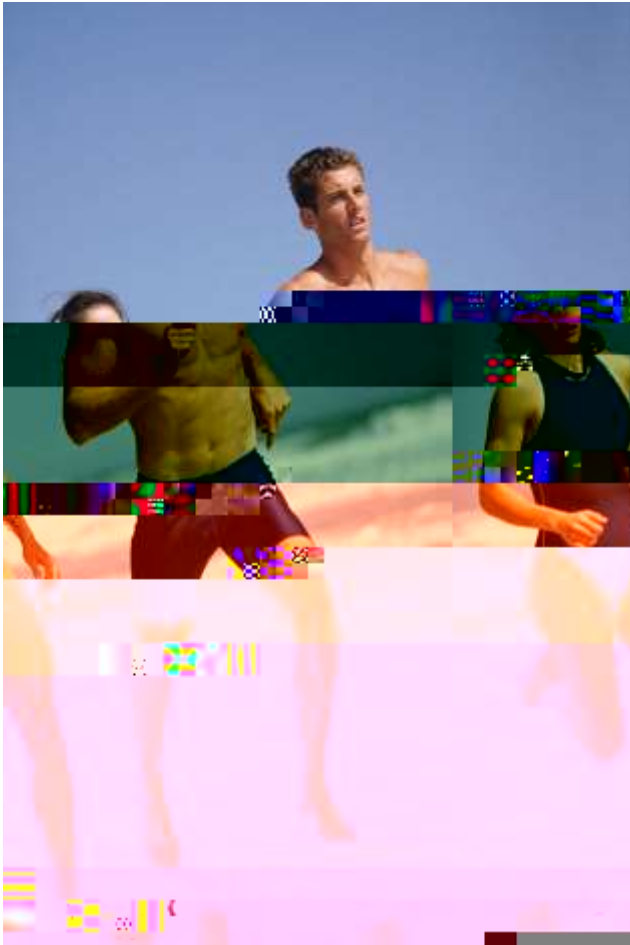


High Intensity Interval Training



Why You MUST Use Intervals

- Interval Training increases total WORK performed at higher intensity resulting in:
 - Faster improvement in VO2 Max
 - Greater adaptation of Type II Muscle Fibers
 - Increased Lactate & Ventilatory Thresholds
 - Increased Weight Loss



High Intensity Intervals

- Tabata (1996)
 - 6 weeks Training Study
 - Continuous: 5 days/wk; 70% VO_2 ; 60 min.
 - H.I.I.T. 4 days/wk; 20 sec. work (170% VO_2 max), 10 sec. rest; 7-8 sets; 1 day/wk-70% VO_2 ; 30 min.
- H.I.I.T.
 - VO_2 7ml/kg/min and Anaerobic Performance 28%
 - Continuous VO_2 5ml/kg/min Anaerobic 0%

Intervals Increase Weight Loss By:



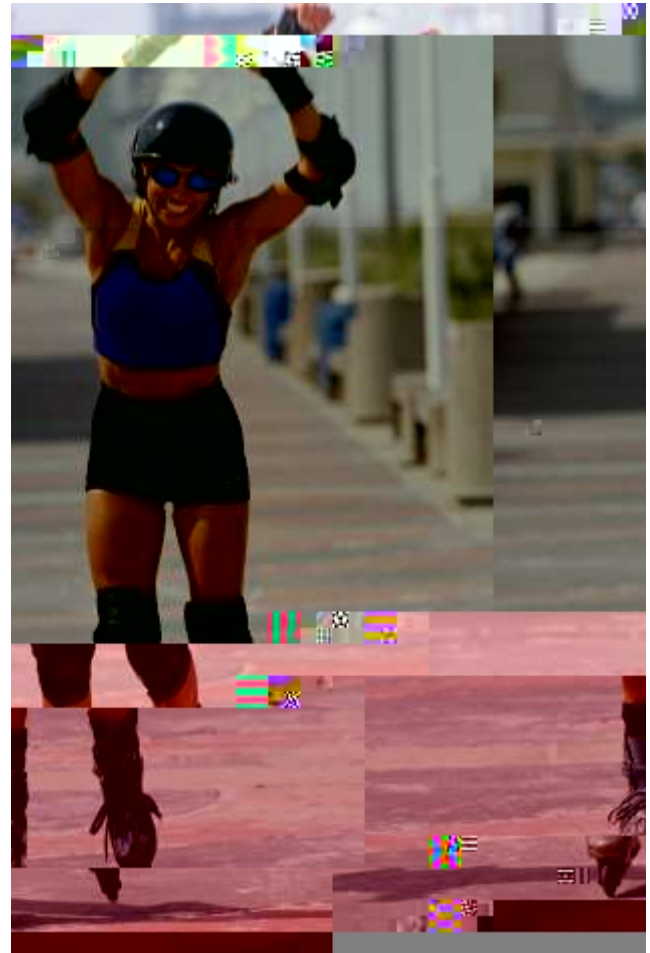
- Increases Total Calorie Expenditure During the Workout
- Increases Fat Utilization both During and After Exercise
- Increases Excess Post-Exercise Oxygen Consumption (E.P.O.C.) – The Afterburn

