. Strength & Power	3-5	2- 3	85-95% 1-RM	3(2)

in mental training may cause increases in performance just as differences in physical training can and do cause the same kinds of performance differences.

Summary of hypotheses

Based on a critical review of the literature, the following hypotheses have been formulated and will be evaluated in this research:

- (1) Subjects trained in internal imagery (muscular response propositions) will demonstrate greater strength than subjects trained in external imagery (ocular response propositions). Strength is operationally defined as the amount of peak torque on the knee extension/ flexion exercise using Cybex II. Both Lang (1978, 1980) and Hale (1982) among others, have demonstrated that physiological activity is consonant with the response descriptions in the imagery instructions. Therefore, since bodybuilding is an activity which involves developing muscle it seems logical to assume greater training effects will occur with the more consonant response proposition, the internal imagery technique.
- (2) Both imagery groups will demonstrate greater strength than the control group. This hypothesis is based on the general conclusions drawn from the

mental practice literature. Namely that mental practice along with physical practice is better than physical practice alone, and;

- (3) Subjects trained in internal imagery will increase vividness ratings on the kinesthetic subscale of the Betts QMI Vividness of Imagery Questionnaire while subjects trained in external imagery will increase vividness ratings on the visual subscale. This hypothesis is based on Lang's finding that response trained subjects report more vivid images than stimulus trained subjects. Furthermore, because imagery has been found to be modality specific it is inferred that the vividness of an image increases only in the sensory system in which one is trained, i.e., muscular response images increase ratings of kinesthetic vividness and ocular response images increase ratings of visual vividness.

METHOD

Subjects

Subjects were forty-five females who agreed to participate in an eight-week beginning body building workshop at a local health club (the Blacksburg Health Spa). Out of the forty-five women who began the program, forty-four completed it. One woman had to drop out due to

mononucleosis. The age range of the subjects was 19 to 34. Subject occupations included student, homemaker, professor, secretary, librarian, minister, reporter, waitress, and unemployed. Subjects rated their physical health from excellent to poor. Physical measures of fitness included height, weight, resting pulse, blood pressure, and body fat composition. The range in height and weight was 154 cm. to 176 cm. for height and 48.5 kg. to 82.6 kg. for weight. The average height and weight was 164 cm. and 60.3 kg., respectively. Resting pulse ranged from 54 to 114 with the average being 79. Blood pressure ranged from 100/60 to 130/90 with the average being 114/74. Body fat composition ranged from 12.5 to 33.9 with 1 person falling in the excellent category; 10 people in the above average category; 25 people in the average category, and; 8 people in the below average category (Jackson, Pollock and Ward, 1980). The average body fat measure for the overall group was 22.5. The majority of subjects had little or no experience with weight lifting. Three had weight lifted for approximately one year, but not on a regular basis.

Dependent Measures

Physical Assessment

All subjects underwent knee joint strength testing at the beginning, middle, and end of the eight week period. Subjects also calculated their 1-RM (one-repetition maximum) on the leg extension exercise.

Imagery Assessment

All subjects were tested on two imagery scales at the beginning, middle and end of the eight week period. These were: (1) a shortened form of Betts Questionnaire upon Mental Imagery (Sheehan, 1967) and; (2) a 7-point Imagery Exercise Questionnaire (adapted from Epstein, 1980; & Hale, 1982; see Appendix C for a sample of the physical and psychological testing packet).

Equipment

Subjects in the body building workshop were trained in the use of free weights and Universal variable resistance weight training equipment. The Universal Leg Extension/Leg Curl machine was used to build strength for the knee extension and flexion exercise.

Cybex II was used to measure strength on both knee extension and knee flexion exercises. Equivalency between the Universal Leg Extension/Leg Curl machine and Cybex II was calibrated by estimating the total range of motion, (124°) and the time for the total muscle contraction on the leg extension machine (4 seconds). The testing time was set at 56 degrees per second joint angle velocity (D.R. Sebolt, Personal Communication; January, 1985).

Relaxation and imagery instructions were administered by tape over a Sony Walkman with headphones and a stereo sound system.

Procedure

Subjects were recruited for this (workshop) study by a publicity campaign via local newspapers and flyers (See Appendix D). Interested participants were informed about the purpose and requirements of the study and were asked several pre-screening questions in order to meet American College of Sports Medicine guidelines as well as requirements for the study (See Appendix E).

Prior to testing, all subjects were required to sign a subject consent form (see Appendix F) informing them of the nature of the research. Subjects were also required to sign a medical consent form stating that they were in good physical condition, and releasing the health spa from liability (see Appendix G). A cost of \$15.00 was charged to each participant to cover use of the health spa facility and training materials.

All testing was conducted in the Muscular Functioning Laboratory in the Department of Health, Physical Education and Recreation at Virginia Polytechnic Institute and State University. The initial testing was conducted in four phases: (1) the physical assessment questionnaire which collected data concerning, (a) age, (b) height, (c) weight, (d) resting pulse, (e) body fat composition, (f) blood pressure, (g) self rating of physical condition, (h) prior weight lifting experience and (i) physical abnormalities; (2) the Cybex II test of knee joint strength for extension and flexion (at 56°/s joint angle velocity); (3) the two imagery questionnaires, and (4) 1-RM test for the leg extension exercise.

All subsequent testing, (at the midpoint and end of the eight week program) included: (1) the Cybex II test and (2) the two imagery questionnaires (see Appendix C) for all testing materials. Upon completion of testing, subjects made their final choice of four class times. These were: (1) Tuesday and Thursday, 8:30-9:30 a.m.; (2) Wednesday, 1:00 p.m. and Saturday, 9 a.m.; (3) Friday, 6:00 p.m. and Sunday at 5:00 p.m., and; (4) Friday, 7:00 p.m. and Sunday at 4:00 p.m. After subjects picked their class times, the experimenter randomly chose which experimental condition each group would be assigned. The experimental conditions were: (1) subjects trained to use muscular response scripts (internal imagery); (2) subjects trained to use ocular response scripts, (external imagery), and; (3) subjects who received no imagery training. Table 4 shows how the class times and experimental conditions corresponded.

 Insert Table 4 Here

Upon completion of the testing, all participants met at their assigned times for physical training at the Blacksburg Health Spa (a.k.a., Goad's Gym).

During the first workshop session, subjects were trained to perform five stretching exercises and fourteen resistance exercises to build strength (see Appendix H for a listing of specific exercises). In the second session of the first week, subjects began the physical training.

TABLE 4

Assignment of Experimental Condition
to Class Time

	Number of	Experimental
Class time	Participants	condition
Tuesday-Thursday	11	Internal
Wednesday-Saturday	4	Internal
Friday-Saturday 1	15	Control
Friday-Saturday 2	15	External

In the first session of the second week, subjects assigned to the experimental conditions received instruction in their respective relaxation and imagery procedures. These relaxation and imagery practices were adapted from Lang (1979; 1980) and administered by pre-recorded tapes (see Appendix I for the copy relaxation and imagery scripts). In this and the next two sessions, subjects were instructed in a ten-minute relaxation procedure. Then, prior to performing the leg extension exercise, they listened to a pre-recorded tape on how to image performing the leg extension exercise. These instructions were administered via a Sony Walkman with two sets of earphones so two people working out together could listen at the same time.

During these three sessions, subjects were asked to describe the content of their images during the leg extension exercise. Phrases similar to those used in the respective imagery instructions were verbally reinforced by the experimenter. Phrases that did not resemble the original script were not reinforced. Subjects were also asked to evaluate the vividness of their visual and/or muscular images using an adapted version of the 7-point imagery scale (Epstein, 1980; Hale, 1982, see Appendix J).

After these three sessions, each of which began with a ten-minute relaxation procedure, subjects listened to a shortened version of the relaxation technique combined with imagery. These taped instructions were administered to the respective experimental groups via the health club stereo system prior to working out. In addition, subjects were requested to try imaging for all of the exercises and to continue filling

out the 7-point imagery scale after performing the leg extension movement. This continued until the seventh week when subjects were instructed to continue on their own. All subjects met twice per week for lecture/discussion on physical training and work-outs. (See Appendix K for the curriculum outline and training materials). Subjects were also requested to work out a third time on their own, in what was called a self-control session. Imagery instructions were not available for the self-control workout. However, subjects were instructed to image on their own. Vividness ratings were requested during this third time period. However, it was soon immediately apparent that it was difficult to achieve compliance. At the end of the eight-week period and after all testing had been completed a debriefing session was conducted at the Blacksburg Health Spa.

RESULTS

Assessment of Physical and Psychological Measures Between Groups

To insure more accurate statistical analysis of strength and imagery differences the number of subjects in each group was equated by dropping one subject from the external imagery group and one from the control group. This was done by utilizing a random numbers table.

Equivalency between the three groups was assessed during the first testing session. The following measures were taken to determine possible physical and psychological differences between groups. These were: (1) age; (2) height; (3) weight; (4) body fat composition; (5) resting pulse; (6) blood pressure; (7) strength (using 1-RM on the leg

extension); (8) imagery vividness, and (9) imagery type (internal v. external). At the end of the study, class attendance and number of self-control sessions were also tabulated.

A one-way analysis of variance found significant differences between groups on measures of weight, $F(2,39) = 3.46$, $p < .04$ and body fat $F(2,39) = 3.29$, $p < .04$. The Student-Newman-Keuls test on the weight variable found that the external imagery group was significantly heavier than the internal imagery group. The external imagery group was not significantly heavier than the control group nor was the control group significantly heavier than the internal imagery group, (See Table 5).

 Insert Table 5 Here

In terms of body fat composition the Student-Newman-Keuls test indicated that the control group had significantly higher levels of body fat than the internal imagery group. The control group did not have significantly higher levels of body fat than the external imagery group nor did the external imagery group have significantly higher levels than the internal imagery group (See Table 6).

 Insert Table 6 Here

Table 5

Student-Newman-KeulsTest on Weight

Grouping	Mean	Group
A	64.2 kg	External
BA	59.0 kg	Control
B	57.4 kg	Internal

Note: Means with the same letter are not significantly different. On all other physical and psychological measures there were no significant differences between groups.

Table 6

Student-Newman-Keuls

Test on Body Fat Composition

Grouping	Mean	Group
A	24.78	Control
BA	22.56	External
B	20.19	Internal

Table 7 compares the range and means on these measurements for the three groups.

 Insert Table 7 Here

Strength Gain

Two of the hypotheses used strength on Cybex II as the dependent measure. The two hypotheses stated: (1) the internal imagery group will demonstrate greater strength than the external imagery group, and; (2) both imagery groups will demonstrate greater strength than the control. A two-way analysis of variance with repeated measures using Cybex II showed significant strength differences between groups $F(2,38) = 3.19$, $p \leq .05$. Additionally, significant strength differences for all groups over time was demonstrated, $F(2,38) = 38.63$, $p \leq .0001$ (See Table 8).

 Insert Table 8 Here

A least significant difference (LSD) test on strength differences between groups showed that the internal imagery group showed significantly greater strength than the control group. No significant strength difference was found between the internal imagery group and the external imagery group. In addition, no significant strength

Table 7

Range and Means on Physical and Psychological Measures

Measurement	Group					
	1		2		3	
	Mean	Min-Max	Mean	Min-Max	Mean	Min-Max
Age	26	20-34	24	19-34	26	20-32
Height (cm)	163	157-176	166	154-176	164	157-176
Resting Pulse	75	54-84	77	60-102	83	66-114
Blood Pressure ¹	113/74	100/60-130/90				
Strength (1RM leg extension)	56	30-115	76	10-100	62	20-120
Imagery Vividness (Total on Betts Questionnaire ²)	16	11-20	16	7-32	16	10-21
Imagery Type-I/E/N ³ (Imagination Exercise)	9/5		12/2		11/2/1	
Attendance ⁴	13	8-16	13	10-16	13	9-15
Self Control Session	<u>5</u>	<u>2-8</u>	<u>6</u>	<u>2-8</u>	<u>5</u>	<u>0-8</u>
Total Workout	17	10-24	19	12-24	18	9-23

Note 1: For all groups

Note 2: Possible Min-Max = 7-49; A score of 7-10 = Vivid imager;
30-49 = Non imager (P. J. Lang Personal Communication,
September, 1984)

Note 3: Not mean and range data
Ratio = Internal/External/Nonclassified

Note 4: Maximum Classes = 16 Max. Self Control = 8 Total = 24

Table 8

Summary of Two-Way Analysis of Variance
for Strength Measured by Cybex II

Source	df	Sum of Squares	F	P
<hr/>				
Total		125051.415		
Group	2	12969.794	3.19	$\leq .05$
Error (Group)	38	77286.287		
Time	2	17348.634	38.63	$\leq .0001$
Error (Time)	76	17064.707		
Interaction	4	381.992	.43	$\leq .7899$

difference was found between the external group and the control group. (See Table 9). However, a test for trend showed a significant linear trend in the direction of the hypothesis, $F(1,38) = 3.70$ $p(<.05)$ (See Table 10). Figure 1 illustrates the strength differences between the three groups.

 Insert Tables 9 and 10 Here

 Insert Figure 1 Here

A least significant difference (LSD) test on strength differences between the three different time periods showed that all three groups showed significant strength differences at both the midpoint and final testing period. (See Table 11).

 Insert Table 11 Here

Imagery Vividness Analyses

The third hypothesis used imagery vividness ratings on the Betts Subscale Upon Mental Imagery (Sheehan, 1967) as the dependent measure. This hypothesis stated that subjects trained in internal imagery would increase vividness ratings on the kinesthetic subscale of

Table 9

LSD Test on Strength Between Groups

Grouping	Mean	N	Group
A	258.31	42	Internal
BA	238.43	42	External
B	235.13	39	Control

Table 10

Summary of Test for Trend on Strength Differences Between Groups

Source	DD	df	MS	F	P
Strength Gain	(12969.79)	(2)			
Linear	522.38	1	7522.38	3.70	$\leq .05$
Quadratic	3848.55	1	3848.55	1.89	N.S.
Error	77286.28	38	2033.84		
Total	90256.07	40			

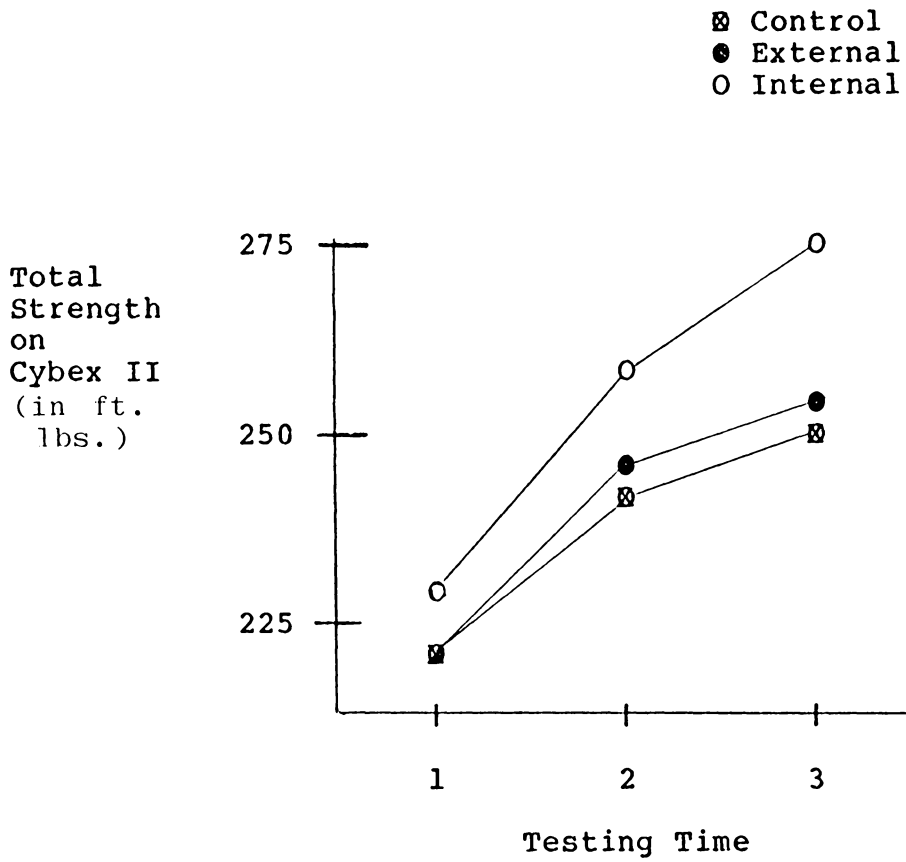


Figure 1. Strength Differences Between Groups Over Time

Table 11

LSD Test on StrengthDifferences for All Groups Over Time

<u>Grouping</u>	<u>Mean</u>	<u>N</u>	<u>Time</u>
<hr/>			
A	259.15	41	Final Testing
B	243.27	41	Midpoint Testing
C	230.10	41	Initial Testing

Betts, while the subjects trained in external imagery would increase vividness ratings on the visual subscale. A two-way analysis of variance with repeated measures showed that the vividness rating on the kinesthetic subscale did not increase significantly between groups. However, vividness ratings on this subscale did increase significantly for all subjects over the eight week time period $F(2,39) = 5.42$, $p \leq .0062$. (See Table 12). A least significant difference test indicated that the vividness increase did not occur until the final testing period.

Insert Table 12 Here

Finally, examination of vividness increases on the visual subscale using a two-way analysis of variance with repeated measures revealed no significant differences either between groups or over the eight-week time period.

Table 12

Summary of Two-Way Analysis of Variance for Imagery VividnessOn the Kinesthetic Subscale of Betts Questionnaire

Source	df	Sum of Squares	F		P
Total		67.054			
Group	2	.173	.09	≤	.9166
Error (group)	39	38.721			
Time	2	3.366	5.42	≤	.0062
Error (Time)	4	.587			

DISCUSSION

In general, the results of this study provide further evidence for the hypothesis that psychological factors enhance physical development and/or fitness. More specifically, the three hypotheses of this study are supported by the following set of results: (1) Significant strength was demonstrated by all groups. Further, the internal imagery group showed significantly greater differences than the control group; (2) The significant linear trend with the mean of the external group falling between the internal and control group, and; (3) significant improvement on the kinesthetic subscale of the Betts questionnaire for all groups. The trend of the means on the kinesthetic subscale, though not significantly different indicates that the internal imagery group had slightly more improvement than the other two groups. Together these findings support the three hypotheses of this thesis.

