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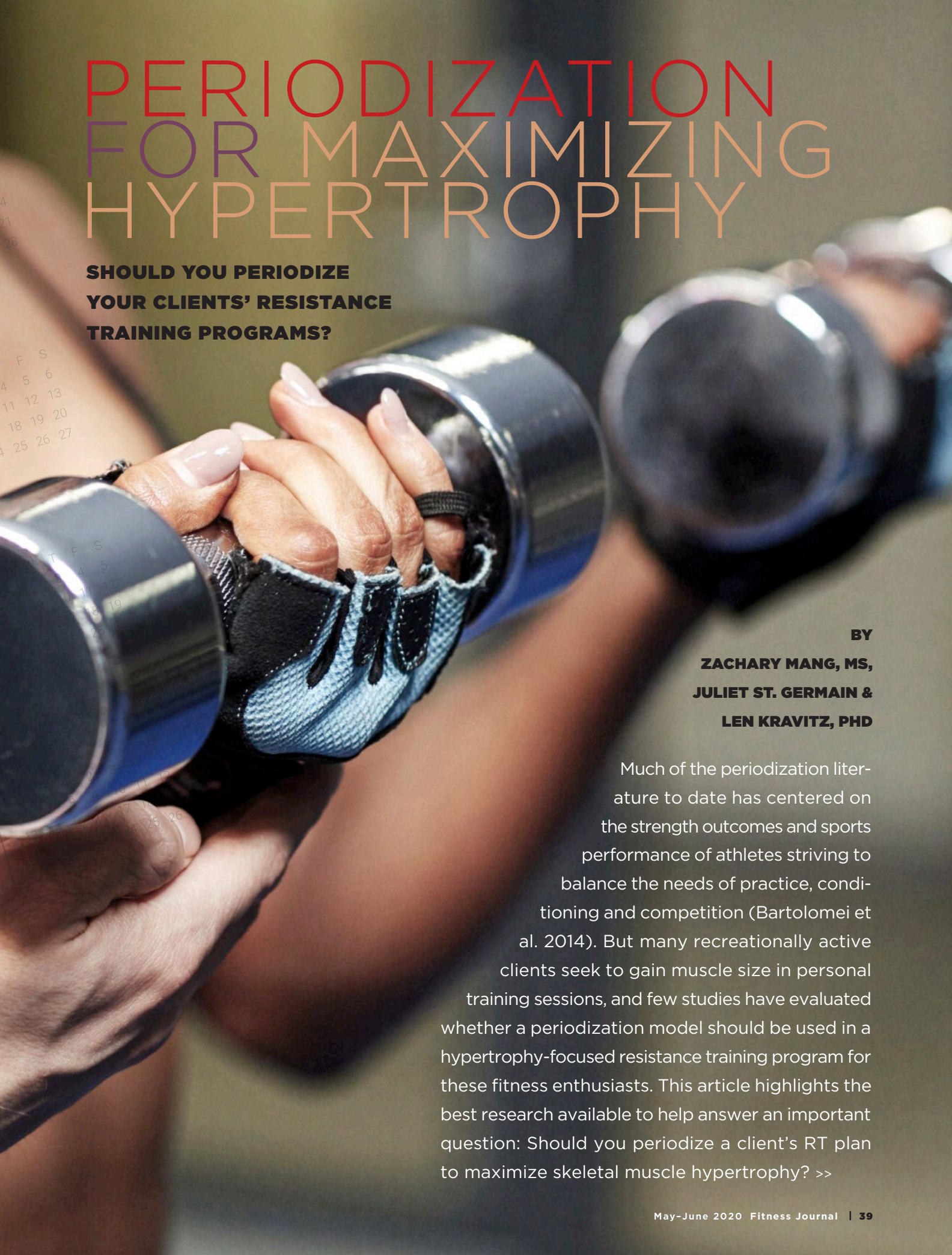
PERIODIZATION FOR MAXIMIZING HYPERTROPHY

SHOULD YOU PERIODIZE YOUR CLIENTS' RESISTANCE TRAINING PROGRAMS?



BY ZACHARY MANG, MS, JULIET ST. GERMAIN & LEN KRAVITZ, PHD

Much of the periodization literature to date has centered on the strength outcomes and sports performance of athletes striving to balance the needs of practice, conditioning and competition (Bartolomei et al. 2014). But many recreationally active clients seek to gain muscle size in personal training sessions, and few studies have evaluated whether a periodization model should be used in a hypertrophy-focused resistance training program for these fitness enthusiasts. This article highlights the best research available to help answer an important question: Should you periodize a client's RT plan to maximize skeletal muscle hypertrophy? >>

Helpful Strategies to Add Variety to a Resistance Training Program

Vary the intensity. Research has shown that incorporating a variety of training intensities, such as light (20- to 30-RM), moderate (8- to 12-RM) and high (2- to 4-RM), effectively elicits hypertrophy (Schoenfeld et al. 2016), empowering you to use a blend of loading zones to add variety and keep your clients engaged.