What is E.P.O.C.?

- O₂ Consumption Necessary to Return to the Pre-Exercise Physiological Resting State
 - Replacing oxygen stores,
 - Phosphagen (ATP-PC) resynthesis,
 - Lactate removal, and
 - The increased ventilation, blood circulation and body temperature above pre-exercise levels

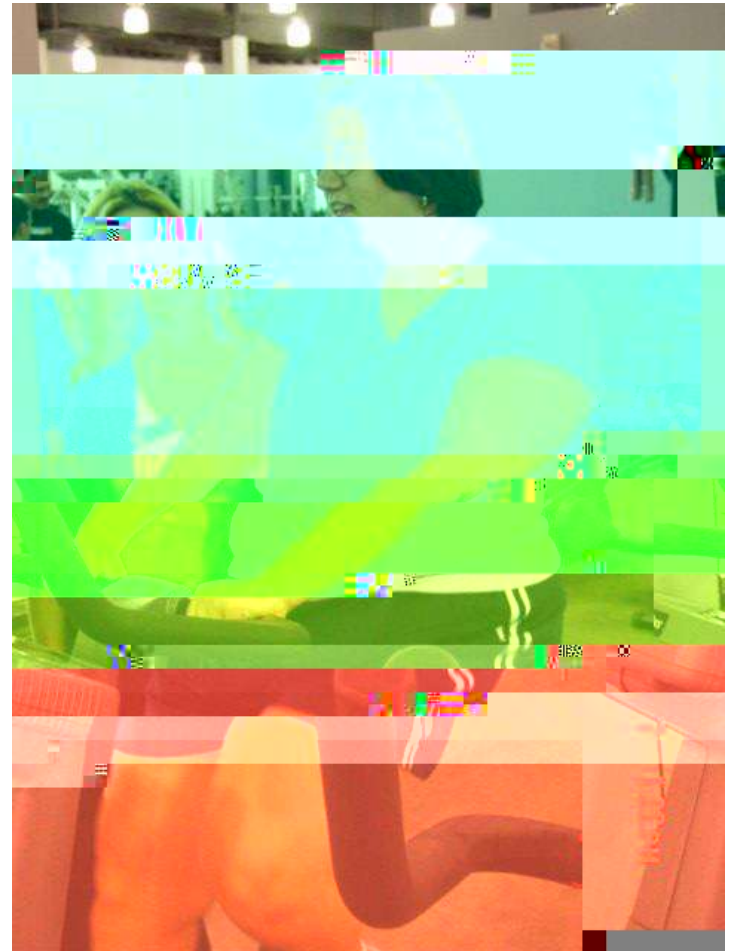
Expend More Calories at REST

- Studies have shown increases of additional 10-160 kcals over the course of 24 hours



Enhancing EPOC

- Studies show that EPOC is dependent on both the intensity and duration of exercise
 - Bahr and Sejersted (1991)
 - Smith and McNaughton (1993)
 - Phelian et al. (1997)