First, it was hypothesized that the internal imagery group would demonstrate greater strength gains than the external imagery group. There was a significant linear trend showing the internal imagery group had greater strength gains than the external imagery group. Even more convincing is the finding that the internal imagery group showed significantly greater strength differences than the control group. This difference becomes more meaningful when one considers that all groups made significant strength gains during the eight-week training period. In other words, one can interpret this to mean that an individual can achieve muscle development by using the 'periodization' concept of physical training. However, muscle development can be further

enhanced by a combination of physical and mental training that is consonant with the physiological responses one is trying to achieve. This finding can also be interpreted as support for Lang's (1979) 'bio-informational theory of emotional imagery'. For example, one functional aspect of Lang's theory is that the image in the brain is a set of responses that includes a perceptual-motor set which is modality specific. Lang's studies have demonstrated that it is possible to alter the cognitive structure of these responses thereby altering specific patterns of physiological and behavioral responding. This study also suggests that the set of cognitive responses one consciously chooses can significantly alter physiological responses---in this case, increased muscle development.

Another important element of Lang's theory is that it is modality specific. His imagery studies indicate that it is important to utilize cognitive response sets which are relevant and specific to the physiological and behavioral pattern one is trying to change. In this study, it seems logical that the response pattern instructions of the internal imagery group are more specific to muscle development than the external imagery instructions. In other words, imaging kinesthetic sensations within a muscle seems more specific to strength than imaging the appearance of a muscle, particularly when one considers that strength is generally defined as how much force one can exert against an external object. At this point, the modality specific interpretation of the imagery is speculative in relation to muscle development. But certainly, early psychophysiological studies by Jacobson (1930) and the

more recent study by Hale (1982) indicate there is evidence for this kind of interpretation. Further studies utilizing biofeedback could clarify this issue. For instance, it is conceivable that the early procedures of Jacobson (1930) (in which subjects were wired to EMG & EOG equipment) could be modified for more applied studies by using recent technological advances in biofeedback.

The modality specific nature of imagery is further complicated by individual differences in imagery ability. This leads to possible reasons for the lack of a significant finding on the least significant difference test for the second hypothesis. The second hypothesis was that both imagery groups would demonstrate greater strength than the control group. In general, the significant linear trend showed that this was the case, with the internal group showing the greatest strength and the control group showing the least strength. This trend supports the conclusion drawn from the mental practice literature stating that mental practice along with physical practice is better than physical practice alone. However, the lack of a statistically significant finding on the least significant difference test points to a possible methodological problem that should be taken into account in future studies of this type. This problem has to do with the imagery perspective one chooses. For instance, this study controlled for imagery ability and perspective through the process of random assignment. In terms of imagery ability and perspective, the groups were essentially equivalent. All groups had more members who chose an internal imagery style over an external imagery style. Furthermore, the imagery perspective that

was utilized by the individual at the beginning of the study did not change significantly over the eight-week time period. In other words, most of the subjects were internal imagers to begin with, and they became better at internal imagery through the course of the study. Therefore, future studies might utilize a matched groups design with an equal number of external and internal imagers assigned to each condition.

Use of this technique might also clarify the reason for the lack of significant findings for the third hypothesis. The third hypothesis was that subjects trained in internal imagery would increase vividness ratings on the kinesthetic subscale of the Betts questionnaire and subjects trained in external imagery would increase vividness ratings on the visual subscale. This hypothesis was not supported, possibly due to the fact that there were a greater number of internal imagers in the overall group. This interpretation is augmented by the statistically significant finding of an increase in imagery vividness on the kinesthetic subscale for the group as a whole. Furthermore, significant increases in kinesthetic vividness is consistent with Lang's theory.

His theory (1979) states that the propositional structure of an image can be modified either through (1) verbal report (instructions) and/or (2) systematic shaping of physiological output. One could interpret this to mean the increases in vividness on the kinesthetic subscale may be due to the consistent physical training which might have enriched the propositional structure of the kinesthetic sense modality. Further, a trend that also seems to strengthen this

interpretation is that improvement on the kinesthetic subscale was greater for the internal imagery group than the other two groups.

Finally, three factors may have had an effect on the lack of support for the third hypothesis. First, the average person in the study had an above average imaging ability at the beginning of the study. For example, the Betts Questionnaire has a seven-point rating scale with a ranking of one being "perfectly clear and as vivid as the actual experience" and seven being "no image present at all, only knowing that you are thinking of the object." On the kinesthetic subscale, the average person ranked the images at 2.14 at the beginning of the training and 1.86 at the end. This difference indicated a statistically significant improvement but clearly imagery abilities began at a high level. It is possible that use of the Betts Questionnaire to assess imagery vividness created a ceiling effect and could not adequately measure the effects of the imagery training. Future studies might use psychophysiological recordings to additionally monitor imagery vividness. This method could be similar to the one used by Lang in monitoring vividness difference between stimulus and response scripts.

The second factor that may have had an effect on the lack of significance for the third hypothesis was that most subjects in the study were good internal imagers at the onset. It may be difficult for one who is proficient in one imagery style to become proficient in another. Indeed, it is interesting to note there was a trend on the visual subscale of the Betts Questionnaire indicating the external group

showed the lowest vividness ratings of all groups over time. This is exactly the opposite of what was hypothesized. One might interpret this to mean that perhaps there is some type of interference effect when trying to switch from one style to another. It would be useful for future studies to evaluate the effect of changing perspective between good imagers and poor imagers from internal to external and vice versa.

Finally, group size made it difficult for the experimenter to monitor both the physical and psychological training. Future studies should insure that both types of training are being adequately monitored either by: (1) reducing the size of the groups; (2) using two experimenters, one to monitor physical training, while the other monitors psychological training, or; (3) introducing the psychological training a week or so later when the subjects have become more familiar with the exercise routine and techniques.

In summary, the statistically significant results as well as the trends support the hypotheses of this investigation. Furthermore, the use of Lang's bio-informational theory of emotional imagery (1979) provides a theoretical context which enables better understanding of how imagery techniques can be used to mediate behavior. Clearly, many additional issues have been raised as a result of this investigation. Future studies could utilize psychophysiological equipment in the manner of Jacobson (1930) and Lang (1979) to clarify issues concerning whether: (1) imagery is more effective when it is modality specific, or; (2) whether there is some type of complex

interaction between the physiological system one is trying to alter and the imagery perspective and ability of the person utilizing the technique. Further, the use of a matched group design should be utilized to help increase the sensitivity of these studies. Certainly future studies utilizing more controlled designs as well as advanced technology would aid in understanding how the mechanism of imagery works to alter physiological responding and behavior. The present study indicates that imagery increases performance for the 'everyday' athlete as well as the elite athlete in an applied setting. Furthermore, this investigation is the first controlled experimental study using beginning athletes to demonstrate significant athletic performance effects using mental training above and beyond significant performance effects due to physical training.

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APPENDICES

APPENDIX A

Example of an Internal Imagery Technique

Charles Garfield in his book Peak Performance (1984) describes an internal imagery technique as taught to him by a group of Soviet sport psychologists.

"The Soviets were interested in the fact that I had once bench pressed 365 pounds, and they wanted to know how long I thought it might take to get in shape to lift at that level again. I assured them I could do it within nine to twelve months...(Now) with enormous difficulty, and due mostly to the excitement of the situation, I managed to lift 300 pounds...Following the lift the Soviets went to work...They asked me to lie on my back and proceeded to guide me into a deep state of relaxation...When nearly forty minutes has passed, they asked me to sit up slowly...Next, I was told to psychologically visualize myself approaching the bar, sitting on the bench, lying down, and then, with total confidence lifting the 365 pounds. I was also instructed to imagine the sounds I would hear, the dull metallic ring as the bar tipped slightly, jangling the weights together, the sound of my own breathing and any vocalizing I ordinarily did before working out...They asked me to zoom in and out on the images imprinted in my mind...to imagine how my muscles would feel as I completed the lift. They talked me through the entire process again and again, all the while monitoring my psychological and physical responses with their instruments. Surprisingly, everything began to come together for me, much the way it does split seconds before you know you are going to succeed at an athletic goal for which you have been preparing for months...I lifted the (365 pounds)" (Garfield, 1984, p. 18-19).

APPENDIX B

Example of Stimulus and Response Scripts

:

Action Scene Scripts

Stimulus Script

'You are flying a kite on the beach on a bright summer day. Your red kite shows clearly against the cloudless blue sky, and whips quickly up and down in spirals with the wind. The sun glares at you from behind the kite and makes the white sandy beach sparkle with reflections. The long white tail dances from side to side beneath the soaring kite. A strong gust of wind catches the kite sending it higher and higher into the sky' (Lang et al. 1980, p. 183).

Response Script

'You breathe deeply as you run along the beach flying a kite. Your eyes trace its path as it whips up and down in spirals with the wind. The sun glares into your eyes from behind the kite, and you tense the muscles in your forehead and around your eyes squinting to block out the bright sunlight. You follow with your eyes the long white tail which dances from side to side beneath the soaring kite' (Lang et al., 1980, p. 183).

APPENDIX C

Sample of the Physical and Psychological Testing Packet

Physical Assessment Questionnaire

1. Name _____
2. Address _____
3. Phone _____ 4. Age _____ 5. Height _____
6. Weight _____ 7. Resting Pulse _____
8. Body Fat Composition _____

9. Aerobic capacity _____
10. Knee joint strength
Extension _____
Flexion _____
11. How would you rate your physical condition?
- | 1 | 2 | 3 | 4 |
|-----------|------|---------|------|
| Excellent | Good | Average | Poor |
12. How much prior weight lifting experience do you have?
- a. How long have you been lifting? _____
- b. How many times per week do you work out? _____
- c. Are you consistent in following a regular schedule?
_____ Yes _____ No
13. Do you have any physical abnormalities or injuries that need to be considered for weight training? _____ Yes _____ No

If yes, describe:

Example Replica of Cybex Output

Cybex II
 Data Reduction
 Memory Test - OK B

=====

NAME
 DATE
 BODYWEIGHT
 JOINT TEST CODE 1
 RIGHT (UNINVOLVED)
 KNEE
 EXTENSION/FLEXION

1 TORQUE TEST
 4 REPETITIONS EACH:
 56 DEG/SEC (1)

=====

MAX GET =9 FT-LBS
 =====

RIGHT SIDE DATA
 TEST 1
 56 DEG/SEC 4 REPS

MAX GET =9 FT-LBS
 =====

RIGHT SIDE DATA
 TEST 1
 56 DEG/SEC 4 REPS

MAX GET =9 FT-LBS
 =====

RIGHT SIDE DATA
 TEST 1
 56 DEG/SEC 4 REPS

EXTENSION
 96 FT-LBS * 46 DEG
 81% PEAK%BW RATIO

FLEXION

57 FT-LBS * 40 DEG
 48% PEAK%BW RATIO
 FLEXION/EXTENSION
 59% PEAKS

MAX ROM TESTED
 3 DEG 98 DEG

=====
 MAX GET =9 ft-LBS
 =====

LEFT SIDE DATA
 TEST 1
 56 DEG/SEC 4 REPS

=====
 MAX GET =9 ft-LBS
 =====

LEFT SIDE DATA
 TEST 1
 56 DEG/SEC 4 REPS

EXTENSION
 89 FT-LBS * 44 DEG
 75% PEAK%BW RATIO

FLEXION
 61 FT-lbs * 38 DEG
 51% PEAK%BW RATIO
 FLEXION%EXTENSION
 69% PEAKS

MAX ROM TESTED
 98 DEG 5 DEG

=====
 BI-LAT COMPARISON
 LEFT/RIGHT DEFICITS

EXTENSION
 TORQ AT 56 DEG/SEC
 7% DFCT PEAKS
 FLEXION
 TORQ AT 56 DEG/SEC
 -6% DFCT PEAKS

TO BE STAPLED TO SUBJECT'S FOLDER

OCCUPATION _____

FOR CYBEX TEST:

_____ BACK PADS
_____ NUMBER ON VERTICAL ADJUSTMENT
_____ HORIZONTAL ADJUSTMENT
_____ DOWN VEST (Y OR N)

THE BETTS QMI VIVIDNESS OF IMAGERY SCALE

NAME: _____ DATE: _____

ADDRESS: _____ TELEPHONE: _____

Instructions for Doing Test

The aim of this test is to determine the vividness of your imagery. The items of the test will bring certain images to your mind. You are to rate the vividness of each image by reference to the accompanying rating scale, which is shown at the bottom of the page. For example, if your image is "vague and dim" you give it a rating of 5. Record your answer in the brackets provided after each item. Just write the appropriate number after each item. Before you turn to the items on the next page, familiarize yourself with the different categories on the rating scale. Throughout the test, refer to the rating scale when judging the vividness of each image. A copy of the rating scale will be printed on each page. Please do not turn to the next page until you have completed the items on the page you are doing, and do not turn back to check on other items you have done. Complete each page before moving on to the next page. Try to do each item separately, independent of how you may have done other items.

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

An example of an item on the test would be one which asked you to consider an image which comes to your mind's eye of a red apple. If your visual image was moderately clear and vivid you would check the rating scale and mark "3" in the brackets as follows:

ItemRating

5. A red apple

(3)

Now turn to the next page when you have understood these instructions and begin the test.

Think of some relative or friend whom you frequently see, considering carefully the picture that rises before your mind's eye. Classify the images suggested by each of the following questions as indicated by the degree of clearness and vividness specified on the Rating Scale.

<u>Item</u>	<u>Rating</u>
1. The exact contour of face, head, shoulders and body	()
2. Characteristic poses of head, attitudes of body, etc.	()
3. The precise carriage, length of step, etc. in walking	()
4. The different colors worn in some familiar costume	()
5. The sun as it is sinking below the horizon	()

Think of seeing each of the following, considering carefully the picture which comes before your mind's eye; and classify the image suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all; you only "knowing" that you are thinking of the object	..Rating 7

Think of each of the following sounds, considering carefully the image which comes to your mind's ear, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

<u>Item</u>	<u>Rating</u>
6. The whistle of a locomotive	()
7. The honk of an automobile	()
8. The mewing of a cat	()
9. The sound of escaping steam	()
10. The clapping of hands in applause	()

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

Think of "feeling" or touching each of the following, considering carefully the image which comes to your mind's touch, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness on the Rating Scale.

<u>Item</u>	<u>Rating</u>
11. Sand	()
12. Linen	()
13. Fur	()
14. The prick of a pin	()
15. The warmth of a tepid bath	()

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

Think of performing each of the following acts, considering carefully the image which comes to your mind's arms, legs, lip, etc., and classify the images suggested as indicated by the degree of clearness and vividness specified on the Rating Scale.

<u>Item</u>	<u>Rating</u>
16. Running upstairs	()
17. Springing across a gutter	()
18. Drawing a circle on paper	()
19. Reaching up to a high shelf	()
20. Kicking something out of your way	()

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

Think of tasting each of the following considering carefully the image which comes to your mind's mouth, and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

<u>Item</u>	<u>Rating</u>
21. Salt	()
22. Granulated (white) sugar	()
23. Oranges	()
24. Jelly	()
25. Your favorite soup	()

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

Think of smelling each of the following, considering carefully the image which comes to your mind's nose and classify the images suggested by each of the following questions as indicated by the degrees of clearness and vividness specified on the Rating Scale.

<u>Item</u>	<u>Rating</u>
26. An ill-ventilated room	()
27. Cooking cabbage	()
28. Roast beef	()
29. Fresh paint	()
30. New leather	()

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

Think of each of the following sensations, considering carefully the image which comes before your mind, and classify the images suggested as indicated by the degree of clearness and vividness specified on the Rating Scale.

<u>Item</u>	<u>Rating</u>
31. Fatigue	()
32. Hunger	()
33. A sore throat	()
34. Drowsiness	()
35. Repletion as from a very full meal	()

Rating Scale

The image aroused by an item of this test may be -

Perfectly clear and as vivid as the actual experience	..Rating 1
Very clear and comparable in vividness to the actual experience	..Rating 2
Moderately clear and vivid	..Rating 3
Not clear or vivid, but recognizable	..Rating 4
Vague and dim	..Rating 5
So vague and dim as to be hardly discernible	..Rating 6
No image present at all, you only "knowing" that you are thinking of the object	..Rating 7

Imagination Exercise

Name _____ Date _____

The following exercise is designed to measure various aspects of your experience in imagining things. After reading the exercise, try to imagine the situation and response described. It is often helpful to close your eyes to reduce distractions while you are imagining.

People vary widely in their imaginary experiences and there are therefore no right or wrong answers to these exercises. Just try to imagine the circumstances described and then report your experience as accurately as possible.

EXERCISE

RESULTS
(circle one)

- | | | |
|------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------------|
| 1. Imagine sitting down and "curling" a 25-lb. dumbbell up towards your shoulder by contracting your biceps and bending the elbow. (Take your time.) | Not at
<u>All</u> | Very
<u>Much</u> |
| a. Were you able to imagine any part of the scene?
(If not, ignore the remaining questions) | Yes | No |
| b. How clear or real was your mental picture of lifting the weight? | 1 2 3 4 5 6 7 | |
| c. Did you "feel" the dumbbell in your hand? | 1 2 3 4 5 6 7 | |
| d. Did you "feel" your muscles move as you gripped and lifted the weight? | 1 2 3 4 5 6 7 | |
| e. How difficult was it to maintain your concentration on the exercise? | 1 2 3 4 5 6 7 | |
| f. How difficult was it to control your imaginary pictures and actions? | 1 2 3 4 5 6 7 | |
| g. How actively involved were you in the scene? | 1 2 3 4 5 6 7 | |
| h. Did you "see" any part of your body other than your hand, legs, and the dumbbell?
(first person perspective) | Yes | No |
| i. Was it like standing outside your body and watching yourself sit and lift the dumbbell?
(third-person perspective) | Yes | No |

j. Did you feel like you were inside
your own body when you lifted
the weight?

Yes

No

FINAL PHYSICAL ASSESSMENT, PART 1

1. Name _____
2. How many times have you been absent from class? _____
3. During this 8 week period, have you been able to work out a third time? _____ If yes, how many third workouts did you do during the eight week period? _____.
4. At the beginning of the course, what was your 1RM on the following exercises?
 _____ Leg Extension
 _____ Squat
 _____ Bench Press
 _____ Lat Pulldown
5. At this time what is your 1RM on the following exercises?
 _____ Leg Extension
 _____ Squat
 _____ Bench Press
 _____ Lat Pulldown
6. On the following weeks what were your weights and repetitions (lb./rep.) for the following exercises?

Week	1/20	1/27	2/3	2/17	2/24	3/3
Exercises						
Leg Ext.	_____	_____	_____	_____	_____	_____
Squat	_____	_____	_____	_____	_____	_____
Bench Press	_____	_____	_____	_____	_____	_____
Lat Pulldown	_____	_____	_____	_____	_____	_____

FINAL PHYSICAL ASSESSMENT, PART 2

1. Name _____

2. Weight _____

3. Body Fat Composition

4. How would you rate your physical condition?

1
Excellent2
Good3
Average4
Poor

FINAL ASSESSMENT, PART 3

1. Name _____
2. Did you change any of your dietary habits during the time period of the workshop? _____ If yes, describe
3. Do you plan to continue with weight training? _____ If yes, what plans have you made to continue? (e.g. join a weight club, arrange a future workout with a partner, etc.)
4. Did you do any other form of exercise besides weight training during this eight week period? _____ If yes, describe

How long have you been doing this additional exercise?