Change the volume. Evidence suggests that low-, moderate- and high-volume RT are all effective for muscle growth (Schoenfeld et al. 2019).

Use tapering and/or overreaching. For a stimulus change, you may want to periodically implement microcycles with "tapering" (brief, but meaningful reductions in volume and/or intensity) and/or "overreaching" (concise but significant increases in volume and/or intensity) (Turner 2011).

Change the frequency. Recently, researchers concluded that targeting each muscle group 2 days a week is an optimal plan for hypertrophy in trained individuals (Grgic, Schoenfeld & Latella 2018). However, increasing frequency to 3 days a week in a periodic cycle is a viable strategy for inciting a training overload for a client.

Try reciprocal supersets. With supersets, you select exercises that target agonist/antagonist (e.g., biceps and triceps) or opposite-action (e.g., horizontal flexors and horizontal extensors) muscle groups; your clients will perform the exercises in succession before taking a rest interval (Kelleher et al. 2010). Use this style of program to decrease training time and deliver a stronger metabolic stress stimulus. You can try several push/pull combinations, including bench press + seated row, push press + latissimus dorsi pulldown, and back squat + hamstring curl.

Perform drop sets. In this protocol, load is commonly reduced by 20%–25% with each drop set, allowing minimal rest before starting the next set. It's typical to employ 1–3 drop sets, taking 1–3 seconds on the concentric and eccentric actions (Schoenfeld & Grgic 2017).

SOME QUICK DEFINITIONS

Resistance training programs consist of numerous variables, including volume, intensity, frequency, rest intervals, exercise selection and exercise order (Williams et al. 2017). **Periodization** is defined as a planned, cyclical (i.e., the program repeats) manipulation of these RT variables to attain peak performance at specific times of the year (Evans 2019). Periodized RT plans comprise several cycles:

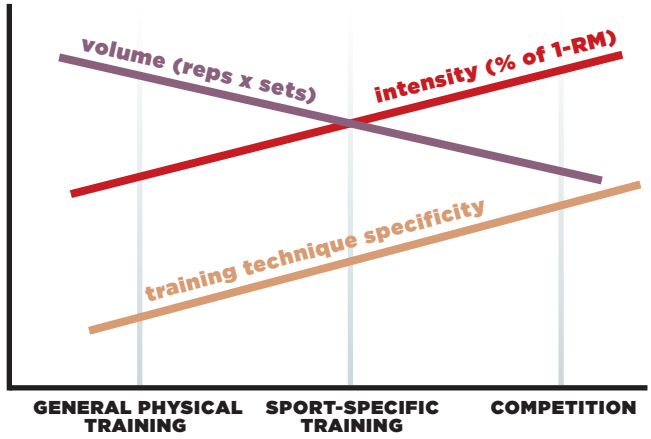
- a macrocycle (6–12 months);
- mesocycles (~1 month); and
- microcycles (~1 week) (Evans 2019; Issurin 2010).

The length of each training cycle in sports will vary, depending on the competition schedule and the athlete's goals. Evans cites research denoting that lengthy periods of training devoid of variation will result in stagnation and fatigue. Thus, a major purpose of periodization is to provide structured variability to combat a plateau or decline in physical performance.

TYPES OF PERIODIZATION

Researchers have focused their investigations primarily on three types of commonly employed periodization types: linear periodization, block periodization and undulating periodization:

FIGURE 1. Linear (Traditional) Periodization Model



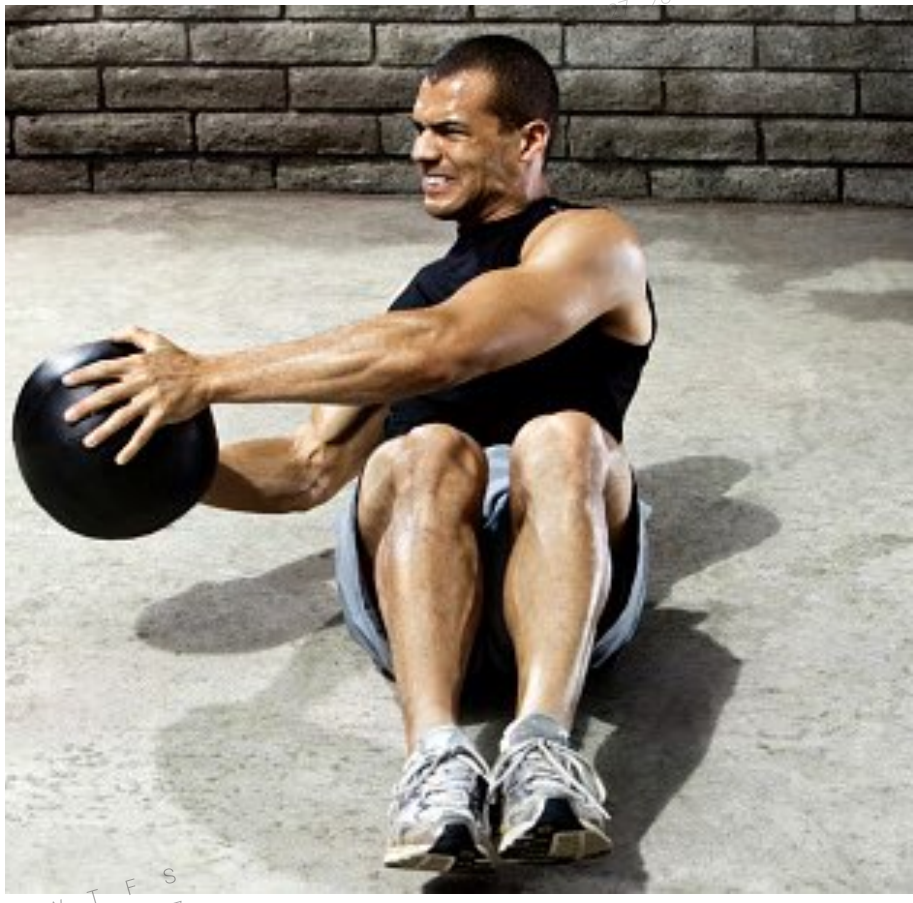
Note that with an increase in intensity there is a simultaneous decrease in exercise volume. Training technique specificity increases in parallel with training intensity.

SOURCE: TURNER 2011.

LINEAR PERIODIZATION

Linear periodization (LP) is a training strategy that starts with high volume and low intensity and then progresses to low volume and high intensity (Grgic et al. 2017). LP was introduced in the late 1950s by Russian professor Lev Matveev and is also referred to as traditional periodization (TP) in the literature (Kok, Hamer & Bishop 2009; Bartolomei et al. 2014). With LP, exercisers gradually increase the intensity of load as the program progresses while simultaneously decreasing the volume (see Figure 1).

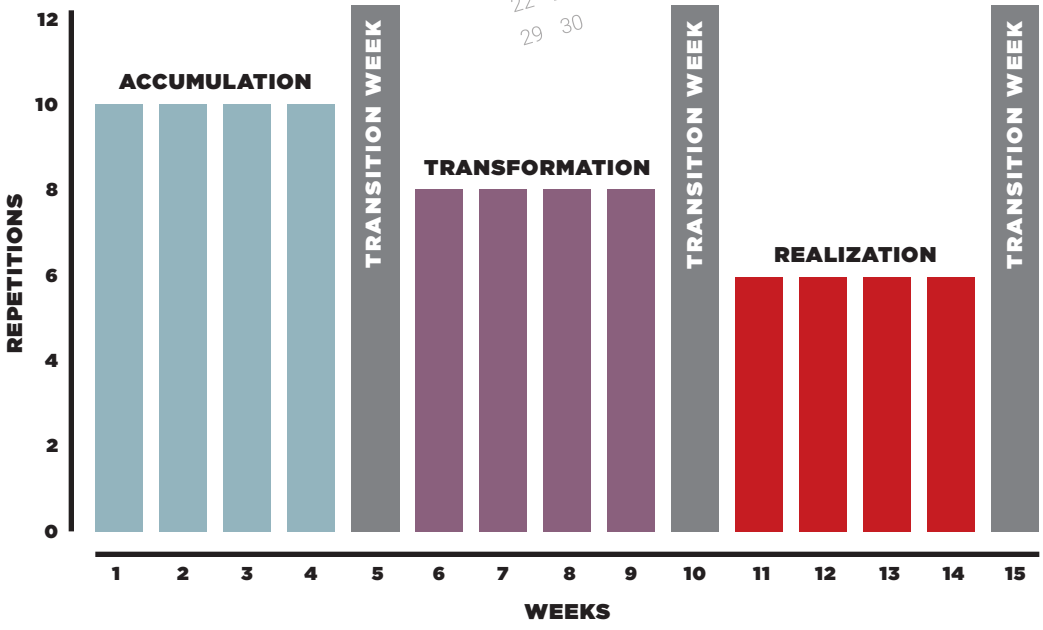
Theoretically, the initial high-volume phase emphasizes hypertrophic adaptations, and the later high-intensity period challenges the neural mechanisms in the body (Kok, Hamer & Bishop 2009). Note in Figure 1 how training technique specificity increases in parallel with training intensity in the LP model. Certainly, LP program designs vary among personal trainers, but it's common to make changes to volume and intensity every 4 weeks (Grgic et al. 2017).