Impact of Training Status & Gender

- Gender

- Smith and McNaughton (1993)

- 30 minutes at 70% VO₂Max

- Men – 141 kcal; Women – 122 kcal

- Increased Lipoprotein Lipase (LPL) activity 386.5 Th₂(se)

DESIGNING INTERVAL PROGRAMS

- Training Variables
 - Work
 - Rest/Recovery
 - Cycles/Repetitions
 - Sets



WORK

- Exercise performed at a higher intensity
- Time & Intensity factors
 - Client's goals, motivation, fitness level, health, and energy system you want to challenge (sport-specific)
- The higher the intensity the shorter the work interval

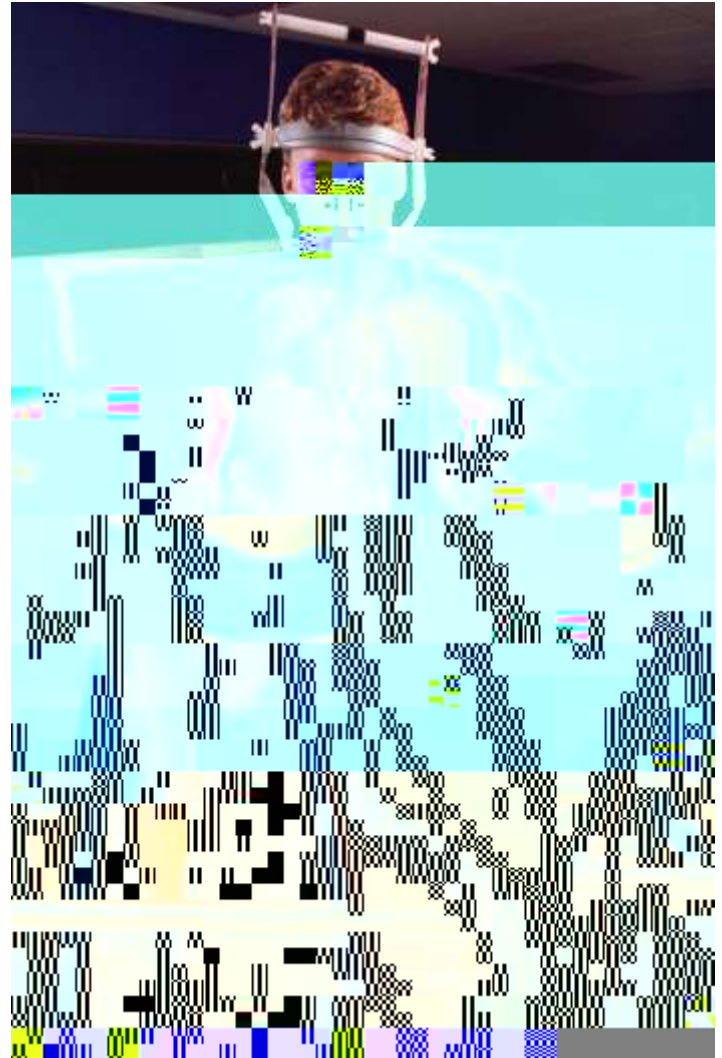


REST/RECOVERY

- Lower intensity
-

CYCLES/REPETITIONS

- Refers to a complete work/rest interval
- Similar to a repetition in weight training
- Can be repeated 1-20 times