5. Have you noticed any physical changes during this eight week period? _____ If yes, describe

How soon did you notice these changes? _____

6. Have you noticed any psychological changes during this eight week period? _____ If yes, describe

7. Has weight training aided you in any other part of your life? _____ If yes, describe.

COURSE EVALUATION

Please rate the following:

1. Materials (e.g. handouts) for the class were:

1	2	3	4
Excellent	Good	Average	Poor

Comments:

2. Instruction of the class was:

1	2	3	4
Excellent	Good	Average	Poor

Comments:

3. My workout partner was:

1	2	3	4
Excellent	Good	Average	Poor

Comments:

4. My third workouts usually were:

1	2	3	4
Excellent	Good	Average	Poor

Comments:

5. Physical benefits from the class were:

1	2	3	4
Excellent	Good	Average	Poor

Comments:

6. Psychological benefits from the class were:

1	2	3	4
Excellent	Good	Average	Poor

Comments:

7. What did you like most about the class?
8. What did you like least about the class?
9. Did you learn anything new from the class? ____ If yes, what?
10. Do you have any suggestions for future classes?

APPENDIX D

Sample Publicity

NEWS RELEASE

CLASSES OFFERED IN BODYBUILDING

BLACKSBURG - Bodybuilding classes to study the effect of special physical and mental exercises on weightlifting will be offered for eight weeks, beginning Friday.

Andrea Dunn, a Virginia Tech graduate student, and Elise Labbe, assistant psychology professor, will conduct the study.

The exercises cause muscles to develop and the participant may lose body fat, Dunn said.

The classes will meet twice a week for eight weeks at the Blacksburg Health Spa, South Main and Marlinton Streets. Participants are expected to do a third workout each week on their own. The cost is \$15.

Three sets of classes are offered: Tuesday and Thursday, 8:30 am; Friday, 7 pm, and Sunday, 4 pm; and Wednesday, 1 pm and Saturday, 9 am.

POSTER

BEGINNING BODYBUILDING FOR WOMEN

Three, 8 week classes for women between the ages of 18-35 are being offered by Elise Labbe, Ph.D. and Andrea Dunn* of the Psychology Department of Virginia Tech. Classes will be held at the Blacksburg Health Spa, twice a week. Cost for classes will be \$15.00. For more information call Andrea Dunn at _____, Psychological Services at _____, or the Blacksburg Health Spa at _____.

*Andrea Dunn is a competitive bodybuilder who currently holds the women's title for the AAU Roanoke Valley.

APPENDIX E

Pre-Screening Explanation

Explanation of bodybuilding programs

Elise Labbe and myself are offering bodybuilding classes to women who would be classified as beginning weightlifters, who are between the ages of 18 and 35. The benefits of participating in this study, if you follow the program, will be an increase in muscle tone and strength. Also, depending on your diet, you may reduce your present level of body fat.

Sessions will meet twice per week for eight weeks at the Blacksburg Health Spa. In addition, you will be asked to perform one additional workout per week at your own discretion, at a location most convenient to you. Sessions will involve learning and performing physical and mental exercises related to weight training.

You will also be asked to undergo testing of various physical and psychological measures. Physical measurements will consist of measuring your height, weight, resting pulse, blood pressure, body fat composition, and knee joint strength. Other physical and psychological measurements will consist of filling out questionnaires. Testing will take place 3 times, at the beginning, middle and end of the program. Each of the testing times will last approximately one hour and will be conducted in the Exercise Physiology Department at Virginia Tech.

There is a cost of \$15.00 for use of the facilities and training materials. Do you have any questions?

PRE-SCREENING FOR BODYBUILDING CLASSES

1. Name _____ 2. Age _____

3. Address _____ 4. Phone _____

5. How would you rate your physical condition?

1 2 3 4

Excellent Good Average Poor

6. Sign up time for testing _____

Tue/Thur Fri/Sun Wed/Sat

7. Sign up time for class _____

8. Do you feel that you can make the commitment for making the classes and the testing for the entire eight weeks? _____.

9. Do you have any prior weight lifting experience? _____.

APPENDIX F

Subject Consent Form

Subject Consent Form

Dr. Elise E. Labbe, Ph.D. and Andrea Dunn, B.A. are conducting a study to evaluate the relative effectiveness of three types of bodybuilding programs. The programs involve weight lifting and differing instructions on how to do it. Benefits of participating in the program include increased muscular strength and endurance. In addition, depending on one's diet, a participant might also reduce body fat composition.

If I agree to participate, I understand the following procedures and requests:

1. Sessions will meet twice per week for eight weeks at the Blacksburg Health Spa on South Main and Marlinton Streets.
2. I will be requested to do one additional workout per week at my own discretion, at a location most convenient to me.
3. Sessions will involve learning and performing physical and mental exercises related to weight training.
4. I will be requested to undergo non-invasive testing of various physical and psychological measures. Physical assessment will consist of measuring height, weight, resting pulse, body fat composition, aerobic capacity and knee joint strength. Other physical and psychological measurements will consist of filling out paper and pencil assessments will take place three (3) times, at the beginning, middle and end of the program period. I understand I will be requested to make a one hour appointment for each assessment period and they will be conducted in the exercise Physiology Department at Virginia Polytechnic Institute and State University.
5. I understand that the cost for use of the facilities and training materials will be \$15.00.

The only discomfort to be expected during the course of this project is possibly a temporary burning feeling in your muscles and muscle soreness.

It is the participant's responsibility to advise the researchers of any medical problems that might arise in the course of this study. It is the participant's right to discontinue participation in this project at any time.

All information will kept strictly confidential and will only be viewed by persons directly associated with this study. If the results of this study are to be published or presented publicly, the names and identifying information of all participants will be withheld.

This research project has been approved by the Human Subjects Research Committee and the Institutional Review Board. Any questions that you might have regarding this project should be directed to:

Elise E. Labbe, Ph.D., 961-5819
Principal Investigator

Andrea Dunn, 552-0054
Associate Investigator

William Schicht, Ph.D., 961-5346
Chairperson, Human Subjects Committee

I hereby agree to voluntarily participate in the research project described above and understand the conditions described above.

Participant's Signature

Date

APPENDIX G

Liability Form

LIABILITY FORM

BLACKSBURG HEALTH SPA

Date Membership Expires _____

Revised Expiration Date _____

Name _____ Phone _____

Address _____

The undersigned (Member) and Blacksburg Health Spa (BHS) hereby agree and are bound to the terms and conditions for membership at BHS as set forth as follows: Member represents that he or she is in good physical condition and is able to use the equipment provided by and is able to attempt the exercises recommended by BHS. Member fully understands and agrees that in participation in one or more of the programs, or in using the facilities maintained by BHS there is the possibility of physical injury. Member agrees to assume the risk for injury and further agrees to indemnify BHS from all liability attributable to BHS as the result of such injury.

Member has paid a total of \$ _____ for a _____ membership term _____ months beginning _____, 19____.

Signature

APPENDIX H

Workout Record

Name _____ Phase* _____ Date _____

Exercise

Exercise Min. or 1 2 Set 4 5
 reps. Weight/Repetitions

1. Aerobic Warm Up (5-10 min)

2. Bend and reach (5-10)

3. Side to side lunges (10-15)

4. Hurdler stretch (5-10)

5. Arm Clasp Stretch (4-6)

6. Crunch (2-3 x 20-30)

7. Squat (*)

8. Leg Extension (*)

9. Leg Curl (*)

10. Hyperextension (*)

11. Lat Pulldown (*)

12. Bench Press (*)

13. Incline Flys (*)

14. Seated Behind Neck Press (*)

15. Dumbbell Curl (*)

16. Standing Dumbbell
Triceps Extension (*)

17. Barbell Reverse Wrist Curl (*)

18. Standing Calf Machine (*)

*The number of sets, reps, and loadings depend on which phase you are in. The phases are as follows:

<u>Phase</u>	<u>Sets</u>	<u>Reps</u>	<u>Loadings</u>
(1) Hypertrophy	3-5	8-20	65-75% 1RM
(2) Strength	3-5	3- 6	75-85% 1RM
(3) Strength & Power	3-5	2- 3	85-95% 1RM

APPENDIX I

Relaxation and Imagery Tape Transcription

Relaxation Tape Transcription

Please focus your attention on your breathing and slowly close your eyes. Now that your eyes are closed, notice: Are your breaths deep or shallow, slow or fast, regular or irregular. Let yourself come to a way of breathing that is deep, slow, comfortable, relaxed and at ease. Now that your breathing is deep, slow and regular, turn your attention to the muscles in your body. In a moment you will begin to count slowly from 1 to 10 focusing your attention on the tension and relaxation of the different muscle groups in your body.

Ready? Breathe in. Count "1" silently to yourself. Focus your attention on the muscles in your right hand and arm. Tense them as tight as you can by making a fist and pushing it against the floor. Tense it tightly. Count "1" again and relax by letting your hand fall open. Note the warmth spreading through your hand. Now breathe in. Count "2" while focusing your attention on the muscles in your left hand and arm. Tense your left arm as tightly as possible by making a fist with your left hand and pushing hard against the floor. Tighter. Tighter. Relax your left hand and arm by letting your hand go limp. Notice the heaviness you feel spreading through your arm. Relax. Now focus your attention on your forehead. Count "3" while you tense your forehead by frowning or raising your eyebrows. Count "3" again, relaxing your forehead by smoothing out all the wrinkles. Smoother. As you count "4" focus your attention on your face. Tense your face by tightly squeezing your face and clenching your jaw. Count "4" again and relax your face. Feel your face becoming smoother and your jaw slacker. Notice how warm and smooth your face feels when you let go of the tension. Attend to your neck and shoulders. Count "5". Tense them by hunching them tightly and pushing them hard against the floor. Tighter. Note the tension and strain you feel. Breathe deeply and count "5" again. Relax your neck and shoulders by letting them feel heavy and limp. Now focus on your abdominal muscles. As you count "6" tense your abdomen by pulling your stomach in tight. Tighter. While holding your breath, count "6" again and relax by breathing out. Note the warmth spreading through your abdomen. Attend to your right thigh muscles. Count "7" and tense your right thigh by pointing your right toe downward and pressing your right thigh to the floor. Tense it tightly. Count "7" again letting your foot go limp. Note the relaxation spreading through your right thigh. Now attend to your left thigh muscles. As you count "8" tense your thigh by pointing your left toe downward and pressing your thigh hard against the floor. Harder. Again count "8" and let your left foot go limp. Note the heaviness and warmth spreading through your thighs. Focus on the muscles in your right calf. Count "9" and tense them by flexing your right foot back toward your knee. Hold it. As you count "9" again relax your right calf by letting your right foot go limp. Now attend to the muscles in your left calf. Count "10" and tense it by bending your left foot back toward the knee. Tense it tightly. As you count "10" again relax your left calf by letting your foot go limp.

Notice the feeling of heaviness and warmth spreading through your entire body. Once again, turn your attention to your breathing and let it be comfortable, slow, relaxed and at ease. In just a moment I will count backward from 3 to 1 and ask you to open your eyes. When you open your eyes you will allow yourself to remain relaxed and at ease. 3 - 2 - 1. Open your eyes. (Adapted from P. J. Lang, personal communication, September, 1984).

Internal Imagery Tape Transcription

Recall the relaxation exercise you have done before. As you silently count from "1" to "10" notice any tension you might have in your muscles and let it flow out of your body. First begin by noticing your breathing. Remember in order to achieve a state of relaxation you want your breathing to be slow, deep and regular. Now take 5 slow, deep regular breaths. You can now begin to relax your muscles by counting from 1 to 10. Ready? Count "1" silently to yourself and relax the muscles in your right hand and arm. "2" Relax the muscles in your left hand and arm. "3" Relax the muscles in your forehead. "4" Relax the muscles in your face. "5" Relax your neck and shoulders. "6" Relax your abdominal muscles. "7" Relax your right thigh. "8" Relax your left thigh. "9" Relax your right calf. "10" Relax your left calf.

Now you should be ready to imagine the leg extension and leg curl exercise you are about to perform. Remember, one of the key elements in achieving vivid images is to actively participate in the scene. To do in the image what is described. Try to imagine this scene as vividly as you can. Imagine that you are setting the weight on the leg extension machine to do your desired number of repetitions. Next, imagine yourself sitting on the leg extension machine ready to begin your set. As you picture this you can feel the warmth and the stickiness of the vinyl on the backs of your thighs. Beginning the exercise you can feel mounting tension on the tops of your feet from the padded rollers. Your attention then focuses on the muscles in your thighs beginning to contract. As you bring the padded rollers up for a count of 2, you can feel more and more muscle cells turning on making the movement very strong. Even though you feel the fibers within the cells beginning to burn you continue the movement calling on more and more fibers to assist you. At the top of the movement, you pause briefly and then sensors within the cells tell you to begin relaxing the tension by slowly lowering the padded rollers for a count of 2. At the start of the next repetition your muscle cells have recovered enough to fire once again, recruiting more and more cells as the tension increases. Again you feel the fibers assisting you with mounting force all the way to the top of the movement. As you tense at the top sensors tell you to begin relaxing. You imagine this process taking place over and over again for the number of repetitions you desire to perform. With each repetition you are pleased that although your thighs feel an increasing burning sensation you continue to turn on more and more muscle cells. After you have finished your desired number of repetitions you are ready to perform the leg extension exercise. Remember to use these images to help you perform the exercise. (Adapted from P. J. Lang, personal communication, September, 1984).

External Imagery Tape Transcription

Recall the relaxation exercise you have done before. As you silently count from "1" to "10" notice any tension you might have in your muscles and let it flow out of your body. First begin by noticing your breathing. Remember in order to achieve a state of relaxation you want your breathing to be slow, deep and regular. Now take 5 slow, deep regular breaths. You can now begin to relax your muscles by counting from 1 to 10. Ready? Count "1" silently to yourself and relax the muscles in your right hand and arm. "2" Relax the muscles in your left hand and arm. "3" Relax the muscles in your forehead. "4" Relax the muscles in your face. "5" Relax your neck and shoulders. "6" Relax your abdominal muscles. "7" Relax your right thigh. "8" Relax your left thigh. "9" Relax your right calf. "10" Relax your left calf.

Now you should be ready to imagine the leg extension and leg curl exercise you are about to perform. Remember, one of the key elements in achieving vivid images is to actively participate in the scene. To do in the image what is described. Try to imagine this scene as vividly as you can. Imagine you can see yourself performing the leg extension exercise as if you are on television. Watch as the camera zooms in on you preparing to perform the exercise. First you see yourself setting the weight on the machine so you can get the number of repetitions you want. Next, the camera shows that you have moved to the seated position on the machine. You see that your knees are firmly against the edge of the machine and the bottoms of your feet are parallel to the floor with your feet flexed underneath the lower roller pads. You watch yourself take a deep breath and see that you are ready to begin the leg extension exercise. The camera begins a slow close-up of your feet moving the rollers upward slowly for a count of 2. After a brief pause at full extension you watch as your feet slowly lower the pads to the starting position for a total count of 4. As you begin the next repetition the camera focuses on the muscles tightening in your thighs. The weight moves upward and you can see the muscles getting larger and more defined. Lowering the weight once again you see the muscle begin to relax. Now the camera moves back and you see yourself performing all the repetitions at the beginning of the leg extension exercise. Imagine with each repetition the camera focuses on the contours of your thighs as they contract and relax. After you have finished imagining the desired number of repetitions you are now ready to begin the leg extension exercise. Remember to use these images to help you perform the exercise. (Adapted from P. J. Lang, personal communication, September, 1984).

APPENDIX J

Rating of Images While Performing the Leg Extension Exercise

Rating of Images While Performing the Leg Extension Exercise

EXERCISE		RESULTS (circle one)							
1.	Imagine the exercise you have just performed (leg extension)								
		Not at All				Very Much			
b.	How clear or real was your mental picture of lifting the weight?	1	2	3	4	5	6	7	
c.	Did you "feel" the weight resisting the muscles in your legs?	1	2	3	4	5	6	7	
d.	Did you "feel" your muscles move as you lifted the weight?	1	2	3	4	5	6	7	
e.	How difficult was it to maintain your concentration on the exercise?	1	2	3	4	5	6	7	
f.	How difficult was it to control your imaginary pictures and actions?	1	2	3	4	5	6	7	
g.	How actively involved were you in the scene?	1	2	3	4	5	6	7	
h.	Did you "see" any part of your body other than your legs, and the weight machine? (first person perspective)					Yes		No	
i.	Was it like standing outside your body and watching yourself sit and lift the pads? (third-person perspective)					Yes		No	
j.	Did you feel like you were inside your own body when you lifted the weight?					Yes		No	

(Adapted from Hale, 1982).

APPENDIX K

Curriculum Outline and Training Materials

My Concept of Bodybuilding

Bodybuilding is not just weight training to refine and reshape your body. Involvement in the sport is a metaphor for understanding and experiencing the concept of balance. For example, to train as a bodybuilder you do not just lift weights, you also balance lifting with other activities such as running, cycling, and dancing. In other words, you learn to balance both aerobic and anaerobic activity. To bodybuild you also learn about nutrition and how the foods you eat affect your body. This is the experience of balancing energy intake with energy output. Bodybuilding also emphasizes both masculine and feminine qualities. In the process of becoming stronger, the lines of the female body become enhanced. Women can now be both strong and feminine. Finally, by placing stress on muscles you can enhance your physical and psychological well being. This added stress to muscles has the possibility of becoming a tool for removing stress from other areas of your life where the effect may be detrimental. Through this process, the health of the body balances with the health of the mind.