BLOCK PERIODIZATION

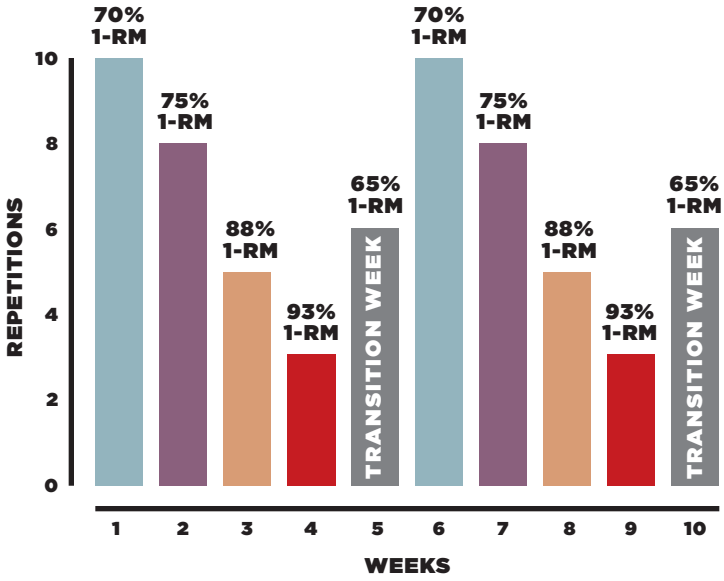
Block periodization (BP) is made up of several mesocycles, each with a concentrated training stimulus for a specific aspect of performance (Bartolomei et al. 2014) (see Figure 2). Each

FIGURE 2.
Block Periodization Model



This is a general-fitness block periodization model with 4-week blocks (created by the authors of this article). With this design, the goal is to increase the client's strength and muscle mass through a progressive increase in training intensity (and decrease in volume) every 4 weeks. Note that weeks 5, 10 and 15 are transition weeks of lighter-intensity exercise. Sets, exercise selection, exercise order and rest between sets would be individualized for each client.

FIGURE 3.
Weekly Undulating Periodization Model



Note that weeks 5 and 10 are transition weeks. Each intensity in this example is based on a percentage of the client's 1-repetition maximum (1-RM).

ADAPTED FROM BARTOLOMEI ET AL. 2015.

Undulating periodization (UP) involves frequent alterations of volume and intensity within a training program.

mesocycle—or block of time—prepares clients for the next cycle. For sport applications, mesocycles are arranged into three categories: accumulation, transformation and realization (Issurin 2010). The BP training methodology was introduced in the mid-1980s by Russian scientist Yuri Verchosanskij to meet the changing needs of athletes (Bartolomei et al. 2014).

Conventionally, the **accumulation** block focuses primarily on general aerobic endurance, basic muscle strength and foundational movement techniques (Issurin 2010). During the next **transformation** block, the athlete performs specialized muscle-conditioning exercises and practices sport-specific techniques (Issurin 2010). Last, the **realization** block is a pre-competition training phase focusing on attaining maximal speed and performance. Each block lasts 2–4 weeks, depending on the program duration and the client's specific goals (Issurin 2010).