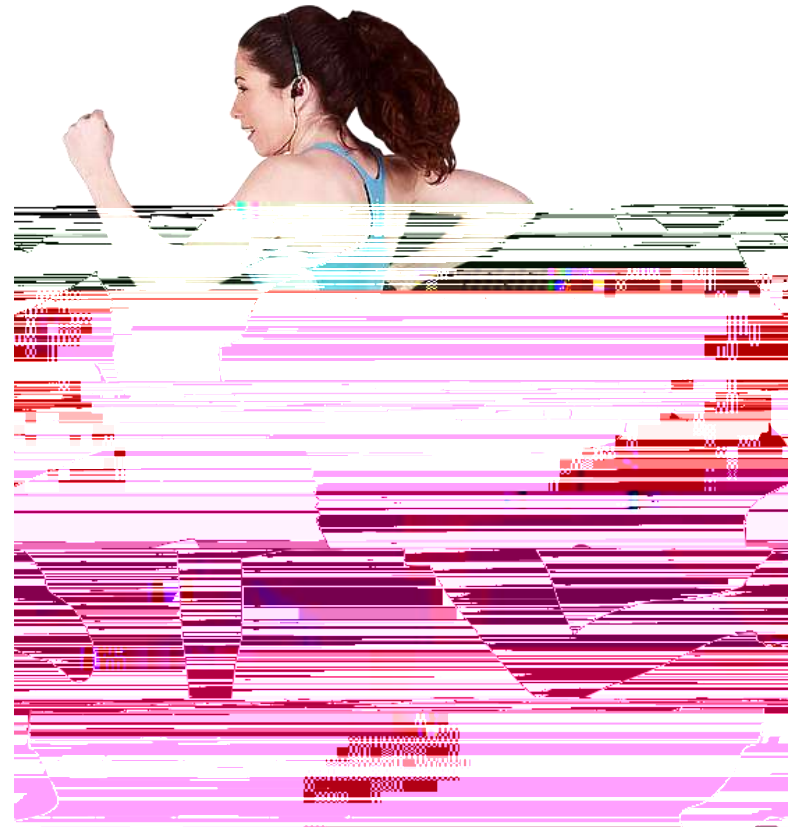
SETS



- The number of times a series of cycles will be performed in a given exercise session
- A longer rest period is given between sets

Programming Intervals Based on Energy Demands

- Phosphagen System
- Glycogen System
- Aerobic System



Phosphagen System

Substrate	Stored ATP/CP
Duration	< 30 sec.
Intensity	95% - 100% Max
Examples	100 meter sprint; power lifting
Evaluation	Vertical Jump

Glycogen/Lactic Acid System

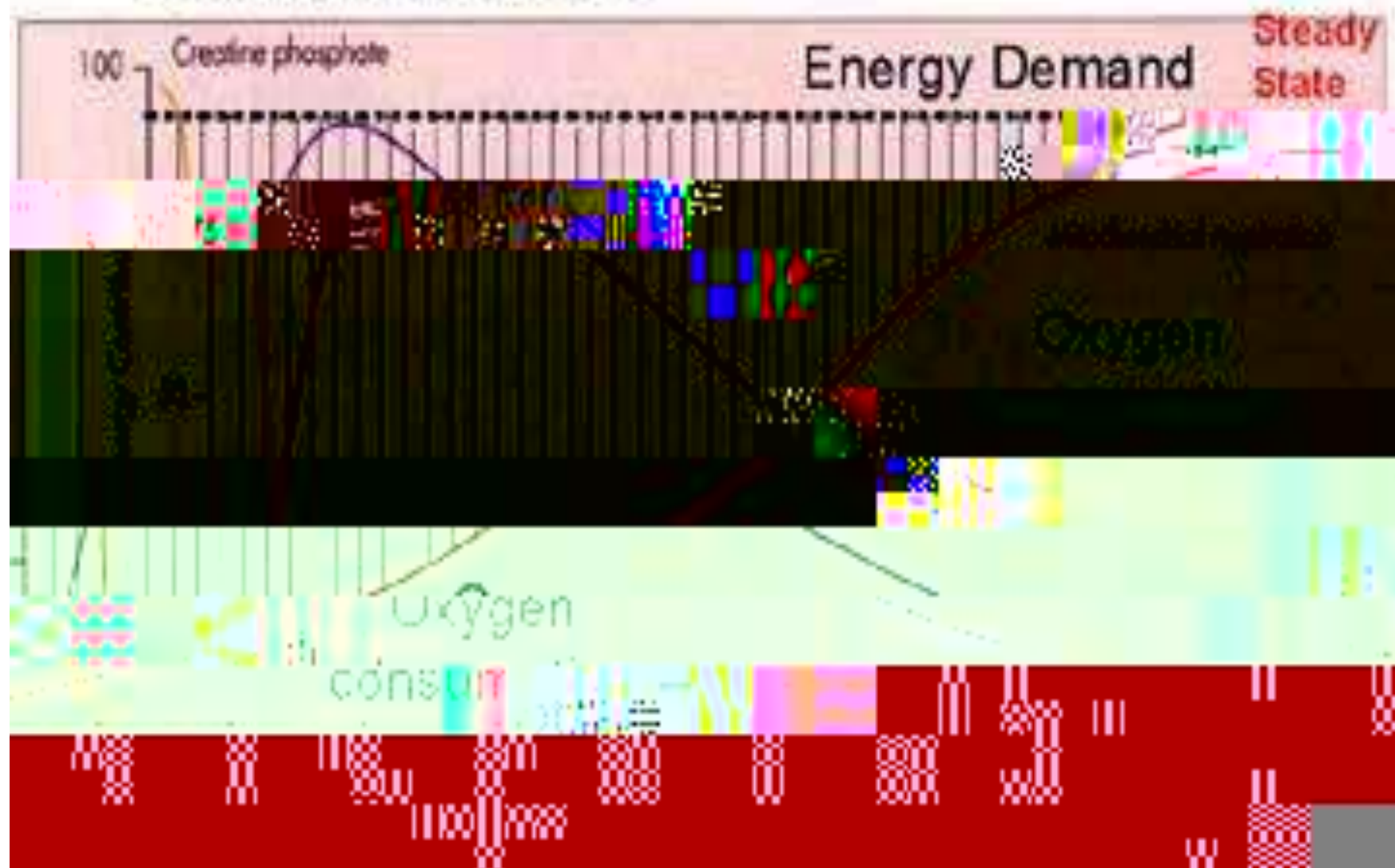
Substrate	Glucose, glycogen
Duration	30 sec. –3 min.
Intensity	85% - 95% Max
Examples	400-800 meter run
Evaluation	300-Yard Shuttle Run