Workshop Curriculum Outline

Orientation & Testing

- Consent forms
- Physical and psychological assessment
- 1RM calculation for leg extension/leg curl exercise

Week 1

Session 1

- Orientation
- Handout recordkeeping folders
- Vocabulary/Safety
- Explanation of the Physical Training Program
- 'Hands On' Demonstration
- 1RM for all exercises

Session 2

- More training
- 'Hands On' Assessment of physical technique

Week 2

Session 1

- Diet and Nutrition, the other half of bodybuilding
- Monitoring calories and ratio of protein, fat and carbohydrate
- Necessity of aerobic exercise for burning fat
- Assignment: healthful recipe exchange for the Bodybuilder's Cookbook

Session 2

- Assessment of individual's exercise technique
- Turn in recipes

Week 3

Session 1

- Additional exercises for the chest

Session 2

- Additional exercises for the waist and abdominals

Week 4 - Appointments for physical and psychological assessment

Session 1

- Additional exercises for the back
- Additional exercises for the shoulders

Session 2

- Additional exercises for the legs and buttocks
- Assessment of individual's exercise techniques

Week 5

Session 1

- Other kinds of bodybuilding routines

Session 2

- Intermediate and advanced techniques

Week 6

Session 1

- Competing in bodybuilding contests*

Session 2

- Making up your own workout routines/Assignment

Week 7

Session 1

- Assessment of routines (1/2 class)

Session 2

- Assessment of routines (1/2 class)

Week 8 - Appointment for physical and psychological assessment

Session 1

- Questions and consultation

Session 2

- Questions and consultation

*Depending on interest

Some Bodybuilding Myths

1. Bodybuilding will make you appear masculine: The natural hormonal balances in a woman's body preclude the development of large, well-defined muscles unless she makes the mistake of resorting to the use of anabolic steroids. A woman will always have smaller muscles and lower strength levels than a man, because her body secretes primarily the female sex hormone, estrogen. Any gains you make in muscle mass will be seen on your body as new feminine curves.
2. Bodybuilding will slow you down. Since athletes in virtually all sports train with weights specifically to increase speed and strength, it is difficult to believe this myth, but it still has many disciples. In reality, scientific studies done as long ago as the early 1950's established that strength training increases the speed of muscle contraction. Reaction time (the speed at which you can initiate a muscular contraction once your eye perceive a stimulus to contract) is unchanged by weight training or any other physical activity, but the speed with which you contract a muscle once the contraction is initiated is significantly improved.
3. Bodybuilding will make you muscle-bound. Men and women with larger-than-average muscles that were gained from heavy weight training are significantly more flexible than the average person.
4. Muscle turns to fat as soon as you stop working out with weights. It is physiologically impossible for muscle tissue to be turned into body fat. However, you must cut back a lot on the number of calories you consume each day if you decide to stop regular weight training, running, or any other type of exercise.

Source:

Sprague, K. and Reynolds, B. (1983). The Gold's Gym book of bodybuilding, Chicago, Illinois: Contemporary Books, Inc.

Common Bodybuilding Terms

BAR - the metal rod four to six feet in length that forms the base of a barbell.

BARBELL - the most basic piece of equipment used in bodybuilding training. It consists of a BAR on which PLATES are added for the desired weight.

BODYBUILDING - This is a type of weight training that is combined with sound dietary practices to reshape the body.

BODYSCULPTING - This is another term for bodybuilding.

CONTRACTION - The shortening or tightening of a muscle or muscle group during a REPETITION of an EXERCISE. Strength training generally falls into two categories - static (ISOMETRIC) and dynamic (ISOTONIC OR ISOKINETIC). Both concentric and eccentric contractions are dynamic. In a concentric contraction a muscle develops tension sufficient to overcome resistance so that the muscle fiber actually shortens and moves a body segment in spite of the resistance, e.g. as in the pulling motion of the biceps curl. In an eccentric contraction the given resistance overcomes the muscle tension so that the muscle actually lengthens, e.g. as in the pushing motion of the triceps pushdown.

DUMBBELL - A short handled version of the BARBELL, intended for use in one hand. Barbells are best for use in training large muscle groups such as thighs, back and chest; dumbbells are best used to exercise smaller groups such as the arms and shoulders.

FORM - The style and quality of an exercise movement. If form is strict, the muscle in training is fully isolated. If form is broken, other muscles are sharing the burden which denotes sloppy training.

HYPERTROPHY - The increase in mass and strength in a muscle resulting from high intensity WEIGHT TRAINING. This is sometimes referred to as growth, although no actual increase in the number of muscle cells occurs. There is only an increase in the cross sectional area of each muscle fiber.

ISOKINETIC - Strength training using accommodating resistance, e.g. Nautilus machines are based on isokinetic principles. The harder you work, the greater the resistance. Furthermore, the speed is controlled, predetermined and constant throughout the movement. Negative force (eccentric contractions) is missing in isokinetic exercise.

ISOMETRIC - A static muscle CONTRACTION. A muscle contraction is

isometric when the length of the muscle does not shorten during the contraction, e.g. when exerting muscle force against an immovable object.

ISOTONIC - A muscle contraction is isotonic when the muscle is able to contract, shorten or lengthen, and work is performed. Both concentric and eccentric contractions are isotonic.

JAWJACKING - Postponing exercise by getting involved in prolonged and usually forced conversation with others in the gym.

1RM - (One Repetition Maximum) - The maximum weight you can lift for one full repetition.

PLATES - The flat metal or vinyl covered disks added to a BARBELL BAR to adjust the weight of the apparatus to the desired level.

PUMP - The briefly larger size of a muscle after it has been exercised. Muscle pump is caused by a greater than normal influx of blood into the muscle; the blood removes fatigue by-products and replenishes the glycogen and oxygen that has been used during a workout.

PYRAMIDING - Beginning a set with low weight and increasing the poundage in each consecutive set.

REPETITION (REP) - This is each full individual execution of an exercise.

RESISTANCE - This is the actual weight of a BARBELL or DUMBBELL being used in a weight training exercise.

REST INTERVAL - A brief pause between SETS that allows the body to partially recover before the next SET is initiated.

ROUTINE - The program of exercises performed in a workout.

SET - A group of REPETITIONS done without a pause. Several sets of each movement are ordinarily done with a REST INTERVAL between.

SOURCES:

Sprague, K. & Reynolds, B. (1983). The Gold's gym book of bodybuilding, Chicago, Illinois: Contemporary Books, Inc.

Clive, T. (1984). "Muscle-ese for pencil necks," Strength Training for Beauty, 1(3), 73-76.

Comereski, J. S. (1984). Isometric? Isokinetic? Isotonic? Muscle & Fitness, 45(4), 149, 208-209.

SAFETY RULES

1. Always Use Spotters You should use a spotter on all bench press movements and squats when you are at or approaching your strength limit.
2. Never Train Alone The majority of serious weight training accidents occur while a bodybuilder is training alone. Try and find a training partner or two and always train with one of them.
3. Use Catch Racks Whenever possible, you should do your squats on a squat rack equipped with catch racks on which you can place the barbell if you can't get up with it.
4. Never Hold Your Breath During an Exercise Doing so will build up intrathoracic pressure, which will impede blood flow to and from your brain. Technically this is called the Valsalva effect. By breathing rhythmically as you exercise you can prevent this from happening.
5. Maintain Good Gym Housekeeping It is both good etiquette and good safety procedure to return all barbells, dumbbells and loose plates to storage racks immediately after you have finished using them.
6. Don't Train in an Overcrowded Gym When the gym is packed you will probably be forced to rest too long between sets of each exercise. This can cause you to cool down enough to become vulnerable to injury.
7. Always Warm Up Thoroughly A thorough warm-up always reduces your chances of incurring a joint or muscle injury due to overstress. A proper warm-up also improves your neuromuscular coordination, making all your exercises smoother and more coordinated.
8. Use Proper Biomechanical (Body) Positions in All Exercises Learn each body position thoroughly and be sure to use it. Deviating from the correct biomechanical position for an exercise while using a heavy weight can leave you vulnerable to injury.
9. Use a Weightlifting Belt On all heavy leg and back exercises, as well as on overhead pressing movements, you should use a weight lifting belt. Cinched tightly around your waist, it will keep your lower back warm and provide your midbody with added stability. The use of a weightlifting belt will cut the frequency and severity of lower back and abdominal injuries by more than 75%.

Source: Sprague, K. & Reynolds, B. (1983). The Gold's Gym Book of Bodybuilding, Chicago, Illinois: Contemporary Books, Inc.

DESCRIPTION OF WEIGHT LIFTING EXERCISES

1. SQUAT - This is the primary front thigh and lower back movement. Secondary stress is placed on the hamstring muscles at the backs of the thighs, the upper back and the abdomen. To perform the exercise, rest a barbell across your shoulders; behind your neck, and grasp the bar out toward the plates. If you rest the bar across your trapezius muscles instead of over your cervical vertebrae you will experience no discomfort. With the bar across your shoulders, stand with your feet approximately shoulder width apart. Your toes should be at about a 45 degree angle. Focus your eyes on a point a shoulder height above and keep it focused on this point. This is to keep your head and back upright during the exercise. Slowly bend you legs and lower your body into a full squatting position. Be sure your knees travel out over your feet. DO NOT bounce at the bottom of ths movement. Slowly come back up to the starting position and immediately begin another rep.
2. LEG EXTENSION. This is an exercise that allows you to train the quadricеп muscles at the fronts of your thighs. Sit in the machine with the backs of your knees at the edge of the padded surface and your legs facing the movement arm of the machine. Place the insteps of your feet under the lower roller pads. Grasp the edge of the machine and straighten your legs slowly. Hold your legs briefly in this position then slowly lower them to the starting position. Repeat the movement for the desired number of repetitions.
3. LEG CURL. This is an exercise designed to train the hamstring (biceps femoris) muscles at the backs of your thighs. To perform the exercise, lie face down on the padded surface of the machine with your knees at the edge of the pad. Place your heels under the upper set of roller pads. Grasp the sides of the padded surface to steady your body. Slowly bend your legs as fully as possible. Hold the fully bent position briefly before slowly lowering the weight to the starting position. Repeat for the desired number of reps.
4. HYPEREXTENSION - This exercise places primary stress on the erector spinae muscles of your lower back without a compression pressure on your spinal vertebrae. Secondary stress is placed on the hamstring muscles at the backs of your thighs. To start the exercise stand in the hyperextension bench facing the large pad. Lean forward on the larger pad so the top edge of your pelvis rests on the padded surface. As you lean forward allow the backs of your ankles to come up against the rear pad. Flex your body at the waist until your torso is perpendicular to the floor. Place your hands behind your neck and keep them in this position during the exercise. Slowly straighten your body until your torso

reaches a position parallel to the floor. DO NOT arch your back. Lower your torso back to the starting position and repeat the desired number of times.

5. LAT PULLDOWN - This develops the large latissimus dorsi muscles of your upper back. Secondary emphasis is placed on the gripping muscles of your forearms, biceps and trapezius muscles. To start, grasp the lat machine handle with a grip a little wider than your shoulders. Your palms will be facing forward. Slowly straighten your arms and either sit or kneel directly beneath the pulley. As you do this movement your elbows will be pulling downward or backward at the same time. Slowly pull the bar down until it touches your upper chest then allow your arms to slowly straighten.
6. BENCH PRESS - This exercise places primary stress on the pectorals, deltoids and triceps with secondary emphasis on the latissimus dorsi muscles. To perform this exercise lie on your back on the flat exercise bench. Take a grip on the barbell with your hands four to six inches wider on each side than the width of your shoulders. Your hands should be facing your feet when you have the bar supported at arm's length above your chest. Slowly lower the bar to your chest and then straighten them slowly. Be sure not to bounce the bar on your chest as you perform the desired number of repetitions.
7. INCLINE FLYS - This exercise places stress on the upper pectorals and front deltoids. To perform the movement grasp two moderately weighted dumbbells in your hands and lie back on an incline bench. Move the dumbbells so they are supported at arms' length directly above your shoulder joints. Your palms should be facing inward throughout the movement. At the start, the dumbbells should be touching each other above your chest with your arms bent slightly at all times. To begin slowly lower the dumbbells outward and downward in semicircular arcs on each side to as low a position as is comfortable. Then raise them back along the same arc to the starting position.
8. SEATED BEHIND THE NECK PRESS - This exercise primarily stresses the front deltoids and triceps. Secondary stress is also placed on the trapezius muscles. To start take a grip slightly wider than shoulder width on a barbell so that your palms face forward. Seated on the end of a bench hold the barbell behind your neck, press it directly upward to arms' length above your head. Lower it slowly back to the starting position and repeat the desired number of repetitions. This movement can also be done in a standing position or using dumbbells.
9. DUMBBELL CURL - This exercise places primary stress on the biceps and secondary stress on the muscles on the inside of the

forearm. To perform the exercise grasp two dumbbells and stand erect with your arms hanging down at your sides. Your palms should be facing your body. To begin slowly move the dumbbells in semicircular arcs upward from the sides of your body until they reach shoulder height. As you curl the dumbbells upward rotate your wrists to bring your palms into a position in which they are facing directly upward. Reverse the procedure and return the dumbbells to the starting position.

10. **STANDING DUMBBELL TRICEPS EXTENSION** - This movement strongly stresses the whole triceps muscle mass. This movement can be done with a barbell, two dumbbells, simultaneously, one dumbbell held in one hand at a time or a single dumbbell held in both hands. To start take a dumbbell in both hands and extend your arms fully above your head. In this position your upper arms will be placed against the sides of your head and should be maintained in this position throughout the exercise. To begin slowly unlock your elbows and let the dumbbell travel downward until it touches the back of your neck. As soon as the dumbbell touches your neck; reverse the direction of travel and return it to the starting point with triceps strength.
11. **BARBELL REVERSE CURL** - This movement, with the palms facing downward, stresses all the muscles on the outsides of your forearms. With the palms facing up it stresses all the muscles on the insides of your forearms. To start take a shoulder width grip on a barbell so your palms face downward. Sit on a flat bench and run your forearms down your thighs so your wrists and hands hang off the edge of your knees. Sag your fists downward then slowly curl upward in small semicircles by flexing your wrists. Lower the weight and perform the desired number of reps. Do an equal number with your palms facing upward.
12. **STANDING CALF MACHINE** - This exercise strongly stresses the calf muscles. To perform the exercise place your feet in the appropriate position on the toe block and bend your legs enough so you can rest the yokes of the machine across your shoulders. Straighten your legs to take the weight of the machine across your shoulders. Sag your ankles as far below your heels as possible. Then rise as high as you can on your toes and the balls of your feet. Then lower your heels back down and repeat the required number of repetitions.

Source: Sprague, K.S. & Reynolds, B. (1983). The Gold's Gym book of bodybuilding, Chicago, Illinois: Contemporary Books, Inc.

McLish, R. & Reynolds, B. (1984). Flex Appeal by Rachel, New York: Warner Books, Inc.

Name _____ Phase* _____ Date _____

Exercise

Exercise	Min. or reps.	Set				
		1	2	3	4	5
1. Aerobic Warm Up (5-10 min)						
2. Bend and reach (5-10)						
3. Side to side lunges (10-15)						
4. Hurdler stretch (5-10)						
5. Arm Clasp Stretch (4-6)						
6. Crunch (2-3 x 20-30)						
7. Squat (*)						
8. Leg Extension (*)						
9. Leg Curl (*)						
10. Hyperextension (*)						
11. Lat Pulldown (*)						
12. Bench Press (*)						
13. Incline Flys (*)						
14. Seated Behind Neck Press (*)						
15. Dumbbell Curl (*)						
16. Standing Dumbbell Triceps Extension (*)						
17. Barbell Reverse Wrist Curl (*)						
18. Standing Calf Machine (*)						

*The number of sets, reps, and loadings depend on which phase you are in. The phases are as follows:

	<u>Phase</u>	<u>Sets</u>	<u>Reps</u>	<u>Loadings</u>
(1)	Hypertrophy	3-5	8-20	65-75% 1RM
(2)	Strength	3-5	3- 6	75-85% 1RM
(3)	Strength & Power	3-5	2- 3	85-95% 1RM

II. Imaging Instructions

- A. If you know people in the other classes, please do not talk about this aspect of the training.
- B. Imagination is probably the most widely applied mental tool in modern sports. A wide body of scientific evidence has shown that appropriate images can affect physiological processes. For example, when a person is hooked to an EMG machine, an instrument used to measure muscle contractions, it has been found that when that person imagines running, the muscles associated with running begin to contract. It has also been found that when imagery is combined with physical practice that performance can be better than just by using physical practice alone. Imagery is a fairly simple skill to learn but it does take practice. This is what you will do to learn the imagery procedure.

First, it is important to begin each session with a relaxation process. For the next three class times we will start each class with a short relaxation process.

Second, you will then start the physical exercises. Before you begin the leg extension exercise, there is a three minute tape instructing you in a brief relaxation/imagery process. You will use the Walkman to listen to the tape before you perform the leg extension exercise. After you do the leg extension and leg curl exercise, I will ask you how you imagined the leg extension exercise and then have you fill out a short questionnaire. On the days that you do the unsupervised work-out, try doing the imagery on your own. Then write a brief description of how you imagined and rate it using the short questionnaire.

Rating of Images While Performing the Leg Extension Exercise

EXERCISE		RESULTS (circle one)						
1.	Imagine the exercise you have just performed (leg extension)							
		Not at All			Very Much			
b.	How clear or real was your mental picture of lifting the weight?	1	2	3	4	5	6	7
c.	Did you "feel" the weight resisting the muscles in your legs?	1	2	3	4	5	6	7
d.	Did you "feel" your muscles move as you lifted the weight?	1	2	3	4	5	6	7
e.	How difficult was it to maintain your concentration on the exercise?	1	2	3	4	5	6	7
f.	How difficult was it to control your imaginary pictures and actions?	1	2	3	4	5	6	7
g.	How actively involved were you in the scene?	1	2	3	4	5	6	7
h.	Did you "see" any part of your body other than your legs, and the weight machine? (first person perspective)				Yes		No	
i.	Was it like standing outside your body and watching yourself sit and lift the pads? (third-person perspective)				Yes		No	
j.	Did you feel like you were inside your own body when you lifted the weight?				Yes		No	

(Adapted from Hale, 1982).

Diet and Nutrition

Source: Thirty Days to Better Nutrition by Virginia Aronson

There are many misconceptions about what type of diet bodybuilders use to train and achieve muscular definition. One misconception is that bodybuilders need a diet that is high in protein in order to build muscle. The most recent studies indicate that this is not true. What most athletes need to work is food that provides energy. The most available source of energy comes from carbohydrates which are more easily metabolized than protein or fat.

Another misconception is that bodybuilders starve themselves on 500 calorie diets prior to competition. Many amateurs might use this strategy for a variety of reasons but should not. First, diets which are almost starvation do not provide enough energy to do the work necessary for training. Second, a diet without the proper balance of protein, fat, and carbohydrate can promote a loss of hard earned muscle tissue as well as fat. Third, many cases have been documented which indicate that a diet too low in calories causes metabolism to slow in order to save fat cells. This is a survival mechanism that the body uses to guard against starvation.

The only way to train and achieve a lean appearance is by following sound nutrition principles. Women who wish to gain weight should follow the same general guidelines as those who wish to lose weight. The difference is an increase in calories rather than a decrease. It is important to remember that when following these guidelines you are relearning how to eat as well as what to eat. You want your dietary changes to become permanent habits. Remember the rhythm method of girth-control (seen in Diagram 1) works about as well as the other rhythm method we know about.