UNDULATING PERIODIZATION

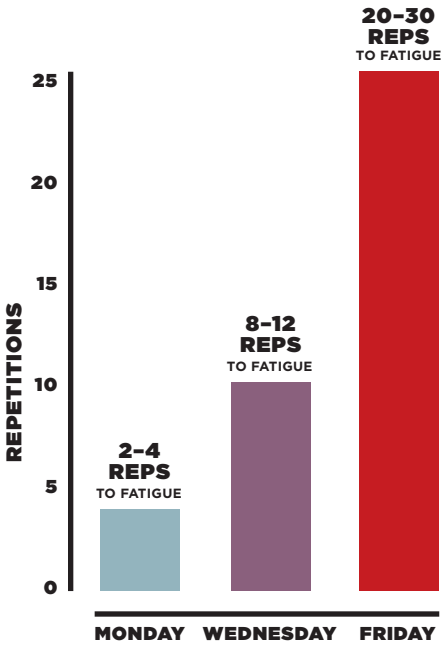
Undulating periodization (UP) involves frequent alterations of volume and intensity within a training program; these alterations often occur weekly (WUP) and/or daily (DUP) (Evans 2019) (see Figures 3 and 4 for daily and weekly undulating periodization models). During a WUP program, exercisers cycle through weeks of light-, moderate- and high-intensity training. During DUP, these intensities vary from day to day. Practically speaking, a client in a DUP program may do a hypertrophy workout, a strength workout and a power workout within 1 week.

Evans summarizes research indicating that UP programs are likely the best choice for developing strength in RT programs. McNamara & Stearne (2010) submit that undulating programs are also advantageous because the design helps to prevent overtraining and mental boredom while also being easily adaptable to a client's travel schedule. The frequent changes of volume and intensity in UP programs may induce larger neural adaptations, while concomitantly counteracting fatigue (Pelzer, Ullrich & Pfeiffer 2017). The term **undulating** refers to the "wave form" representation of intensities when graphed.

PERIODIZATION AND HYPERTROPHY: RESEARCH HIGHLIGHTS

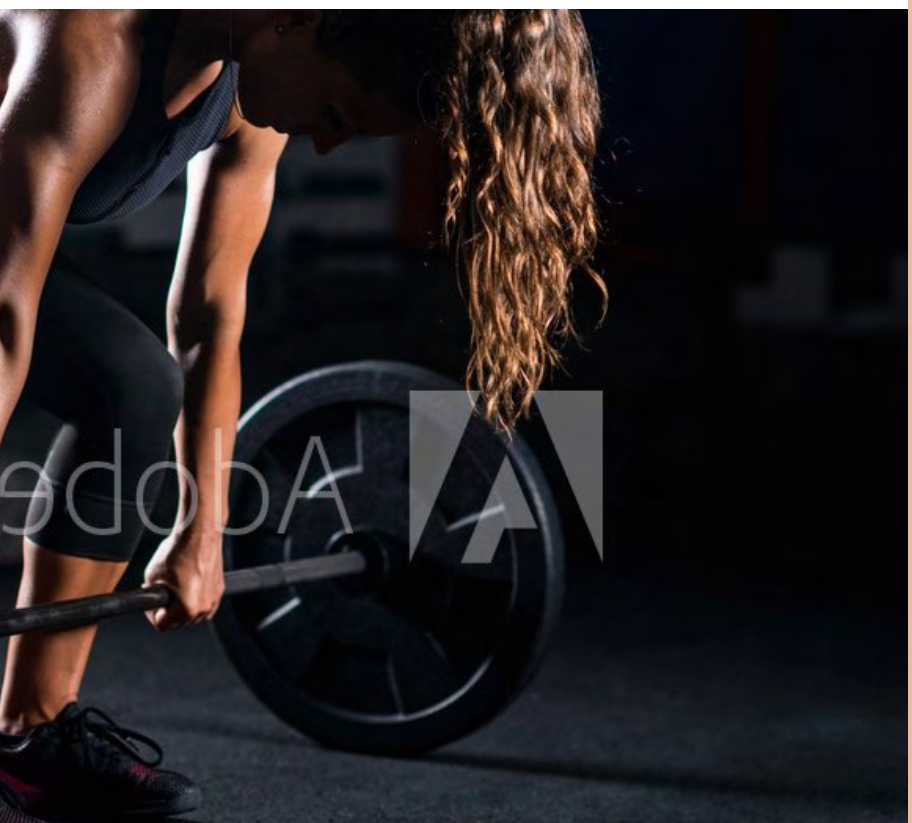
Two periodization studies over the past few years have targeted muscle hypertrophy as an outcome. One study focused on moderately resistance-trained women and the other on highly resistance-trained men. Here are reviews of both:

FIGURE 4. Daily Undulating Periodization Model



Note that each workout day has a different intensity. This pattern continues in subsequent weeks of training. The program follows a repetition-zone intensity design where participants do all exercises to momentary muscular fatigue for each specific repetition zone (2–4 reps, 8–12 reps, 20–30 reps).

ADAPTED FROM SCHOENFELD ET AL. 2016.