Aerobic System

Substrate	Glucose, glycogen, fatty acids, amino acids
Duration	> 3 min.
Intensity	< 85% Max
Examples	>1500 m run, > 3000 m cycling
Evaluation	1.5 Mile Run

System	Work	Rest/Type	Reps	Sets
ATP/PC (Strength & Power)	0-30 sec	0-90 sec Passive	8-10	4-5
Glycogen (Speed)	30-60 sec	90-180 sec Active/Passive	5	3-4
	60-120 sec	120-240 sec Active	5	2-3
Aerobic (endurance)	2-3 min	2-6 min/Active	4-6	1-2
	3-5 min	1 ½ -5 min. Active/Passive	3-6	1

Start of exercise



Thresholds in Interval Training

- Anaerobic Threshold
- Lactate Threshold
- Ventilatory Threshold



Anaerobic vs. Lactate Threshold

- Anaerobic Threshold
 - point at which energy demand shifts from aerobic to anaerobic
- Lactate Threshold
 - The intensity of exercise at which there is an abrupt increase in blood lactate levels
 - 80-90% HRR in trained individuals
 - 50-60% HRR in untrained individuals
 - 13 to 15 on the RPE scale
 - ‘somewhat hard’ and ‘hard’

Ventilatory Threshold



- The point where ventilation deviates from the progressive linear increase
- Breathing becomes labored beyond the Ventilatory Threshold

Psychology of Interval Training

- Interval Training creates significant distress especially for untrained individuals
 - Excessive Lactate and H⁺ Accumulation
 - Respiratory Difficulty
 - Core Temp increases triggering cooling mechanisms (i.e. sweating)
- Intensity and Duration selection must meet the psychological preparedness of the individual

Heart Rate Zone Training

- Zone 1: 50-60%:
 - Heart Healthy
- Zone 2: 60-70%:
 - Fitness or Fat Burning
- Zone 3: 70-80%
 - Aerobic or Endurance
- Zone 4: 80-90%
 - Anaerobic or Performance
- Zone 5: 90-100%
 - Red Line or Maximum Effort