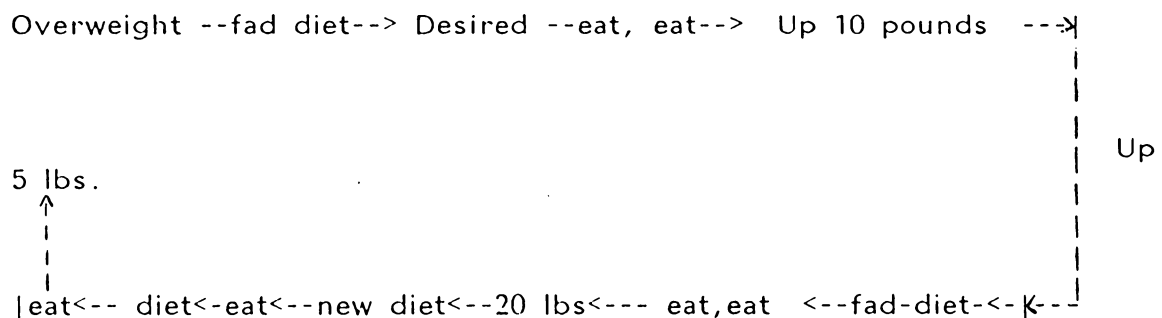


Diagram 1
(Aronson, 1983)

To avoid this yo-yo effect you first need to resolve that the changes you are trying to make will be long-term rather than short-term then take a look at (1) what you eat and (2) how you eat.

(1) The following are guidelines for a sound nutritional program of what to eat. A balanced diet is approximately 50-70 percent carbohydrate, 20 to 30 percent fat, and 20 percent protein.

- a. Protein - To determine how much protein you need, the following standards have been determined by the National Research Council's Food and Nutrition Board:

Individual Status	Recommended Daily Intake of Protein in Grams
Adulthood	0.8/kg. body weight*
Pregnancy	0.8/kg. body weight* + 10 grams
Lactation	0.8/kg. body weight* + 20 grams

*To convert your weight in pounds to kilograms (kg) divide by 2.2. Ex. $135/2.2 = 61$ kg. $61 \times 0.8 = 48.8$

A high quality protein provides all the essential amino acids required by the body. Good sources of high quality animal protein are meat, poultry, fish, eggs, cheese, milk, and yogurt. Good sources of high quality plant protein need to balance with each other to complement the amino acid chains which comprise protein.

Complementary pairings are as follows:

Corn <--> Beans, Peanuts, Soy

Rice <--> Beans, Peanuts

Wheat <--> All legumes

Oats <--> Peanuts

Rye <--> Soy

Sesame <--> Garbanzos

- b. Carbohydrates come in two major forms, sugars and starches. In order to be utilized carbohydrates must be broken down into simple sugars. The following terms are used to identify carbohydrates:

Simple sugars
(monosaccharides)

Glucose ('blood sugar')
Fructose ('fruit sugar')
Galactose

Double sugars
(Disaccharides)
syrups)

Glucose + Fructose = Sucrose
('table sugar,' 'brown sugar,' honey,
Glucose + Galactose = Lactose

	('milk sugar')
	Glucose + Glucose = Maltose
	(malt products)
Starches	Digestible ('starch,' dextrins)
(Polysaccharides)	Partially digestible
	Indigestible ('fiber,' cellulose, hemicellulose, pectin)

The major function of carbohydrates is to provide energy but they are also important for nutrients and fiber. With a high carbohydrate diet it is important to try to eat more complex carbohydrates rather than simple carbohydrates. This is because complex carbohydrates contain more nutrients and fiber. For example, to obtain the amount of calcium provided by one cup of skim milk you would have to consume 296 tablespoons of honey. Considering that one cup of skim milk is less than 90 calories while 296 tablespoons of honey is almost 19,000 calories, it becomes very clear that while the simple sugars provide energy they provide very little if any nutrients and fiber.

The major sources of carbohydrates are cereal grains (barley, buckwheat, corn, millet, oats, rice, rye, wheat), potatoes, fruits and vegetables, dried peas and beans, cassava (tapioca), sugar cane, sugar beet.

- c. Fat - The average American diet is approximately 40% fat. Mostly because foods thought to be rich in protein also contain considerable fat. For example, a 6 oz. sirloin steak is 660 total calories, with 490 of those calories being fat; 1 oz. of cheddar cheese is 110 calories with 80 of those being fat. It is important to learn which foods contain large amounts of hidden fat and reduce their amounts in your diet. Fat cannot and should not be totally eliminated from your diet since it provides for the following functions.

- (1) calories for body energy;
- (2) palatability to enhance the flavor of food;
- (3) satiety value to aid the feeling of 'fullness';
- (4) fatty acids essential for growth;
- (5) transport for certain vitamins.

- d. Vitamins, Minerals and Water are the last three important components to achieve a well balanced diet.

- (1) Small quantities of vitamins are required for the regulation of bodily processes. A healthy person who eats a wide variety of nutritious foods can easily obtain all the necessary vitamins.

- (2) The body's mineral needs can be met through a well balanced

diet. However, women need to be careful to obtain enough iron and calcium.

(3) Because water is not thought of as food, it is often overlooked as a nutrient. The American Medical Association advises drinking 6-8 cups of water per day.

(2) These are questions you need to ask yourself about how you eat. By developing an awareness of what food represents to you and how you use food you can begin to make the behavioral changes necessary for developing healthful eating habits.

a. Ask yourself	Often	Occasionally	Never
1. Do you reward yourself with food?	_____	_____	_____
2. Do you feel guilty if you do not eat all of the food which you have been served? _____	_____	_____	_____
3. Do you associate people, places and events from the past with specific foods? _____	_____	_____	_____
4. Does the sight of food make you feel hungry?	_____	_____	_____
5. Does the smell of food make you feel hungry?	_____	_____	_____
6. Does the thought of eating make you feel hungry?	_____	_____	_____
7. Do you eat according to the clock (e.g. noontime automatically signifies lunch)	_____	_____	_____
8. Do you eat while simultaneously engaged in other activities (reading, watching TV, working - job, house, school, talking on the phone, driving, etc.)?	_____	_____	_____
9. Do you eat when you are emotionally stimulated (you turn to food when you're bored, frustrated, nervous, lonely, tired, happy, depressed)?	_____	_____	_____
10. Do you put off or avoid unpleasant activities by eating instead?	_____	_____	_____

11. Do you eat because of the influence of others (family, employer, friends)? _____

12. Do you find yourself searching unsuccessfully for foods to satisfy unknown cravings? _____

b. If you answered Often or Occasionally try the following to modify your behaviors.

1. Choose desirable alternatives to food for use as a reward. List some examples: _____

2. Leave one bite on your plate at each meal or snack - resist the temptation to "clean your plate." Are you successful at this exercise? _____ Yes _____ No _____ Sometimes. Why or why not? _____

3. Whenever you are eating, ask yourself if it is by your own choice or triggered by someone, someplace, or some event from your past? Briefly describe some of your conclusions. _____

4. Try not to eat in response to the sight of food: if you do so, briefly describe the event(s) and your feelings at the time. _____

5. Try not to eat in response to the smell of food: if you do so, briefly describe the event(s) and your feelings at the time. _____

6. Avoid fantasizing about food: if you do find yourself fantasizing briefly explain what you feel may have triggered your thoughts. _____

7. Avoid eating, according to the clock: if you are unsuccessful, list some examples of and possible reasons behind your failure(s) _____

8. Avoid eating while engaged in other activities by making eating a sole experience. _____

9. Select alternative outlets for emotions. List some examples.

_____.

10. Avoid eating for the purpose of procrastination. When you must face an unpleasant task, do you usually ___ put it off? ___ tackle the problem? ___ eat instead? List some examples.

_____.

11. Develop places other than the kitchen where you can seek refuge from people who stir up your food-related emotions to an undesirable degree. List some of the places you may choose to utilize.

_____.

12. Avoid dissatisfying searches for unknown foods. Whenever you are looking for a specific food to satisfy a particular craving, stop and reflect. List your needs at this time.

_____.

Are any of these needs edible? If not, do you really need to eat? ___ Yes ___ No. Describe your feelings on this.

_____.

The Death of Dieting*

Ruby Greenwald was a 19 year-old new mother in suburban Chicago when her weight problem started. Her doctor put her on a diet, and she quickly lost the extra pounds. But several months later, the pounds were back- plus a few more.

There was another diet. This time it was harder; there was more to lose. "While my children were growing up," says Ruby, "I lost and regained dozens of times: down 30 lbs., up 45, down 45, up 55, always creeping upward. I've spent thousands of dollars and tried every diet program, book and pill; acupuncture and hypnosis, too. They all worked - at least for a while. I'm part of the success statistics of a dozen weight-loss programs. And look what I have to show for it," Ruby gestures indignantly at her 300-lb. body.

Ruby is a "yo-yo dieter," and she's not alone. In a survey of 15,000 readers of a major women's magazine, 42% of the overweight readers said they were on again-off again dieters. They lose weight, then gain. They are always dieting even when they're gaining. They struggle and fail - and hate themselves. And as they diet, their weight baseline continues to rise.

Some of them have even figured it out - crash dieting is bad for them. But do they know how bad? It's not just that these diets don't work. Crash dieting sets up a yo-yo pattern of loss and rebound gain that can make you heavier. For some time, researchers have known that severe calorie restriction forces the body to respond as if to starvation conditions: It conserves energy by lowering the metabolic pacemaker. The biological stage is set for regain on less food. But beyond upsetting the weight-control system, any sequence of severe diets also has health consequences, which only now are being recognized.

In my lab at Northwestern University, we have found in animal tests that the feast-fast cycle itself can cause a distinct form of high blood pressure. This "dieter's hypertension" develops over the course of sizable lose-gain swings and eventually becomes set. In humans, this may lead to congestive heart failure, rather than the heart attacks and kidney disease common to other forms of hypertension. Doctors know overweight people are twice as likely to have hypertension as lean folks, but they have always thought the problem was the extra weight.

My colleagues and I have evidence that the cause is not in the poundage but in the dieting pattern. And we believe we've found an explanation: norepinephrine. This potent stress hormone is the link between body metabolism and blood pressure.

The research trail goes back more than 40 years. In 1938, British scientists found that lab rats deprived of food and then allowed

to feed freely quickly regained weight and became heavier than rats that had never dieted. They called this rebound "overcompensation."

Other early studies found that as weight goes down, we lose both fat and protein, but regained weight is largely fat. Children recovering from serious malnutrition often regain until they become obese. But even if the youngsters' weight is controlled, their body fat content will be unusually high. Cattle raisers have capitalized on this research. By underfeeding animals before fattening them, they have a cheap way of increasing the fat content of beef.

Over-compensation may be fine for tender, marbled steak, but an expanding waistline is not what 50 million dieting Americans have in mind. True, some people lose five to 10 lbs., regain the same amount and never go beyond. Heredity probably protects many from over-compensation. But for a large proportion of dieters the biological cards are stacked against dieting: Cutting calories turns out to be the great fattener. The five-year follow-up records of almost every type of diet program show a third to half of the dieters gained back more weight than they lost.

Over-compensation is kicked off by a profound dietary shock to the system - perhaps a 20% loss of weight - and is fueled at cellular and hormonal levels. During a diet, fat cells shrink; they never disappear. When normal eating is resumed, the fat cells don't just fill up with fat. They multiply - even doubling in number - and refill. The new fat cells are forever, and they encourage your body to accumulate more fat. For wild creatures threatened with periodic famine, such a biologic program offered protection. But in a world of mechanized work and over-abundant food supply, this so-called ratchet effect ups the ante. The body can now store more fat; the next diet will be harder. And failed diets - not just obesity - can sabotage health, even kill.

How Yo-Yoing Boosts Pressure

Jean Mayer, a pioneer in obesity research and president of Tufts University, put lab mice on a feast-fast schedule and found that yo-yoing shortened their lives.

Other researchers put swine through wide weight swings. The animals developed high blood pressure and heart disease.

And epidemiologists have long observed that overweight people are particularly prone to hypertension. But when they tried to determine how extra pounds boost blood pressure, they came up against an apparent contradiction. Fatty breeds of lab animals have normal blood pressure, whereas specially bred high-pressure rats are actually quite svelte.

It's clear that severe dietary restriction lowers blood pressure regardless of weight at the outset. And it always drops before appreciable weight is lost.

If fat tissue is not closely linked to hypertension, then why, I wondered, are fat people so prone to high blood pressure? Fat animals don't ordinarily have hypertension. But when they gain weight, the increase is slow and steady. Most overweight Americans tend to go on and off diets. I began to suspect that wide up-down weight swings might themselves be responsible. So I decided to fatten normal lab rats and then send them crash dieting. Once, twice.

Sure enough, before the third yo-yo cycle was over, the animals developed mild high blood pressure. Mild in degree, that is, not in effect. Even borderline hypertension involves a hormonal assault on the heart that may lead to heart failure.

The Norepinephrine Connection

My research has traced this effect to the nerve cells that manufacture the "fight or flight" hormone norepinephrine. Normally, when the brain signals danger, these cells step up production of norepinephrine. It, in turn, speeds heartbeat, constricts blood vessels and raises blood pressure.

These nerve cells also respond to another kind of stress - overeating. If you overindulge during holiday feasting, your norepinephrine output will increase, triggering metabolic systems that "burn off" the extra calories.

Norepinephrine activation of these "energy-wasting" systems may be the reason most of us can overeat occasionally without gaining weight. It also explains why overfeeding can lead to small increases in blood pressure: The norepinephrine that fans the metabolic fires is the same norepinephrine that speeds the heart and drives blood pressure up.

Thus the body has a natural system linking blood pressure and calorie control. For reasons still unknown, repeated feast-fast cycles make norepinephrine-producing nerve cells permanently hyperactive. As animals go through more swings of the yo-yo, blood pressure no longer drops during dieting, perhaps because permanent blood vessel changes keep pressure elevated.

A critical role in this disruption may be played by an area in the hypothalamus believed to be a brain control center for appetite, insulin levels and metabolism, plus blood pressure. If we remove a certain part of this area - the paraventricular nucleus - from a rat, blood pressure drops - but the rats get fat.

There's good reason to believe this animal research applies directly to people. Inadvertently, the Siege of Leningrad during 1942 turned the city into a natural laboratory for observing the effects of several dieting, however involuntary. As a result of the German blockade, millions of inhabitants "went on a diet." The proportion of hospital beds taken up by patients with diseases related to hypertension fell from a prewar 10% to 2% in 1942.

When food supplies were restored, the prevalence of high blood pressure quadrupled over prewar levels and 50% of all hospital admissions were hypertension-related. The symptoms of high blood pressure in Leningrad were identical to those typical of overweight people: Heart failure was common, but not heart attacks or kidney disease. And they appeared in normal-weight people as well as in the overweight. An epidemic of congestive heart failure peaked a year or two after the siege, about the time people had regained their prewar weight.

A more deliberate study in Los Angeles indicates that loss-regain cycles indeed shorten life. At the Wadsworth Veteran's Administration Hospital, Dr. Ernst J. Drenick put obese men on a total fast for 30 days or more. After release from the hospital, they regained the weight - and more. After losing and regaining again, the men were in trouble: 80% eventually developed diabetes. Fully 25% died, mainly of heart disease. Their death rate was up to 13 times higher than that of equally obese non-dieters in large studies in Norway and Denmark.

Beating the Body's System

Does the weight boomerang spell futility for all attempts to lose weight? Certainly not. But it means we must work with our biochemistry, not at cross-purposes. Dieters' hypertension will disappear with time - provided weight stays constant, either high or low. It seems to take about two years, though recovery is increasingly delayed with each cycle.

The critical factor in breaking out of the cycle is not diet. It's exercise. It's both a cure and an alternative to yo-yo dieting.

The benefits of aerobic exercise do not stem from weight loss per se. Physical activity subtly resets the systems that control metabolism and regulate weight. Exercise can lower dieters' high blood pressure in part of slowing norepinephrine production. And it can strengthen the heart, which may have been weakened by protein loss during dieting (see The Nutrition Report, p. 66).

Crash dieting, with its wide weight swings, is making Americans fat and, worse, sick. The modern compulsion to be thin is thwarted at every turn by nature's determinaton to protect her progeny from starvation; the body can't tell a feast from a famine. On the other

hand, our evolutionary past designed us to be active. When we run, hike, swim or dance, we are giving expression to a biological need. Nature applauds - and doesn't notice we are losing weight.

*Reprinted from Ernsberger, P. (1985, January/February). Yo-yo hypertension, the death of dieting, American Health, 29-33.

Example for Assignment

My Friend's Favorite Breakfast
alias Tofu Pancakes

	Cal.	Prot.	Fat	Carb.
3 egg whites	51	11	0	1
1/2 C. 1% cot. cheese	90	14	1	4
1 C. tofu	100	14	12	0
3 T. dark buckwheat flour	63	2	-	14
2 T. wheat germ	46	3	1	6
1/2 tsp. baking soda	4	-	-	-
1/4+ C. water	-	-	-	-
Total	<u>354</u>	<u>54</u>	<u>14</u>	<u>26</u>

Combine all ingredients in a blender and process until smooth. The consistency should be like whipped cream. The basic recipe yields about 8 pancakes. Each pancake is 45 calories, 7 grams of protein, 1.7 grams of fat and 3.3 grams of carbohydrate. For a variation use oatmeal and apple juice instead of buckwheat flour and water. 1 cup oatflakes = 147 calories, 26.7 grams of carbohydrates, 6.7 grams of protein and 2.1 grams of fat (16 T. = 1 c.) 1 Cup apple juice = 117 calories, 29.5 grams of carbohydrates, 0.2 grams of protein and 0 fat. Fry in PAM.

Instead of syrup, combine Butter Buds, Equal and cinnamon. 4 oz. Butter Buds = 48 calories, with 4 grams of carb., 0 grams of fat and 0 grams of protein. 1 packet of Equal = 4 calories with less than one gram of carbohydrate, 0 grams of fat and 0 grams of protein.