Unique Advantages of Periodized Resistance Training

1. Lifting within the same intensity zone over time may lead to stagnation in results (Turner 2011). A periodized program prevents stagnation by continually overloading the neuromuscular system with varying intensities.

2. Continual training with primarily heavy loads may lead to undue fatigue, overtraining and soft-tissue injury (Turner 2011; Williams et al. 2017). Periodized plans undulate through periods of low, moderate and high volume and intensity to prevent overtraining and performance decrements.

3. In accordance with the S.A.I.D principle (specific adaptations to imposed demands), periodized plans allow personal trainers and their clients to program for a variety of specific training outcomes.

4. Brand-new research demonstrates that low-intensity RT (30% of 1-RM) improves the quality and quantity of mitochondria (i.e., the ATP production organelles of cells) (Lim et al. 2019). Thus, intentionally including blocks of low intensity will also improve the aerobic capacity of skeletal muscle fibers.

5. Periodized programs easily allow personal trainers to program low-volume tapering and de-loading weeks to promote recovery and allow for neuromuscular adaptations (Turner 2011).

6. Periodization plans let personal trainers plan for phases of overreaching (brief microcycles in which volume and/or intensity are ramped up to deliver a strong stimulus for adaptation).

TABLE 1. Muscle Thickness Increases in Vastus Lateralis and Rectus Femoris

MUSCLE	TRADITIONAL PERIODIZATION	DAILY UNDULATING PERIODIZATION
proximal VL	19%	14%
mid VL	18%	17%
distal VL	21%	19%
RF	16%	11%

Researchers measured the vastus lateralis via ultrasound at 33% (proximal VL), 50% (mid VL) and 66% (distal VL) of thigh length, defined as the distance from the greater trochanter to the articular cleft of the knee joint. They performed ultrasound scanning of the rectus femoris about midway between the anterior superior iliac spine and the proximal superior border of the patella.

SOURCE: PELZER, ULLRICH & PFEIFFER 2017.

TABLE 2. Ultrasound Measurement Increases With Daily Undulating Periodization Versus Constant Load

MEASUREMENT SITE	DUP % INCREASE	CSLD % INCREASE
vastus laterals	+7.6%	+8.6%
biceps	+6.6%	+5.0%
triceps	+6.4%	+4.2%

SOURCE: SCHOENFELD ET AL. 2016.

MODERATELY RESISTANCE-TRAINED WOMEN

Pelzer, Ullrich & Pfeiffer (2017) conducted very interesting research with 19 female college-aged students, none of whom were competitive athletes. The women had moderate experience in resistance training (averaging approximately 28 months). Volunteers had each of their legs randomly assigned to one of two conditions: daily undulating periodization or traditional periodization (also called, remember, linear periodization). Participants acted as their own controls because both legs were exercised and yet each was assigned a different periodization model. All volunteers trained 3 days per week for 6 weeks, for a total of 18 sessions, and the only exercise used was a single-leg knee extension.

The DUP leg varied daily among 40%, 60% and 80% of one-repetition maximum, and the TP leg exercised for 2 weeks at each intensity, steadily increasing from 40% to 60% to 80% of 1-RM. Range of motion, volume and time under tension were identical between conditions. Participants completed all sets with one leg before switching to the other leg. There was a 2.5-minute rest between sets.

Ultrasound measurements revealed that both groups significantly increased their vastus

lateralis and rectus femoris thickness (see Table 1) from pre- to posttest. There was no statistically significant difference in muscle thickness between groups (though thickness was slightly greater with TP).

Based on this research, if personal trainers are squeezed for time and a client wants to see results quickly (e.g., in 4–6 weeks), DUP and TP are both viable options for delivering a strong hypertrophic stimulus in moderately trained women.

HIGHLY RESISTANCE-TRAINED MEN

Schoenfeld and associates (2016) divided highly resistance-trained college-aged males into two pair-matched groups based on their squat strength: a constant load (CSLD) group (*n* = 9) and a daily undulating periodization group (*n* = 10). The CSLD group performed moderate-intensity RT (8–12 repetitions) every time they lifted, while the DUP group performed heavy (2–4 reps), moderate (8–12 reps) and light (20–30 reps) RT on training days.

Both groups trained on 3 nonconsecutive days of the week for 8 weeks. All participants were encouraged to perform each set of exercises to the point of momentary failure, defined as an inability to complete the movement's concentric phase. Rest time between sets was 2 minutes. Seven total-body exercises were performed on each day of lifting: bench press, military press, latissimus pulldown, seated row, back squat, leg press and knee extension. Muscle thickness was measured via ultrasound for the biceps, triceps and vastus lateralis at baseline and after 8 weeks of RT (see Table 2).