Example

50 year old female; RHR: 66

- Max HR:
 - $220 - 50 = 170$
 - $170 * \text{Zone 2} = 102-119$
- Max HR 40+:
 - $207 - (50 * .7) = 172$
 - $172 * \text{Zone 2}$
 - $60\% = 104$
 - $70\% = 121$
- HRR:
 - $170 - 66 = 104$
 - $104 * \text{Zone 2} = 62.4/72.8$
 - $62.4 + 66 = 128$
 - $72.8 + 66 = 139$

Perceived Exertion

- Borg's Rating of Perceived Exertion or RPE Scale
 - 6 to 20
- Common Perceived Exertion
 - 0.5 to 10



Beginner Interval Program

- By Perceived Exertion

- 5-7 min. warm-up
- 5 min. run
- 5 min. walk
- Repeat 3x's
- 5-7 min. cool-down

- By Heart Rate Zone

- 5-7 min. warm-up
- 1 min. Zone 3
- 2 min. Zone 2
- Repeat 5x's
- 5-7 min. cool-down

Sample Treadmill Program

<i>week</i>	<i>work</i>	<i>rest</i>	<i>cycles</i>
1-2	3 mph; 1 min	2.5 mph; 3 min	10
3-4	3 mph; 90 sec	2.5 mph; 2 ½ min	10
5-6	3 mph; 2 min	2.5 mph; 2 min	10
7-8	3.0 mph; 2 ½ min	2.5 mph; 90 sec	10
9-10	3 mph; 3 min	2.5 mph; 1 min	10
11-12	3 mph; 3 ½ min	2.5 mph; 30 sec	10

Intermediate Interval Program

- By Heart Rate Zone
 - 5-7 min. warm-up
 - 2 min. Zone 4
 - 3 min. Zone 2
 - Repeat 5x's
 - 5-7 min. cool-down
- By Perceived Exertion
 - 5 min. warm-up
 - 10 min. run
 - 5 min. walk
 - Repeat 2x's
 - 5 min. cool-down

Treadmill Intervals

- Incline Training
 - Recovery
 - Comfortable Speed 3 min.; 0 % grade
 - Work Interval
 - Same Speed
 - 2% grade for 1 minute
 - 4% grade for 1 minute
 - 6% grade for 1 minute
- Speed Training
 - Recovery
 - Comfortable Speed 3 min.; 0 % grade
 - Work Interval
 - Same Grade
 - speed 1/2 mph 1 min
 - speed 1/2 mph 1 min
 - speed 1/2 mph 1 min

Intermediate/Advanced Intervals

-

Programming Advice

- Novice athletes/clients should train mostly EASY
- For intermediate to advanced athletes/clients
 - 2-3 times per week
 - <8-10% of total weekly mileage OR exercise time
 - Cut back Intervals during competitive season
 - Adjust interval pace for factors such as heat, humidity, altitude, headwinds, pollen count, etc.
 - Allow for 48 hours rest between interval sessions

Cardio Interval Variations

- Pyramids/Ladders
 - Systematically increasing the time or distance of the work and rest intervals
- Mixed Intervals
 - Varying the time or distance with each subsequent work/rest interval
- Pick-Ups
 - Increase speed for 10-30 seconds at regular or irregular intervals

Example: Pyramids or Ladders

Zone	Distance	Rest	Time	Rest
5	200 M	200 M	30 s	30 s
5	400 M	400 M	90 s	90 s
5	800 M	400 M	3 min	90 s
4	1200 M	600 M	6 min	3 min
4	1600 M	800 M	8 min	4 min