Nutritive Value of the Edible Part of Foods*

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
MILK, CHEESE, CREAM, IMITATION CREAM, RELATED PRODUCTS					
Milk					
Fluid:					
Whole, 3.5% fat	1 cup	160	9	9	12
Nonfat (skim)	1 cup	90	9	Tr	12
Canned, concentrated, undiluted:					
Evaporated, unsweetened	1 cup	345	18	20	24
Condensed, sweetened	1 cup	980	25	27	166
Dry, nonfat instant:					
Low-density (1 1/3 Cups needed for reconstitution to 1 qt.)	1 cup	245	24	Tr	35
High-density (7/8 Cups needed for reconstitution to 1 qt.)	1 cup	375	37	1	54
Buttermilk (fluid, cultured, made from skim milk)	1 cup	90	9	Tr	12
Cheese:					
Natural:					
Blue or Roquefort type	1 oz.	105	6	9	1
Cheddar	1 oz.	115	7	9	1
Cottage, large or small curd, creamed curd pressed down	1 cup	260	33	10	7
Cream	1 oz.	105	2	11	18
Parmesan, grated	1 Tbsp.	25	2	2	Tr
Swiss	1 oz.	105	8	8	1
Pasteurized processed cheese:					
American	1 oz.	105	7	9	1
Swiss	1 oz.	100	8	8	1
Pasteurized processed chesse food, American	1 Tbsp.	45	3	3	1
Pasteurized process chesse spread, American	1 oz.	80	5	6	2
Cream:					
Half and half (cream and milk)	1 Tbsp.	20	1	2	1
Light, coffee or table	1 Tbsp.	30	1	3	1
Sour	1 Tbsp.	25	Tr	2	1
Whipped topping (pressurized)	1 Tbsp.	10	Tr	1	Tr
Imitation cream products (made with vegetable fat):					
Creamers:					
Powdered	1 Tbsp.	10	Tr	1	1
Liquid (frozen)	1 Tbsp.	20	Tr	2	2
Whipped topping (pressurized, frozen or powdered, made with whole milk)	1 Tbsp.	10	Tr	1	Tr

(Continued)

Food	Food Energy Measure	calories	Protein gms	Fat gms	Carbo- hydrates gms
Milk beverages:					
Cocoa, homemade	1 cup	245	10	12	27
Malted milk	1 cup	245	11	10	28
Milk desserts:					
Custard, baked	1 cup	305	14	15	29
Ice Cream:					
Regular (10% fat)	1 cup	255	6	14	28
Rich (16% fat)	1 cup	330	4	24	27
Ice Milk:					
Bardened	1 cup	200	6	7	29
Soft-serve	1 cup	265	8	9	39
Yogurt (made from partially skimmed milk)	1 cup	125	8	4	13
EGGS					
Eggs, large, 24 oz. per dozen:					
Raw or cooked in shell or wish nothing added:					
Whole, without shell	1 egg	80	6	6	Tr
White of egg	1 white	20	4	Tr	Tr
Yolk of egg	1 yolk	60	2	5	Tr
Scrambled, with milk and fat	1 egg	110	7	8	1
MEAT, POULTRY, FISH, SHELLFISH, RELATED PRODUCTS					
Bacon (20 slices per lbs.) broiled or fried crisp (4 slices = 3.2 oz.)	2 slices	90	5	8	1
Beef, cooked:					
Cuts braised, simmered, or pot-roasted					
Lean and fat	3 oz.	245	23	16	0
Lean only	3 oz.	170	26	6	0
Hamburger (ground beef) broiled:					
Lean	3 oz.	185	23	16	0
Regular	3 oz.	245	21	17	0
Roast, oven-cooked, no liquid added:					
Relatively fat, such as rib:					
Lean and fat	3 oz.	375	17	34	0
Lean only	3 oz.	210	23	11	0
Relatively lean, such as heel of round:					
Lean and fat	3 oz.	165	25	7	0
Lean only	3 oz.	140	26	3	0

(Continued)

Food	Food Energy Measure	calories	Protein gms	Fat gms	Carbo- hydrates gms
Steak, broiled:					
Relatively fat, such as sirloin:					
Lean and fat	3 oz.	330	20	27	0
Lean only	3 oz.	175	27	6	0
Relatively lean, such as round:					
Lean and fat	3 oz.	220	24	13	0
Lean only	3 oz.	165	26	5	0
Beef, canned:					
Corned beef	3 oz.	185	22	10	0
Corned beef hash	3 oz.	155	7	10	9
Beef, dried or chipped	2 oz.	115	19	4	0
Chicken, cooked:					
Flesh only, broiled	3 oz.	115	20	3	0
Breast, fried, 1/2 breast (with bone add 0.6 oz)	2.7 oz.	155	25	5	1
Drumstick, fried (with bone add 0.8 oz.)	1.3 oz.	90	12	4	Tr
Chicken, canned, boneless	3 oz.	170	18	10	0
Chili con carne, canned:					
With beans	1 cup	335	19	15	30
Without beans	1 cup	510	26	38	15
Heart, beef, lean, braised	3 oz.	160	27	5	1
Lamb, cooked:					
Chop, thick, with bone, broiled, 4.8 oz.	1 chop	400	25	33	0
Lean and fat	1 oz.	300	19	25	0
Lean only	1 oz.	160	24	7	0
Leg, roasted:					
Lean and fat	3 oz.	235	22	16	0
Lean only	3 oz.	155	23	6	0
Shoulder, roasted:					
Lean and fat	3 oz.	285	18	23	0
Lean only	3 oz.	170	23	8	0
Liver, beef, fried	2 oz.	130	15	6	3
Pork, cured, cooked:					
Ham, light cure, lean and fat, roasted	3 oz.	245	18	19	0
Luncheon Meat:					
Boiled ham, sliced	2 oz.	135	11	10	0
Canned, spiced or unspiced	2 oz.	165	8	14	1
Pork, fresh, cooked:					
Chop, thick with bone (3.5 oz)	1 chop	260	16	21	0
Lean and fat	3 oz.	340	21	27	0
Lean only	3 oz.	230	26	12	0
Roast, oven-cooked, no liquid added:					
Lean and fat	3 oz.	310	21	24	0
Lean only	3 oz.	220	25	13	0

(Continued)

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
Cuts, simmered:					
Lean and fat	3 oz.	320	20	26	0
Lean only	3 oz.	185	25	81	0
Sausage:					
Bologna, slice, 3 in. dia. by 1/8 in.	2 slices	80	3	7	Tr
Frankfurter, heated (8 per lb. pkg.)	1 frank	170	7	15	1
Pork links, cooked (16 links per lb. raw)	2 links	125	5	11	Tr
Salami, dry type	1 oz.	130	7	11	Tr
Salami, cooked	1 oz.	90	5	7	Tr
Veal, medium fat, cooked, bone removed:					
Cutlet	3 oz.	185	23	9	Tr
Roast	3 oz.	230	23	14	0
Fish and shellfish:					
Clams, raw, meat only	3 oz.	65	11	1	2
Crabmeat, canned	3 oz.	85	15	2	1
Fish sticks, breaded, cooked, frozen;					
1 stick 3" x 1" x 1/2"	10	400	38	20	15
Haddock, breaded, fried	3 oz.	140	17	5	5
Ocean perch, breaded, fried	3 oz.	195	16	11	6
Oysters, raw, meat only (13-19 selects)	1 cup	160	20	4	8
Salmon, pink, canned	3 oz.	120	17	5	0
Sardines, Atlantic, canned in oil, drained solids	3 oz.	175	20	9	0
Shrimp, canned, meat	3 oz.	100	21	1	1
Tuna, canned in oil, drained solids	3 oz.	170	24	7	0
MATURE DRY BEANS AND PEAS, NUTS, PEANUTS: RELATED PRODUCTS					
Almonds, shelled, whole kernals	1 cup	850	26	77	28
Beans, dry:					
Cooked, drained:					
Great Northern	1 cup	210	14	1	38
Navy (pea)	1 cup	225	15	1	40
Canned, solids and liquid:					
White with pork and tomato sauce	1 cup	310	16	7	49
Red kidney	1 cup	230	15	1	42
Peanuts, roasted, salted halves	1 cup	840	37	72	27
Peanut butter	1 Tbsp.	95	4	8	3
Peas, split, dry, cooked	1 cup	290	20	1	52
VEGETABLES AND VEGETABLE PRODUCTS					
Asparagus, green pieces, cooked, drained	1 cup	30	3	Tr	5
Beans:					
Lima, immature seeds, cooked, drained	1 cup	190	13	1	34

Snap:					
Green, cooked drained	1 cup	30	2	Tr	7
Yellow or wax, cooked, drained	1 cup	30	2	Tr	6
Sprouted mung beans, cooked, drained	1 cup	35	4	Tr	7
Beets, diced or sliced, cooked, drained	1 cup	55	2	Tr	12
Beet greens, leaves and stems, cooked and drained	1 cup	25	3	Tr	5
Broccoli, cooked, drained:					
Whole stalks, med. size	1 stalk	45	6	1	8
Cut into 1/2 inch pieces	1 cup	40	5	1	7
Brussels sprouts, 7-8 sprouts per cup, cooked	1 cup	55	7	1	10
Cabbage, common varieties:					
Finely shredded	1 cup	20	1	Tr	5
Cooked	1 cup	30	2	Tr	6
Carrots:					
Raw, whole, 5 1/2 by 1 inch	1	20	1	Tr	5
Cooked, diced	1 cup	45	1	Tr	10
Cauliflower, cooked	1 cup	25	3	Tr	5
Celery, raw:					
Stalk, large outer	1	5	Tr	Tr	2
Pieces, diced	1 cup	15	1	Tr	4
Corn, sweet:					
Cooked, ear 5 x 1 3/4 in.	1 ear	70	3	1	16
Canned, solids and liquid	1 cup	170	5	2	40
Cucumbers:					
Raw, pared	1	30	1	Tr	7
Raw, pared, sliced 1/8 in. thick	6 slices	5	Tr	Tr	2
Lettuce, raw	1 head	60	4	Tr	13
Mushrooms, canned, solids and liquid	1 cup	40	5	Tr	6
Onions:					
Mature:					
Raw, 2 1/2 in. diameter	1 onion	40	2	Tr	10
Cooked	1 cup	60	3	Tr	14
Young, green, small, without tops	6 onions	20	1	Tr	5
Parsley, raw, chopped	1 Tbsp.	Tr	Tr	Tr	Tr
Peas, green, cooked	1 cup	115	9	1	19
Peppers, green, raw	1 pod	15	1	Tr	4
Potatoes, medium (3 per lb. raw)					
Boiled, peeled after boiling	1	105	3	Tr	23
French fried, cooked in deep fat,					
piece 2 by 1/2 x 1/2 in.	10 pieces	155	2	7	20
Mashed, milk added	1 cup	125	4	1	25
Potato chips, medium	10 chips	115	1	8	10
Radishes, raw, small	4 radishes	5	Tr	Tr	1
Sauerkraut, canned, solids and liquids	1 cup	45	2	Tr	9
Spinach, cooked	1 cup	40	5	1	6
Squash, cooked:					
Summer, diced	1 cup	30	2	Tr	7
winter, baked, mashed	1 cup	130	4	1	32

(Continued)

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
Sweet potatoes:					
Baked, medium, peeled after baking	1	155	4	1	32
Canned	1 cup	235	4	Tr	54
Tomatoes:					
Raw, wt. 7 oz.	1	40	2	Tr	9
Canned, solids and liquid	1 cup	50	2	1	10
Tomato catsup	1 Tbsp.	15	Tr	Tr	4
Tomato juice	1 cup	45	2	Tr	10
FRUITS AND FRUIT PRODUCTS					
Apples, raw (3 per lb.)	1	70	Tr	Tr	18
Apple juice	1 cup	120	Tr	Tr	30
Applesauce, canned, sweetened	1 cup	230	1	Tr	61
Apricots:					
Raw (12 per lb.)	3	55	1	Tr	18
Canned in heavy syrup	1 cup	220	2	Tr	57
Avocados, whole, raw	1	370	5	37	13
Bananas, raw, medium size	1	100	1	Tr	26
Blackberries, raw	1 cup	85	2	1	19
Blueberries, raw	1 cup	85	1	1	21
Cantaloupe, raw, medium	1/2 melon	60	1	Tr	14
Cranberry juice, canned	1 cup	165	Tr	Tr	42
Cranberry sauce, sweetened, canned, strained	1 cup	405	Tr	1	104
Fruit cocktail, canned, in heavy syrup	1 cup	195	1	Tr	50
Grapefruit, raw, medium	1/2	50	1	Tr	13
Grapefruit juice, canned, unsweetened	1 cup	100	1	Tr	24
Grapes, raw (American type)	1 cup	65	1	1	15
Grape juice:					
Canned or bottled	1 cup	165	1	Tr	42
Frozen conc., sweetened, diluted with 3 parts water by volume	1 cup	135	1	Tr	33
Lemon juice, raw	1 cup	60	1	Tr	20
Lemonade conc., diluted with 4 1/3 parts water, by volume	1 cup	110	Tr	Tr	28
Lime juice, fresh or canned, unsweetened	1 cup	65	1	Tr	22
Oranges, raw, 2 1/2 in. diameter	1	65	1	Tr	22
Orange juice, fresh	1 cup	120	2	Tr	10
Canned, unsweetened or froz. conc. diluted with 3 parts water by vol.	1 cup	120	2	Tr	29
Peaches:					
Raw, whole, medium	1	35	1	Tr	10
Canned, solids and liquid:					
Syrup pack, heavy	1 cup	200	1	Tr	52
Water pack	1 cup	75	1	Tr	20

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
Pears:					
Raw	1	100	1	1	25
Canned, solids and liquid, syrup pack, heavy	1 cup	195	1	1	50
Pineapple:					
Raw, diced	1	75	1	Tr	50
Canned, heavy syrup pack, solids and liquid:					
Crushed	1 cup	195	1	Tr	50
Sliced, with juice	1 slice	90	Tr	Tr	24
Pineapple juice, canned	1 cup	135	1	Tr	34
Plums, raw	1	25	Tr	Tr	7
Prunes, dried, medium	4	70	1	Tr	18
Prune juice, canned or bottled	1 cup	200	1	Tr	49
Raisins, seedless	1 oz.	80	Tr	Tr	22
Raspberries, red:					
Raw	1 cup	70	1	1	17
Frozen, 10 oz. carton	1 carton	275	2	1	70
Strawberries:					
Raw, capped	1 cup	55	1	1	13
Frozen, 10 oz. carton	1 carton	310	1	1	158
Tangerines, raw, medium	1	40	1	Tr	13
Watermelon, raw, wedge, 4 x 8 inches	1 wedge	115	2	1	27
GRAIN PRODUCTS					
Bagel, 3 in. dia.	1	165	6	2	28
Barley, pearled, light uncooked	1 cup	700	16	2	158
Biscuits, baking powder from home recipe, 2 in. dia.	1	105	2	5	13
Bran flakes (40% bran)	1 cup	105	4	1	28
Bran flakes with raisins	1 cup	145	4	1	40
Breads:					
Boston brown bread, slice, 3 x 3/4 in.	1 slice	100	3	1	22
Raisin bread, 18 slices/1 lbs. loaf	1 slice	65	2	1	13
Rye bread, American, light, 18 slices/1 lb. loaf	1 slice	60	2	Tr	13
White bread, enriched:					
Slice, 18 slice/1 lb. loaf	1 slice	70	2	1	13
Slice, 22 slices/1 lb. loaf	1 slice	55	2	1	10
Whole wheat bread, 18 slices/1 lb. loaf	1 slice	60	3	1	12
Breadcrumbs, dry, grated	1 cup	390	13	5	73
Cakes made from cake mixes:					
Angelfood, 1/2 of a 10 in. diameter cake	1 piece	135	3	Tr	32
Cupcakes, small 2 1/2 in. dia. with choc. icing	1 cake	130	2	5	21
Devil's food, 2-layer, with choc. icing,					
1/16 of 9 in. diam. cake	1 piece	235	3	9	40
Gingerbread, 1/9 or 8 in. square cake	1 piece	175	2	4	32

(Continued)

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
Cakes made from home recipes:					
Fruitcake, dark 1/30 of 8 in. loaf	1 piece	55	1	2	9
Pound, slice, 1/2 in. thick	1 piece	175	2	1	32
Cookies:					
Brownies with nuts, home recipe	1	95	1	6	10
Chocolate chip, commercial	1	50	1	2	7
Fig bars, commercial	1	50	1	1	11
Sandwich, choc. or vanilla, commercial	1	50	1	2	7
Corn flakes, added nutrients:1					
Plain	1 cup	100	2	Tr	21
Sugar-covered	1 cup	155	2	Tr	36
Corn muffins, enriched cornmeal & flour, 2 1/2 in. dia.	1	125	3	4	19
Corn, puffed, presweetened, added nutrients	1 cup	115	1	Tr	27
Crackers:					
Graham, 2 1/2 inch square	4 crackers	110	2	3	21
Saltines	4 crackers	50	1	1	8
Danish pastry, plain round piece, 4 1/2 dia. by 1 in.	1 pastry	175	5	15	30
Doughnuts, cake type	1	125	1	6	16
Macaroni, enriched, cooked until tender	1 cup	155	5	1	32
Macaroni, (enriched) and cheese, baked	1 cup	430	17	22	40
Muffins, with enriched white flour, 3 in. diam.	1	120	3	4	17
Noodles (egg), cooked, enriched	1 cup	200	7	2	37
Oatmeal, or rolled oats, cooked	1 cup	130	5	2	23
Pancakes, 4 in. dia. wheat, plain or buttermilk	1 cake	60	2	2	9
Pie (piecrust, unenriched flour), 1/7 of 9 in. pie:					
Apple (2 crust)	1 piece	350	3	15	51
Cherry (2 crust)	1 piece	350	4	15	52
Custard (1 crust)	1 piece	285	8	14	30
Lemon meringue (1 crust)	1 piece	305	4	8	45
Pecan (1 crust)	1 piece	490	6	27	60
Pumpkin (1 crust)	1 piece	275	5	15	32
Pizza (cheese): 1/8 of 14 in. dia. pie	1 piece	185	7	6	27
Popcorn, popped:					
With oil and salt	1 cup	40	1	2	5
Sugar coated	1 cup	135	2	1	30
Pretzels"					
Dutch, twisted	1	60	2	1	12
Stick, regular, 3 in.	5 sticks	10	Tr	Tr	2
Rice, white, enriched, cooked	1 cup	225	4	Tr	2
Rice, puffed, added nutrients	1 cup	60	1	Tr	50
Rolls, enriched:					
Cloverleaf or pan, home recipe	1 roll	120	3	3	20
Frankfurter or hamburger	1 roll	120	3	3	21

(Continued)