Both groups significantly improved muscle thickness, and there was no statistical difference in results between the two protocols. When examining the statistical magnitude of pre- to posttest change, referred to as the **effect size,** the research team found that DUP produced a more substantial improvement than CSLD in the biceps and triceps. This suggests that the DUP magnitude of difference for the biceps and triceps is noteworthy. In summary, the study findings indicate that 8 weeks of either DUP or CSLD training can significantly improve muscular adaptations in trained young men.

OVERCOMING THE BIGGEST LIMITATION IN PERIODIZATION SCIENCE

The biggest limitation in the periodization science is the short length of studies. Fortunately, there is a 9-month study conducted by Kraemer and associates (2003) for us to review. The researchers divided 30 female collegiate tennis players into three groups: daily undulating periodization, constant load training and a control group (CON). Subjects assigned to DUP and CSLD performed total-body RT 3 days a week for 36 weeks, for a total of 108 sessions, while the CON group did not participate in any RT. With volume (sets × reps) equated, the DUP group rotated through three loading zones (4–6 reps, 8–10 reps and 12–15 reps), while the CSLD group performed RT at the same loading zone (8–10 reps) for the entire study. Of note, for both experimental groups, when a participant was capable of performing the required number of repetitions for three consecutive sets of a particular exercise, the training load was increased in increments of about 2–13 kilograms.

Compared with control participants, the two RT groups significantly increased their muscle mass (i.e., fat-free mass) (DUP = +7.1%; CSLD = +3.5%) and decreased their body fat (DUP = -16.6%; CSLD = -8.9%); more favorable results occurred in the DUP group, though there was no statistical difference between DUP and CSLD. To

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Three Periodization Plans

Do you have a relatively new, untrained client who wants to perform total-body resistance training? Here are three periodized training plans adapted from the research cited within this article. Select seven or eight exercises that target all major muscle groups and train on 2 nonconsecutive days (e.g., Monday and Thursday). Over time, go up to 3 training days (e.g., Monday/Wednesday/Friday), increasing frequency and volume concurrently by repeating the Day 1 or Day 2 workout on a nonconsecutive day.

LINEAR PERIODIZATION

Volume decreases, and intensity increases. Changes are made every 4 weeks.

TRAINING OUTCOME	TOTAL BODY: DAY 1	TOTAL BODY: DAY 2
endurance: weeks 1–4	2 sets × 15–20 reps	2 sets × 15–20 reps
hypertrophy: weeks 5–8	3 sets × 8–12 reps	3 sets × 8–12 reps
strength: weeks 9–12	4 sets × 4–6 reps	4 sets × 4–6 reps

WEEKLY UNDULATED PERIODIZATION

olume and intensity vary from week to week.

TRAINING OUTCOME	TOTAL BODY: DAY 1	TOTAL BODY: DAY 2
endurance: weeks 1, 4, 7, 10	2 sets × 15–20 reps	2 sets × 15–20 reps
hypertrophy: weeks 2, 5, 8, 11	3 sets × 8–12 reps	3 sets × 8–12 reps
strength: weeks 3, 6, 9, 12	4 sets × 4–6 reps	4 sets × 4–6 reps

BLOCK PERIODIZATION

Each block has a specific training outcome. Intensity increases over time.

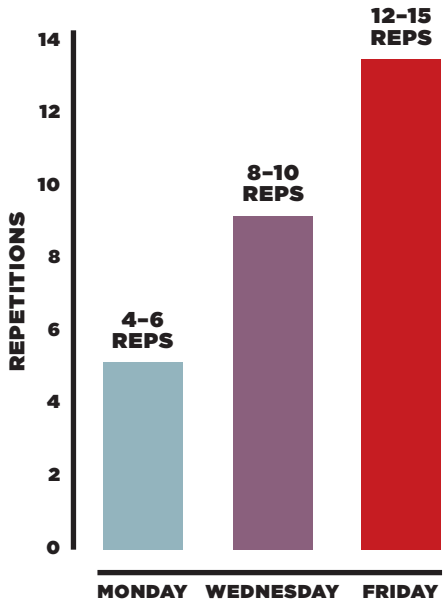
BLOCKS	TOTAL BODY: DAY 1	TOTAL BODY: DAY 2
accumulation: 5 weeks	3–4 sets × 8–12 reps	2–3 sets × 8–12 reps
transformation: 5 weeks	4–5 sets × 4–6 reps	3–4 sets × 4–6 reps
realization: 2 weeks	5–6 sets × 1–3 reps	4–5 sets × 1–3 reps

ensure long-term (e.g., 9- to 12-month) muscle adaptations, personal trainers are encouraged to periodize times of light, moderate and heavy lifting (see Figure 5) in their female clients' training plans, as the DUP program in this study showed distinctively impressive results in many physiological parameters. DUP may also promote recovery between workouts, target multiple energy systems and limit the psychological burnout associated with performing the same routine every day.