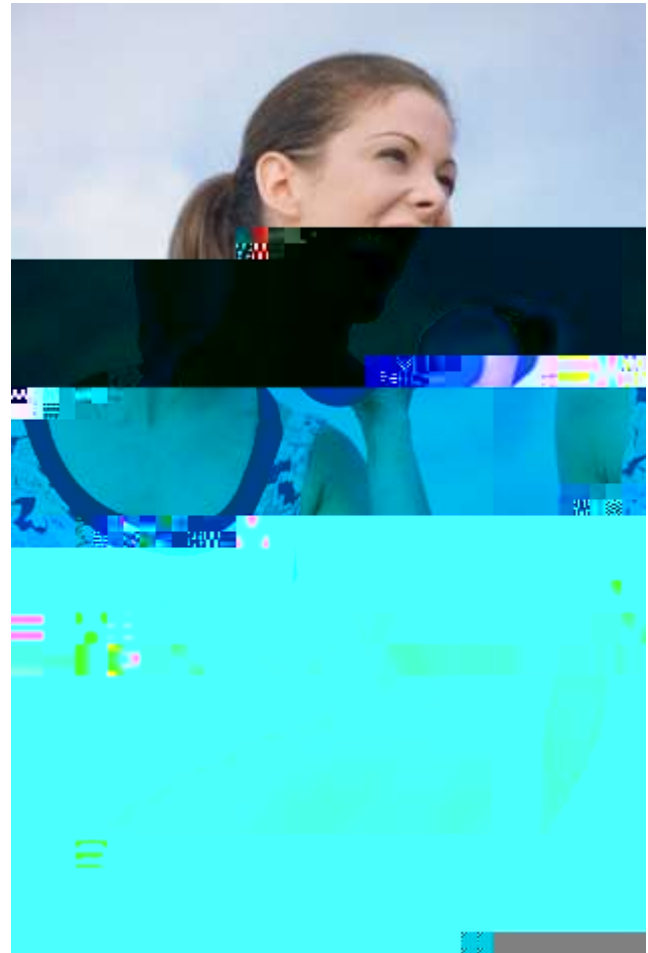
- Repeat in Descending Order
- Every 400 M = $\frac{1}{4}$ mile

Example: Mixed Intervals

Zone	Distance	Rest	Time	Rest
5	800 M	300 M	3 min	60 s
5	300 M	200 M	60 s	40 s
4	1200 M	400 M	6 min	2.5 min
5	600 M	200 M	2.5 min	40 s min
4	1600M	600M	8 min	2.5 min

Go With the Flow

- Fartlek training
 - Work/Rest Interval durations and intensity are dependent on subjective monitoring of intensity
 - Work as hard as you feel motivated to
 - Rest as long as you need to



Suggested Race Training Intervals

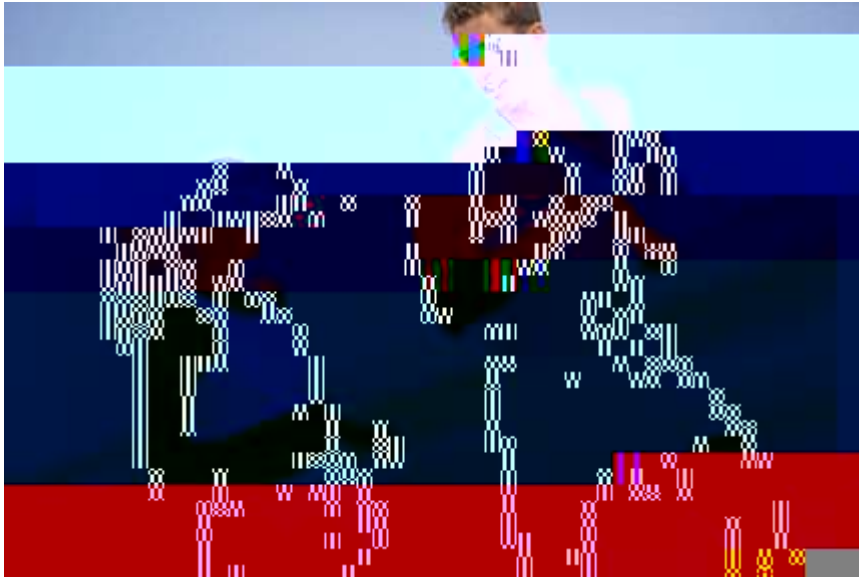
Race Distance	Interval Distance
5K	200-800M
10K	400-1200M
½ Marathon	400-2000M
Marathon	800-3200M