Food	Measure	Food Energy calories	Protein gms	Pat gms	Carbo- hydrates gms
Rye wafers, whole-grain, 2 by 3 1/2 in.	2 wafers	45	2	Tr	10
Spaghetti, cooked, tender stage, enriched	1 cup	155	5	1	32
Spaghetti with meatballs and tomato sauce, canned	1 cup	260	12	10	28
Waffles, with enriched flour, 7 in. diam.	1	210	7	7	28
Wheat, puffed, added nutrients	1 cup	55	2	Tr	12
Wheat, shredded, plain	1	90	2	1	20
Wheat flakes, added nutrients	1 cup	105	3	Tr	24
Wheat flours:					
Whole-wheat, from hard wheats, stirred	1 cup	400	16	2	85
All-purpose or family flour, enriched, sifted	1 cup	420	12	1	88
FATS, OILS					
Butter:					
Regular, 4 sticks per lb.	1 Tbsp.	100	Tr	12	Tr
Whipped, 6 sticks or 2 8 oz. cont./lb.	1 Tbsp.	65	Tr	8	Tr
Fats, cooking:					
Lard	1 cup	1,180	0	205	0
	1 Tbsp.	115	0	13	0
Vegetable fats	1 cup	1,770	0	200	0
	1 Tbsp.	110	0	13	0
Margarine, regular, 4 sticks per lb.	1 Tbsp.	100	Tr	12	Tr
Oils, salad or cooking (corn, cottonseed, olive peanut, safflower, soybean)	1 cup	1,945	0	220	Tr
	1 Tbsp.	125	0	14	0
Salad dressings:					
Blue cheese	1 Tbsp.	75	1	8	1
Commercial, mayonnaise type	1 Tbsp.	65	Tr	6	2
French	1 Tbsp.	65	Tr	6	3
Mayonnaise	1 Tbsp.	100	Tr	11	Tr
Thousand Island	1 Tbsp.	80	Tr	8	3
SUGARS, SWEETS					
Candy:					
Caramels, plain or chocolate	1 oz.	115	1	3	22
Chocolate, milk, plain	1 oz.	145	2	9	16
Fudge, plain	1 oz.	115	1	4	21
Hard	1 oz.	110	0	Tr	28
Chocolate-flavored syrup or topping:					
Thin type	1 fl. oz.	90	1	1	24
Fudge type	1 fl. oz.	125	2	5	20
Chocolate-flavored beverage powder, 4 heaping tsp./oz.	1 oz.	100	1	1	25

(Continued)

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
Honey, strained or extracted	1 Tbsp.	65	Tr	0	17
Jams and preserves	1 Tbsp.	55	Tr	Tr	14
Jellies	1 Tbsp.	50	Tr	Tr	13
Molasses, cane					
Light (first extraction)	1 Tbsp.	50	Tr	Tr	13
Blackstrap (third extraction)	1 Tbsp.	45	Tr	Tr	11
Syrup, table blends, chiefly corn, light and dark	1 Tbsp.	60	0	0	15
Sugar, white, granulated	1 Tbsp.	40	0	0	11
MISCELLANEOUS ITEMS					
Beverages, alcoholic:					
Beer	12 fl. oz.	150	1	0	14
Gin, rum, vodka, whiskey 86 proof	1 1/2 fl.oz.	105	Tr	Tr	Tr
100 proof	1 1/2 fl.oz.	125	Tr	Tr	Tr
Wines					
Dessert	3.5 fl. oz.	140	Tr	0	8
Table	3.5 fl. oz.	85	Tr	0	4
Beverages, carbonated, sweetened, nonalcoholic:					
Carbonated water	12 fl. oz.	115	0	0	29
Cola type	12 fl. oz.	145	0	0	37
Fruit-flavored sodas and Tom Collins mixes	12 fl. oz.	170	0	0	45
Root beer	12 fl. oz.	150	0	0	39
Bouillon Cubes, 1/2 inch	1 cube	5	1	Tr	Tr
Chocolate, bitter or baking	1 oz.	145	3	15	8
Gelatin, plain, dry powder in envelope	1 env.	25	6	Tr	0
Gelatin dessert, prepared with water	1 cup	140	4	0	34
Olives, pickled:					
Green	4 med	15	Tr	2	Tr
Ripe: Mission	3 small	15	Tr	Tr	6
Pickles, cucumber:					
Dill, medium, whole	1	10	1	Tr	1
Sweet, gherkin, small, whole	1	20	Tr	Tr	6
Relish, finely chopped, sweet	1 Tbsp.	20	Tr	Tr	5
Pudding, home recipe with starch base:					
Chocolate	1 cup	385	8	12	67
Vanilla (blanc mange)	1 cup	285	9	10	11
Sherbet	1 cup	260	2	2	59
Soups, canned, condensed, ready-to-serve					
Prepared with an equal volume of milk:					
Cream of chicken	1 cup	180	7	10	15
Cream of mushroom	1 cup	215	7	14	16
Tomato	1 cup	175	7	7	23

(Continued)

Food	Measure	Food Energy calories	Protein gms	Fat gms	Carbo- hydrates gms
Prepared with an equal volume of water:					
Beef broth, bouillon, consomme	1 cup	30	5	0	3
Beef noodle	1 cup	70	4	3	7
Cream of chicken	1 cup	95	3	6	8
Cream of mushroom	1 cup	135	2	10	10
Minestone	1 cup	105	5	3	14
Split pea	1 cup	145	9	3	21
Tomato	1 cup	90	2	3	16
Vegetable Beef	1 cup	80	5	2	10
Tapioca desserts:					
Apple	1 cup	295	1	Tr	74
Cream pudding	1 cup	220	8	8	23
Tartar sauce	1 Tbsp.	75	Tr	8	5
Vinegar	1 Tbsp.	Tr	Tr	0	0
White sauce, medium	1 cup	405	10	31	23

The Calorie used in human metabolism is the heat needed to raise the temperature of one kilogram (2.2 pounds) of water from 15 degrees to 16 degrees Centigrade.

Adapted from U.S. Department of Agriculture, Agricultural Research Service, Nutritive Value of Foods. (Home and Garden Bulletin No. 72) Washington, D.C.: U.S. Government Printing Office, 1970.

*From Slim Chance in a Fat World, Behavioral Control of Obesity by R. F. Stewart and B. Davis.

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The Cookbook

compiled by

Blacksburg's Womens Bodybuilding Pioneers

Mary Ann T's Strawberry Shake

(4 servings, 65 calories each)

	Prot.	Fat	Carb.
*2 cups hulled fresh strawberries	2	2	26
*2 egg whites	8	tr	tr
*1 cup (8 oz.) plain yogurt	16	8	26
*2 packets artificial sweetener	-	-	-
Crushed Ice			

Process all * ingredients in a blender until they are smooth and creamy. Pour into glasses filled halfway with crushed ice. Garnish each with a strawberry.

Rene L's Easy Vegetable Dip

1 pint yogurt
1 small (8 oz.) lowfat cottage cheese

Mix the above then add any natural seasoning packet or mix your own of garlic, minced onion, parsely flakes and other spices you like. Refrigerate for 1/2 hour. It's great with celery, carrots, cauliflower or green peppers.

Sue B's Red Onion Potato Salad

	Cal.	Prot.	Fat	Carb.
6 med. potatoes	730	18	2	138
1 cup sliced celery	15	1	tr	4
1 cup thin sliced red onion	60	3	tr	14
1/3 cup chopped parsley	tr	tr	tr	tr
1/4 cup low-cal. Italian dressing	96	tr	tr	16
3 tbs. vinegar				
2 tsp. salt				
Dash cayenne pepper				
Total	901	22	2	169

Boil potatoes in skin, peel and slice hot. Place potatoes in large bowl and mix with Italian dressing. Chill. Combine remaining ingredients and chill until served.

Make 5 1/2 cup servings with about 108 calories, 4 grams protein, 1 gram of fat, 35 grams of carbohydrate.

Gloria G's Cool As A Cucumber Salad

50 calories, 6 servings

1 package (4 serving size) Sugar Free Jello gelatin, Lime flavor
 1/2 tsp. salt
 3/4 cup boiling water
 1 tbs. lemon juice
 1/2 cup cold water
 ice cubes
 1/2 cup sour cream
 1 cup chopped, seeded, peeled cucumber
 1 tbs. minced onion
 1 tsp. dillweed or 1 Tbs. chopped fresh dill

Dissolve gelatin and salt in boiling water. Add lemon juice. Combine cold water and ice cubes to make 1 1/4 cups. Add to gelatin, stirring until slightly thickened. Remove any unmelted ice. Blend in sour cream; add remaining ingredients. Pour into individual dishes and chill, soft set in 30 minutes.

Bran Muffins

1 1/4 cups all purpose flour
 3 tsp. baking powder
 1/2 tsp. salt
 1/2 cup sugar
 1 1/2 cups Kellogg's All-Bran or Bran Buds cereal
 1 1/4 cups skim milk
 1 egg
 1/2 cup shortening or vegetable oil

1. Stir together flour, baking powder, salt and sugar. Set aside.
2. Measure cereal and milk into a large bowl. Stir to combine. Let stand 1 to 2 minutes to soften cereal. Add egg and shortening. Beat well.
3. Add flour mixture, stirring only until combined. Portion batter evenly into 12 greased 2 1/2 inch muffin pan cups.
4. Bake at 400° F for about 25 minutes or until lightly browned.

Yield: 12 muffins

Cal.	Protein	Fat	Carb.
120	3	4	17

Whole Wheat Biscuits

Stir together:

1/2 cup skim milk
 1/3 cup corn oil

In separate bowl, stir together:

1 cup all purpose flour
 1 cup whole wheat flour
 4 tsp. baking powder
 1/4 tsp. salt

Add oil mixture stirring constantly with a fork. With hands, form dough into ball. Turn onto lightly floured surface and knead gently 10-15 times. Roll out or pat dough to 1/2 inch thickness. Cut with floured 2 inch cutter. Place biscuits on ungreased cookie sheet. Bake at 425 degrees F. for 12-14 minutes or until lightly browned.

Makes 12 biscuits.

Each biscuit contains:

130 calories 3 grams protein 16 grams carbohydrates
 4 grams polyunsaturated fat 1 gram saturated fat
 150 milligrams sodium

Rachel S's Spanish Rice and Garbanzos

2/3 cup rice
 small onion, chopped
 1/3 cup green pepper, chopped
 1 large clove garlic, minced
 3 tbs. oil
 1 to 1 1/2 cups water
 1 tsp. salt
 1/4 tsp. pepper
 1 can tomatoes (16 oz.)
 1 can garbanzos (20 oz.), drained
 1/2 tsp. oregano

In large heavy skillet over medium heat saute rice, onion, green pepper and garlic in oil, stirring occasionally for about 10 minutes or until rice is a light golden color and onion and green pepper are becoming tender. Add water, salt and pepper. Bring to a boil, reduce heat, cover and cook about 15 minutes or until rice is tender, adding more water if necessary. Once rice is tender, stir in tomatoes, garbanzos and oregano and cook until heated through.

Noami T's Wheat Germ Veggieburgers

	Cal	Prot.	Fat	Carb.
1 cup grated zucchini	30	2	tr	7
1 egg	80	6	6	tr
6 tbs. grated Monterey Jack cheese	105	8	8	1
6 tbs. wheat germ	120	9	3	18
3 tbs. chopped fresh mushrooms	10	3	tr	3
1 tsp. chopped onion	4	tr	tr	1
1/4 tsp. salt	-	-	-	-
dash thyme	-	-	-	-
1 tbs. margarine (or Pam)	449	28	29	30

Combine all ingredients except margarine. Shape into two patties and cook in a non-stick skillet until heated through. Each patty is 225 calories if cooked in the margarine or 175 to 180 if cooked in Pam.

(These are a bit messy because they never seem to stay together, but they are delicious. Try eating it on a whole wheat roll or just plain.)

Robin B's Shepherd's Pie

350 deg oven 1 1/4 hours to prepare, 35 min. to
bake 4-5 servings

2 large potatoes	Salt + pepper to taste
1 Tbs. butter	1/2 cup yogurt
	1/2 cup freshly minced chives
	1/2 cup freshly minced parsley
1 1/2 tbs. butter	1 lb. eggplant in small cubes
1 1/2 cup chopped onion	1 green pepper minced
1 lg. clove garlic, crushed	1/4 tsp. thyme
black pepper	1 tsp. salt
1 stalk finely minced celery	1/2 tsp. each: basil, oregano
12 oz. chopped mushrooms	1 cup raw (fresh or frozen) peas
	1/2 cup (packed) grated cheddar cheese
	3 tbs. wheat germ
	1 tbs. cider vinegar

1. Cook the potatoes (in their skins) in boiling water until soft. Drain and mash with all ingredients from I. Set aside.
2. In a large, heavy skillet, saute the onions and garlic in 1 1/2 tbs. butter, with salt and pepper, until the onions are soft (about 5-8 minutes)
3. Add the celery, mushrooms and eggplant. Cook over low heat, stirring occasionally. When the eggplant is cooked through (and this will happen more quickly if you cover the skillet between stirring), add green pepper, herbs, and peas. Continue cooking about 5 minutes longer.
4. Remove from heat; toss with cheese, wheat germ and vinegar. Spread this mixture into your buttered deep dish casserole. Spread the mash potatoes on top as a crust.
(Optional and optimal) Sprinkle extra cheese plus some paprika on top.

Bake uncovered, 35 minutes.
188.3 calories per serving

Shepherd's Pie	Total	941.5	41	43.5	106.5
	Cal	Pro	Fat	Carb	
1/2 cup yogurt	62.5	4	2	6.5	
2 potatoes	210	6	tr	46	

1 tbs. butter	100	tr	12	tr
1 1/2 tbs. butter	150	tr	18	tr
onion (1 med)	40	2	tr	10
celery (1 stalk)	5	tr	tr	2
mushrooms (1 1/2 c)	60	7.5	tr	9
eggplant (1)				
bell pepper (1)	15	1	tr	4
peas (frozen 1 pkg)	115	9	tr	4
1/2 cup. cheese				
(1 oz)	115	7	9	1
wheat germ (3 tbs)	69	4.5	1.5	9
vinegar (1 tbs)	tr	tr	0	0

Eileen M's Baked Lentils

8 servings (adapted from Honey Baked Lentils, p. 108, in More with Less Cookbook)

	Cal.	Prot	Fat	Carb
1 lb. (2-1/3 cup) dry lentils	1564	114	?	?
1 small bay leaf	-	-	-	-
5 cups water	-	-	-	-
1 tsp. salt (or less)	-	-	-	-

Combine in dutch oven, cover and bring to a boil. Reduce heat and simmer 30 minutes. Do not drain. Discard bay leaf. Preheat oven to 350 deg. F.

Combine in bowl and add to lentils:

1 tsp. dry mustard	?	?	?	?
1/2 cup chopped onion	38	1	?	?
2 cups tomato sauce, stewed tomatoes or fresh	160	69	?	?
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Cover tightly and bake one hour. Serve with cooked rice and soy sauce to complete the protein. If you like, layer cooked rice in bottom of a casserole dish and cover with lentil mixture, then bake.

One cup of enriched white rice has: (measured after cooking)	225	4	?	?
One C. dry uncooked white rice	712	13	?	?
One C. dry uncooked brown rice	704	15	?	?
One serving baked lentils	220	46	?	?
1/2 C. cooked brown rice about	136	3	?	?
A serving of baked lentils on rice	356	9		
all or most of a day's protein.				

Lentils are good source of calcium, phosphorus, iron, Vitamin B1 and B2 and niacin.

Cathryn K's Stuffed Cabbage Rolls

Delicious and worth the effort

	Cal	Fat	Prot	Carb
1 large head of cabbage	94	.5	7.3	23

Filling:

2 Tbs. minced onions
 1 Tbs. safflower oil
 1 cup brown rice
 2 cups vegetable stock or water
 2 Tbs. raisins
 1/2 tsp. cinnamon
 dash of pepper

Sauce

2 cups fresh tomatoes
 1/4 cup chopped onion
 1/8 tsp. salt
 1/2 tsp. pepper
 2 cups vegetable stock

Filling: saute onion in oil; then stir in rice and saute a few minutes longer; add stock, raisins and seasonings. (For added flavor add chopped carrots and/or celery: that's optional). Bring to a boil, cover, lower heat, and cook for 45 minutes.

Sauce: saute onion until soft; add tomatoes, stock and seasonings and simmer 30 minutes.

Remove core from cabbage and steam for 5 minutes over boiling water. Carefully peel 18 or so of the outer leaves.

Preheat oven to 350 deg. F.

Place 2 Tbs. filling in each leaf; fold end in and roll up. Spread sauce in bottom of 8 x 13 pan and place rolls seam side down. You can place them in layers if needed. Cover and bake 45 minutes. Sprinkle with lemon juice and paprika - Serve and enjoy

Mary L's Baked Ziti

	Cal	Prot	Fat	Carb
1/2 lb. ziti, spirals or small shells	620	20	40	128
2 cups tomato sauce	100	4	2	20
1 cup part skim ricotta cheese	150	26	2	12
4 oz. thinly sliced mozzarella	<u>320</u>	<u>32</u>	<u>20</u>	<u>4</u>
Total	1190	82	28	164
Per Serving	298	21	7	41

Preheat oven to 350 F. Cook pasta in boiling salted water until barely tender (about 10 minutes) and drain. Combine pasta, tomato sauce and ricotta in 2 qt. baking dish. Top with cheese slices. Bake about 15 minutes until very hot and cheese has melted. Serves 4.

Cathy L's Lentil Soup

1 bag of dry lentils
6 cups water
2 onions, sliced
3 carrots, sliced
3 celery stalks, sliced
2 potatoes, diced 1/2 inch
1/2 head broccoli, cut into flowerets, stalks sliced
cumin, oregano, parsley, bay leaf, basil, cayenne pepper
1 clove garlic, pressed
salt and pepper

Cook lentils in water. Bring to a boil, simmer on low for a total of 1 1/2 to 2 hours (do not presoak). After 1/2 hour add onions, carrots, celery and garlic. After another 1/2 hour add potatoes. When lentils are fully cooked (soft but not mushy) add broccoli and herbs, spices and salt to taste. You'll need a lot because the lentils will tend to taste bland. Cook 15 more minutes and serve.

If you like, you can cook the chicken broth or bouillion, but if spiced well, plain water is sufficient. If all the water is soaked up during cooking, keep adding more, the soup should be thick but not dry.

Linda D's Lo-Cal Lo-Fat Omelet

	Calories
2 eggs	150
1 slice Lite Line cheese	50
Pam	3
1/4 cup milk (skim)	22
2 slices tomatoes	
2 to 3 mushrooms	
sliced onions	about
green pepper	25 ea.
Total Calories	250

Add coffee or tea to drink with sweet & low or 1/2 cup V-8 (35 cal) for variation.

Saute vegetables in Pam and put aside. Mix eggs and milk with a little garlic, pepper, worcester sauce or any variation of seasonings handy. Spray pan with Pam. Add egg mixture and then vegetables and cheese. After eggs have set up fold and cook for about 1 1/2 minutes.

Karen E's Crunchy Biscuit Chicken Casserole*

2 (5 oz) cans boned chicken or 2 cups cooked cubed chicken
 10 3/4 oz. can condensed cream of chicken soup
 8 1/2 oz. can sliced green beans, drained
 2 1/2 oz. jar sliced mushrooms, undrained
 4 oz. (1 cup) shredded Cheddar cheese or American cheese
 1/2 cup mayonnaise or salad dressing
 1 tsp. lemon juice
 10 oz. can Hungry Jack Refrigerator Big Flaky Biscuits
 1 to 2 Tbs. margarine or butter, melted
 1/4 to 1/2 cup crushed cheddar cheese or seasoned croutons

Heat oven to 375 deg. F. In medium saucepan, combine chicken, chicken soup, green beans, mushrooms, cheese, mayonnaise and lemon juice. Heat until hot and bubbly. Pour hot chicken mixture into ungreased shallow 2 qt. casserole or 12 x 8 inch (2 qt.) baking dish. Separate biscuit dough into 10 biscuits. Arrange biscuits over hot chicken mixture. Brush each biscuit with margarine; sprinkle with crushed croutons. Bake at 375 deg. F. for 25 to 30 minutes or until deep golden brown. Serve immediately. 4 to 6 servings.