INTRODUCING FLEXIBLE PERIODIZATION: A NEW PERIODIZATION APPROACH

As every personal trainer knows, life brings unexpected twists that can cause clients undue stress, potentially interfering with their ability to perform at their optimal level. Smaller setbacks can be disruptive, too: A poor night of sleep, less than formidable pre-exercise nutrition or one skipped meal may leave a client feeling fatigued and unmotivated, even before the training session begins. In these situations, it may be best to modify the workout of the day to accommodate your client's energy level and

FIGURE 5.
Daily Undulating Periodization Model With Women Tennis Players



ADAPTED FROM KRAEMER ET AL. 2003.

mood. You can do this by employing flexible undulating periodization.

Flexible undulating periodization (FUP) is a transient strategy for adapting a periodization program to a client's immediate health, nutrition or energy-level circumstance. In a 12-week training study by McNamara and Stearne (2010), researchers randomly assigned 16 untrained resistance participants (ages 18–23; males, *n* = 12; females, *n* = 4) to a FUP resistance training group (*n* = 8) or an undulating periodization training group. Twice-weekly 30-minute workouts combined free-weight and machine exercises. Both groups completed the same training volume using three intensity loads: 10-RM, 15-RM and 20-RM. However, the FUP group was given the freedom to choose which days they would perform the 10-RM, 15-RM and 20-RM loads of the various upper-body and lower-body exercises. Researchers took pre- and posttest measurements for the chest press, leg press and standing long jump.

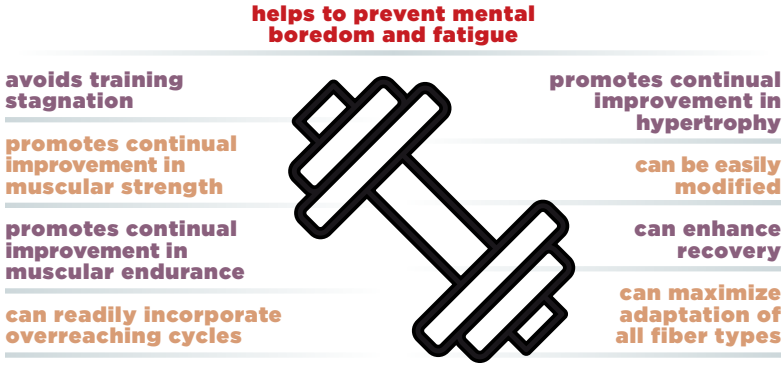
Compared with the volume-matched undulating group, FUP participants showed similar improvements in the chest press and standing long jump. In the leg press, however, FUP participants saw a much greater strength increase (+62 kilograms) than the UP group (+16 kg).

McNamara and Stearne submit that flexible undulating periodization is a highly personalized program that adjusts workload to correspond with a client's workout energy level or demeanor. Fitness professionals can easily employ FUP by simply assessing the present state of their client immediately before the training session and adjusting the workout accordingly. Ultimately, a FUP approach accounts for a client's daily fluctuations in fatigue and psychological readiness. Logically, FUP may also increase exercise adherence by providing the client with autonomy and the freedom to direct training sessions based on his or her physiological status and/or mental demeanor.

CONCLUSION

Periodized resistance training delivers many essential physiological and mental health benefits (see Figure 6). Several studies indicate that linear periodization, undulating periodization and block periodization are all effective for attaining hypertrophy goals. You may want to consider employing each of these periodization types (as well as flexible undulating periodization) during the year to provide variety for your clients. Importantly, whichever periodization model you choose, the research provides a steadfast finding that optimal muscle and neural adaptations over the long run occur when the physiological training stress changes regularly. So be creative and, yes, definitely periodize!

FIGURE 6.
Key Physiological and Mental Benefits of Periodization Training



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Len Kravitz, PhD, CSCS, is the program coordinator of exercise science at the University of New Mexico, where he has received the Outstanding Teacher of the Year and Presidential Award of Distinction. His third book is HIIT Your Limit *(Amazon 2018).*

References available on ideafit.com.

Fitness professionals can easily employ FUP by simply assessing the present state of their client immediately before the training session and adjusting the workout accordingly.

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