Sprint/Metabolic Intervals

- Total Workout Time: <40 minutes
 - Warm-up 5-7 minutes
 - Work Interval:
 - Sprint 30 sec (95%+; Run/Cycle for your life!)
 - Recovery Interval:
 -

Sprint Intervals

Example: Sprinter/Track Program



- Sprint Intervals:
 - Set 1-4 x 220 yds
 - Set 2-8 x 110 yds
 - Set 3-8 x 110 yds
- Accelerations:
 - Jog 50-120 yds
 - Sprint 50-120 yds
 - Walk 50-120 yds

Group Fitness Intervals

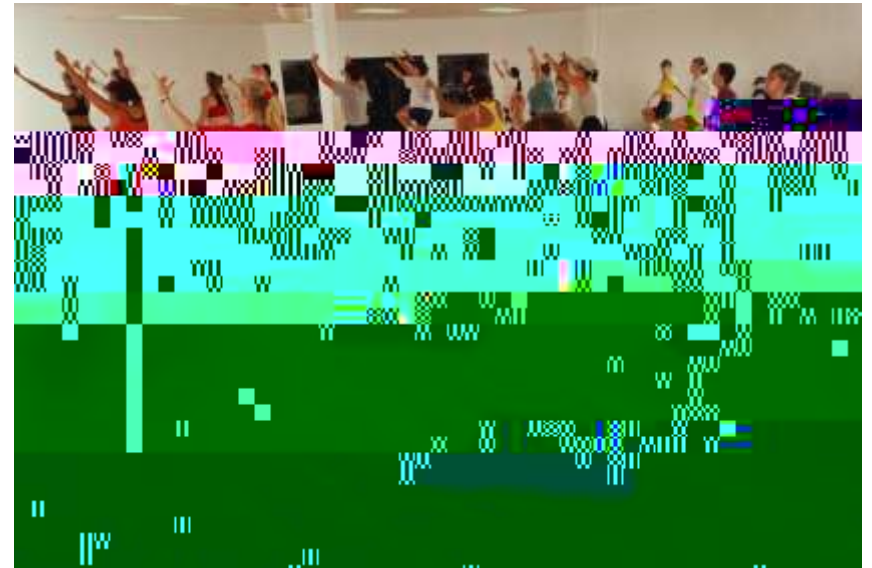
- Adding Intensity

Increase
movement speed

Add traveling
moves

Increase ROM, use
longer levers

Add propulsions



GROUP FIT: AEROBIC INTERVAL

Type	Intensity % HRR	Time
Work-high/low Aerobics/step	> 75% RPE 14 – 16	3 –

Time

GROUP FIT: ANAEROBIC INTERVAL

Type	Intensity % HRR	Time
Work-power step/aerobics	> 80% RPE 14 – 18	60 – 90 sec.
Rest- aerobic/step	60 – 70% RPE 12 - 13	3 minute

DON'T MAKE THIS MISTAKE!



- Some instructors and participants may be accustomed to or mistakenly desire continuously high work intensities
- Incomplete or inadequate rest limits the peak intensity of the subsequent intervals

GROUP TRAINING CIRCUIT

<u>Station 1</u> Lateral Hops Over Step	<u>Station 2</u> Push Ups	<u>Station 3</u> Band Squats
<u>Station 4</u> Leg Raises	<u>Station 5</u> Rope Jumping	<u>Station 6</u> Inverted Pull-Ups or Alternating DB Rows
<u>Station 7</u>		

Resistance Training Intervals

- Tabata Method
 - Barbell or Dumbbell Squats
 - Using 25-40% of 1RM
 - 8 reps followed by 10 sec rest
 - Repeat for 4 minutes
 - STOP Workout!!!
- Not for the weak of heart OR mind
- DO NOT attempt with heavier resistance

Hybrid Intervals/Complexes

- Complex 1
 - Kettlebell Swings
 - Squat-Thrust w/ Max Push-Ups
 - Sprint 50 yards
- Complex 2
 - Squat Jumps
 - Max Pull-Ups
 - Jog 400 m