Serving size - 1/8 of recipe

Calories - 530, Protein - 22 g, Carbohydrate - 28 g

Fat 37 g, Sodium 1275 mg, Potassium - 215 mg.

*Editorial Comment - This recipe is not exactly a 'low-fat' 'low-calorie' recipe. Most bodybuilders or people desiring to lose weight would do better not eating a dish with so many high fat ingredients.

Melissa M's Multigrain Pizza

	Cal	Prot	Fat	Carb
1 cup whole wheat flour	400	16	2	85
1 cup oat flour	163	6.25	2.5	28.75
(made from 1 1/4 cups oatmeal)				
1 tsp. baking powder				
2/3 cup milk	60	6	tr	8
1/4 cup cooking oil	486	0	14	0
2 8 oz. cans pizza sauce				
1 green pepper,				
cut into rings	15	1	tr	4
1 1/2 cups cheddar				
cheese (6 oz)	690	42	54	6

Combine flours and baking powder. (To make oat flour, place 1 1/4 cups rolled oats or quick cooking oats in blender. Cover, blend till fine) Add milk and oil; mix well. Using greased hands, press dough onto greased 14 inch pizza pan. Build up edges slightly; snip at 1 inch intervals. Bake in a 425 deg. F. oven 12 to 15 minutes. Spread pizza sauce over crust. Top with pepper rings and cheese. Return to oven. Bake 10 to 15 minutes more. Makes 4 to 5 servings.

Beth D's Rice Salad Vinaigrette

Serves 6 or more

	Cal	Prot	Fat	Carb
1/3 cup finely diced carrots	40	2	tr	10
3/4 cup frozen green beans,				
cut in bits	30	2	tr	7
1/4 cup diced celery	4	tr	tr	tr
1/2 cup chopped spanish onion	40	2	tr	10
3 Tbs. minced parsley	tr	tr	tr	tr
2 1/2 cups cooked rice	575	10	tr	150
4 Tbs. grated parmesan cheese	100	8	8	tr
4 Tbs. olive oil	500	0	56	0
3 Tbs. white wine vinegar	tr	tr	0	0
Pinch: thyme, basil,				
oregano, pepper, salt				
Total	1319	26	64	182
1 Serving	220	4.3	10.6	30.3

Cook carrots and beans until barely tender and drain immediately. Combine first 7 ingredients in large bowl

and toss. Combine cheese, oil, vinegar and spices and whisk until smooth. Pour dressing over salad and toss until combined. Chill and serve.

Susan T's Clam Sauce Linguine 6 servings

This is a great company dish and can be prepared in less than twenty minutes. Supplies protein, B vitamins, and iron.

Ingredients	Cal	Prot	Fat	Carb
12 oz. enriched linguine	1260	42	6	258
1/4 cup olive oil	486	0	55	0
1 med. onion, chopped	40	2	tr	10
1/4 cup fresh parsley, chopped	tr	tr	tr	tr
3-4 cloves garlic, minced or pressed	--	--	--	--
2 Tbs. enriched white flour	53	2	tr	11
Fresh ground pepper to taste	--	--	--	--
3 cans (8 oz each) minced clams drained with liquid reserved	520	88	8	16
Totals	2359	134	69	295
Per Serving	393	22	12	49

1. Cook linguine following package directions; drain and keep hot. (Coordinate this step with the following steps. If linguine sits too long after it is drained it will stick together and get soggy.)
2. While linguine is cooking, heat olive oil in saucepan. Add onion, garlic and parsley; cook about 3 minutes, stirring occasionally.
3. Stir flour and pepper into the above; cook until flour mixture is bubbly.
4. Slowly stir in the reserved clam liquid to which enough water has been added to equal 1 1/2 cups liquid. Blend thoroughly. Bring rapidly to boiling, stirring constantly, and boil 1 to 2 minutes.
5. Mix in minced clams and heat, but do not boil. (I usually heat just until the first bubbles begin to form.)
6. Serve sauce over hot linguine. Garnish with fresh parsley.

(OPTIONAL: Sprinkle tablespoon of grated Parmesan cheese over each serving. Add 25 Calories, 2 grams protein, 2 grams fat to above serving totals.)

Helen H's Ambrosia

	Cal	Prot	Fat	Carb
16 oz. fruit cocktail, drained (Del Monte Lite)	200	0	0	60
20 oz. crushed pineapple, drained	350	0	0	18
11 oz. mandarin oranges, drained	200	0	0	25
1/4 - 1/2 cup sour cream	100/200	0	8/16	2 / 4
Total	850/950	0	8/16	105/107

Gloria G's Munch Cups

1 pkg (4 oz serving size) Sugar Free Jello Gelatin,
orange or lime
3/4 cup boiling water
ice cubes
1 tsp. lemon juice (optional)
1 1/2 cups sliced or diced vegetables or fruit

Dissolve gelatin in boiling water. combine cold water and ice cubes to make 1 1/4 cups. Add to gelatin with lemon juice, stirring until slightly thickened. Remove any unmelted ice. Add vegetables and spoon into individual dishes. Chill, soft set in 30 minutes.

Suggested variations
sliced celery, chopped cabbage, shredded carrot,
chopped apple

15 calories, 6 servings

Exercises for the Chest

1. Bench Press (For a description of how to perform the exercise refer to the handout describing exercises in your current routine.) Variations of the bench press can be done as follows:
 - a. Varying the width of the grip
 - a wide hand spacing puts the exercise stress on the outer part of the pectoral
 - a medium grip will develop the middle part of the chest
 - a narrow grip will develop the inner pectorals (and also the triceps)
 - b. Varying where you lower the bar
 - as you lower the weight, you activate whatever area is in line with the bar, e.g. when you lower the bar to your middle middle chest that is where you will stimulate the most development
 - c. Varying the angle of movement
 - using an incline bench stimulates upper pectoral development
 - using a decline bench stimulates lower pectoral development
 - using a flat bench stimulates mid-pectoral development
 - d. Varying the movement
 - using dumbbells instead of a barbell. In most cases the use of dumbbells allows for more of a stretch than the use of barbells.
2. Flyes (For a description of how to perform this exercise refer to the handout describing exercises in your current routine.)
 - a. The purpose of flyes is to work the outer pectoral muscle.
 - b. Variations can be achieved by changing the angle of the movement e.g. incline, decline, flat.
3. Parallel Bar Dips - This exercise strongly stresses the lower and outer areas of the pectoral muscles. Secondary stress is placed on the front deltoids and triceps. To start, grasp a pair of parallel bars with your palms facing each other. Jump up to support yourself above the bars on straight arms. Tilt your head forward and bend your legs. Slowly bend your arms and lower your body down between the bars then push back to the starting position by straightening your arms. In some gyms it is possible to vary this exercise by using different grips or adding a weight by wearing a dumbbell or barbell plate around your waist.
4. Cross-Bench Pullovers - This exercise is to develop the pectoral, latissimus dorsi and serratus muscles. To start, grasp a moderately weighted dumbbell with your palms against the inside plate so that the dumbbell handle hangs directly downward. Lie across a flat

exercise bench with only your shoulders in contact with the bench. Extend your arms directly upward so that the dumbbell is right above your chest. Place your feet a comfortable distance apart and bend your knees enough so that your hips are below the level of your chest. To perform the exercise, bend your arms slightly and slowly lower the dumbbell backward and downward in a semi-circle to as low a position behind your head as possible. Then return to the starting point. Repeat for the desired number of repetitions.

Source: Gold's Gym Book of Bodybuilding by K. Sprague and B. Reynolds

Exercises for the Abdomen

1. For the upper and lower abdominals
 - a. Situp - When done correctly the situp uses the upper abdominals to start the movement and the lower abdominals to finish it. To perform the situp lie face up on an abdominal board and secure your feet. Keep your knees bent throughout the movement. With your hands across your chest, curl your trunk until your head touches your knees, pause, then return by uncurling your trunk. When you can do 3-5 sets of 20-25 reps, increase the resistance by changing the angle of the board or holding a weight behind your head.
 - b. Alternate Incline Knee Up - In contrast to the situp, the lower abdominals start this movement and the upper abdominals finish it. To perform the exercise lie face up on a situp board. Grasp the back of the board and lift your feet about 20 inches off the board. Maintain this position while pulling one knee to your chest without bending the other. As you return to the start, pull the other leg up.
2. For the upper abdominals
 - a. Crunch - Lie face up on the floor and rest your feet over a bench. With your chin pressed against your chest, slowly curl your shoulders toward your torso. Resistance can be added by holding a weight behind your head.
 - b. Cable Crunch - is a variation done with a high pulley. To perform this exercise attach a rope to the pulley. Kneel and face the weight stack. Then curl your shoulders to your knees with your chin pressed against your chest.
3. For the lower abdominals
 - a. Leg Raises
 - on a chinning bar
 - on a stand
 - on a bench

To perform this exercise keep your knees together and straight. Lift your legs until they are parallel to the floor, pause, then lower them slowly to take advantage of the negative resistance.
 - b. Knee Raises
 - on a chinning bar
 - on a stand
 - on a bench

This is performed the same way as leg raises except that the legs are bent. For a variation use a low pulley to add resistance.
4. For the obliques
 - a. Side Twists - To perform this exercise place a stick behind your shoulders and position your feet shoulder width apart. Keeping the stick parallel to your shoulders and your hips stationary, twist your trunk in each direction.
 - b. Seated Side Bends - To perform this exercise sit in the center of a bench. Place your hands behind your head and bend to

one side as far as possible. Return to the start position and then bend to the opposite side. For increased resistance hold a barbell plate behind your head.

Source: Gold's Gym Book of Bodybuilding, K. Sprague and B. Reynolds.

Exercises for the Back

Back exercises are designed to develop the two columns of the lumbar region in the lower back (the erector spinae) and the two largest muscles of the upper back (the latissimus dorsi and the trapezius).

Exercises for the lower back are:

- (1) Hyperextensions - (See description from the original routine for how to perform this exercise). When you can do 20 repetitions of this exercise for several sets add resistance by holding a barbell plate behind your head.
- (2) Good Mornings - To perform this exercise place a barbell across your shoulders as for the start of a squat. Set your feet approximately shoulder width apart and point your toes directly forward. To start the exercise keep your legs straight and bend forward at the waist until your torso is parallel to the floor. Return to the starting position and repeat the desired number of repetitions. When using heavier weight bend your knees slightly while performing the exercise.

Exercises for the latissimus dorsi are:

- (1) Bent Over Rows - To perform this exercise place a loaded barbell on the floor. Bend over and grip the bar slightly wider than shoulder width. Your legs should also be shoulder width apart with knees slightly bent. With your arms straight and your torso parallel to the floor pull the bar from arms length to touch the lower part of the rib cage. Be sure that your elbows travel both upward and backward then slowly lower to the beginning. Variations of bent over rows can be achieved by changing the width of the grip on the bar. You can also vary rows by using dumbbells and different apparatus such as a T-bar Pulley or by laying stomach down on a high bench.
- (2) Lat Machine Pulldown (See description from the original routine for how to perform this exercise.) This exercise can be varied by changing the width of your grip or changing the position of your hands on the bar e.g. palms facing your shoulders or palms away from your shoulders.
- (3) Chins - To perform this exercise jump up and grasp a chinning bar with your palms pointed forward and your hands wider than shoulder width. Bend your legs from 45 - 70 degrees and cross your ankles. Beginning at arm's length, bend your arms and pull your body up to the bar until your upper chest touches the bar. Be sure your elbows move downward and backward and that you arch your back as you pull yourself upward. Next, slowly lower yourself back to the starting point. Variations of chins can be done by pulling the bar behind the neck or varying the

grip.

- (4) Bent Arm Pullovers (See additional chest exercises for how to perform this exercise.)

Exercises for the trapezius muscles are:

- (1) Upright Rows - To perform this exercise take a narrow grip on a barbell so that your palms are facing your body when standing erect. Starting with the barbell across your upper thighs, with your arms straight pull upward keeping your elbows above the level of your shoulder at all times. Pull the bar until it touches the underside of your chin. Pause a moment at the top of the movement then slowly lower the bar to the starting position. Variations can be done with different apparatus such as dumbbells or a floor pulley. Different grip widths can also be used.
- (2) Shrugs - To perform this exercise take a shoulder width grip on the barbell with your palms toward your body. Your arms should be kept straight through the whole movement. To start, sag your shoulders as far downward as possible then slowly shrug them upward and backward trying to touch your shoulders to your ears. Slowly lower the weight to the start position. Variations can be done using dumbbells.

Source: Gold's Gym Book of Bodybuilding, K. Sprague and B. Reynolds.

Additional Exercises for the Shoulders

Because the shoulders have a ball and socket type joint, it allows you to move your arms with a wide range of motion. Due to this range of motion the shoulder (or deltoid) muscle is divided into three separate areas ("heads"): the anterior (front), medial (side), and posterior (rear) deltoid. No exercise works all three of these areas at one time. Therefore, for the purpose of this class, shoulder exercises have been classified by what area of the deltoid they work.

Anterior Deltoid

1. Press (see description of this movement in your original workout routine). Variations of the 'Press Movement' are the Military Press, Dumbbell Press, Seated Press & Machine Press.
2. Front Lateral - To perform this exercise grasp a barbell using a shoulder width grip. To start the barbell is resting across your thighs with your palms toward your body. Then slowly move the barbell in a semicircular arc until it reaches shoulder level. Slowly lower it back to the starting position. Variations of this exercise can also be done with two dumbbells (alternately or together) or one dumbbell.

Medial Deltoid

1. Side Lateral Raise - This exercise is performed as the Front Lateral Raise except that it is done with two dumbbells raised at the same time out to the side. A variation of this exercise can be done using a low pulley. The Side Lateral Raise and Cable Lateral Raise also work the Anterior Deltoid as well. To further isolate the medial deltoid head you can perform this movement while lying on your side on an abdominal board.

Posterior Deltoid

1. Seated Bent Lateral - This movement is the same as the side lateral movement except that is performed by sitting on the end of a bench, bent at the waist with your torso resting on your thighs. A variation of the bent lateral movement can also be performed by standing using the low-pulley machine. A second variation can also be performed by laying on your stomach on an incline bench. This is called a Prone Incline Lateral and also works the medial deltoid head as well as the posterior head.

Source: Gold's Gym Book of Bodybuilding, K. Sprague and B. Reynolds.

Additional Exercises for the Legs (including buttocks and calves)

1. Squats (see description of how to perform this exercise in your original exercise routine). Variations of the squats can be done by: (1) changing the width of your foot position; (2) performing partial squat movements e.g. bottom-up half squats, top-down half squats; (3) changing the position of the barbell as for Front Squats where the bar rests across the front of your shoulders; (4) using a machine such as a Hack Squat or Smith machine, and; (5) changing the angle of your back and using no resistance at all, as for Sissy Squats. (The name was derived from the myth of Sisyphus. This exercise is definitely not for sissies) To perform this exercise hold onto an upright with your feet about 18 inches apart. Rise up on your toes and lower into a squat while leaning as far back as possible. The idea of this exercise is to keep your thighs and torso in the same plane throughout the exercise.

2. Lunges - This exercise works your front thighs and buttocks. To perform a lunge, rest a barbell across your shoulders as for squats. From an erect position with your feet about shoulder width apart step forward 2 1/2 to 3 feet with your left foot and place it flat on the floor. During the movement your torso should be upright and your right leg relatively straight (about 3-5 inches from the floor). From the bottom position push yourself back to the starting position. Then alternate with the right leg for the next repetition. Variations of this exercise can be done by: (1) doing all the reps on one side first; (2) using dumbbells instead of a barbell (the dumbbells are held at your sides); or (3) lunging onto a bench.

3. Pulley Leg/Hip Movement These movements stress the hip, buttock and inner and outer thighs. To do this movement you need to use a floor pulley machine. There are four variations of this exercise, each works a different part of the leg area.

(a) Buttocks Extension - To perform this exercise fasten a padded cuff to the floor pulley. Facing the machine grasp an upright to maintain your body position. While keeping your torso straight slowly raise your foot upward and backward as high as you can. Contract your buttocks at the top of the movement then slowly lower back to the start. After the desired number of repetitions switch legs.

(b) Outer Thigh Pull - This exercise is performed as above except your body is turned toward the side so that you can lift the cuffed leg up and out to the side.

(c) Inner Thigh Pull - This exercise is done as above except that your foot moves across the midline of your body.

(d) Forward/Leg Push Kick - Holding an upright with your back to the machine let the weight pull your foot back to the machine then kick slowly forward as if you are kicking a football.

(4) Calf Raises (see a description of how to perform this exercise in your original routine). All calf movements are performed in the same way. Variations can be performed by using: (1) different machines such as a seated calf machine, a leg press, or even a hack squat; (2) bending over with a partner sitting on your back as for Donkey Calf Raises, or; (3) performing the movement with one-leg at a time as for One Leg Toe Raises.

Source: Gold's Gym Book of Bodybuilding, K. Sprague and B. Reynolds.

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the scanned document**

Imagery Content and Perspective and Its
Effect on Development of Muscular Strength

by

Andrea L. Dunn

Committee Chairperson: Elise E. Labbe

Psychology

(ABSTRACT)

Equivocal results for imagery as a beneficial adjunct to performance may be due to diverse methodologies as well as a lack of clarity about the relationship between imagery ability and imagery perspective. This study used a randomized group design with repeated measures to evaluate the effect of imagery content and perspective on strength.

Subjects were 44 women, ages 19 to 34, classified as beginning weight lifters. All were pre-tested on imagery ability and knee joint strength. Subjects were randomly assigned to one of three training conditions: (1) an internal imagery perspective; (2) an external imagery perspective, and (3) no imagery training. Training was conducted twice per week for eight weeks. Subjects were also asked to work out a third time.

The dependent measure to assess strength at the beginning, middle, and end of the eight-weeks was the Cybex II dynamometer. The dependent measure to assess imagery

vividness was the Betts Questionnaire Upon Mental Imagery. Imagery perspective was measured by the Imagination Exercise.

Results of a two-way analysis of variance with repeated measures using Cybex II found significant strength differences for: (1) all groups and (2) the internal imagery group. A significant linear trend was also found between groups. Additionally, a two-way analysis of variance with repeated measures, using imagery ratings found significant improvement in kinesthetic vividness for all groups.

This investigation is the first experimental study using beginning athletes to demonstrate significant performance effects using mental training above and beyond significant effects due to physical training.