






## Training for Peak Performance


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## Overtraining, Tapering, Recovery


- overtraining vs overreaching
  - definitions, symptoms
- tapering, peaking
  - strategies, outcomes
- Enhancing recovery
  - Practical applications






## The 8 S's... now 10.....

- SKILL
- SPEED
- STAMINA
- STRENGTH
- SUPPLENESS
- 'SYCH (Psychology)
- STRUCTURE (Anthropometrics)
- SUSTENANCE (Nutrition & Regeneration)
- SCHOOLING (Education)
- SOCIO-CULTURAL (Dynamics)



After Balyi, Smith, & Norris....

## GLOBAL ATHLETIC PERFORMANCE

Optimal ←————→ Under-performance

Competition Sequencing

PHYSIOLOGY

BIOMECHANICS

Overtrained / Under - rested

PSYCHOLOGY

TACTICS

Optimal / Under - performance



HEALTH LIFESTYLE

Optimal / Poor

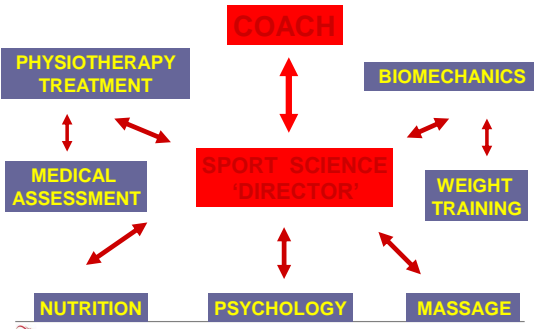
SEQUENCE OF TRAINING ( Macro, Meso, Micro )

Overtrained / Under - rested      Optimal / Under - performance      Overtrained / Under - rested      Optimal / Poor      Optimal / Illness



Smith & Norris, 2000

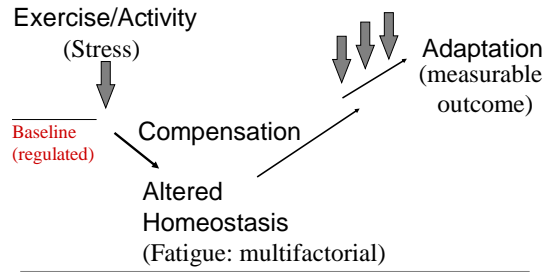
### INTEGRATED SUPPORT TEAM





Smith & Norris, 2000





## Stress-Adaptation (one factor theory of super-compensation)



### A Balancing Act



**Eustress:**  
Synthesis/  
Regeneration

**Distress:**  
Degradation/  
Inflammation

**STRESS** is a balance of **OVERLOAD** (stimulates turnover) and **RECOVERY** (allows remodeling)

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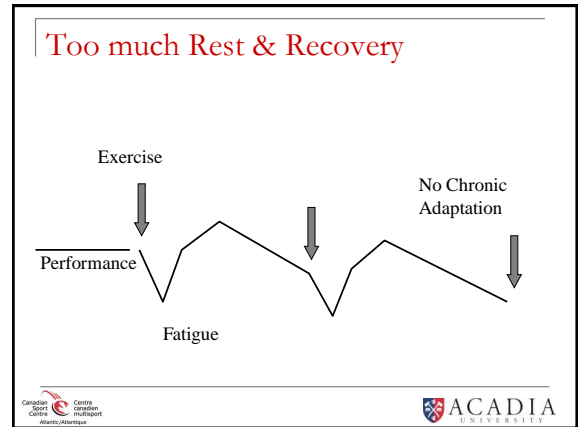
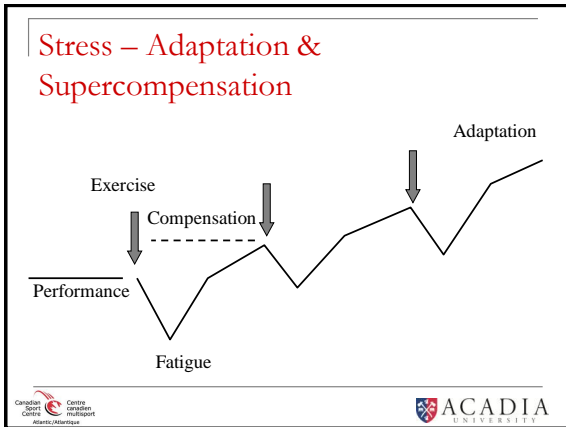
### Overtraining

Defn: (Fry & Kraemer, 1997)  
Any increase in volume and/or intensity of training resulting in **LONG-TERM** performance decrements

- **Overreaching:** a period of intensified training resulting in **SHORT-TERM** decrements
  - lack of proper R & R -> overtraining

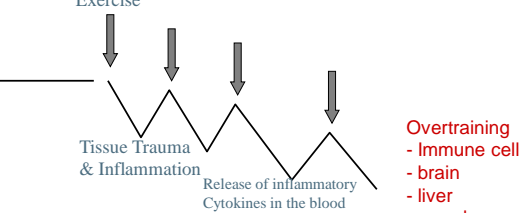
**Equation** (Kentta & Hassmen 1997)  
 $\frac{\text{Magnitude of total STRESS}}{\text{total recovery}}$   
Overall capacity for STRESS

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### Cytokine Theory overtraining

Smith LL (MSSE, 2000; Sports Med, 2003; JSCR, 2004)



The graph shows a line representing performance. It starts at a baseline, then drops sharply after an 'Exercise' arrow, reaching a point labeled 'Tissue Trauma & Inflammation'. It then rises to a level higher than the baseline, but after another 'Exercise' arrow, it drops again and then rises to a level lower than the first peak, labeled 'Release of inflammatory Cytokines in the blood'.

**Overtraining**  
- Immune cells  
- brain  
- liver  
- muscle

Part of fatigue response is inflammation.  
Chronic inflammation activates the immune system

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### Question

How do you feel during training camp/playoffs competition?  
???

How do you feel after training camp/playoffs/competitions are over?  
???

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### Question

- How do you know when your athletes are:
  - Fatigued?
  - Overreached?
  - Overtrained?
- What do you do about it? Considerations?
  - E.g. modern age of ....

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### Signs & Symptoms

- Overtraining is chronic over-stress (Selye)
  - Stage I (& power sports):
    - high RHR, anxiety, inability to sleep, restlessness,
    - loss of appetite, lose weight, performance
  - Stage II (chronic & endurance sports):
    - low RHR, rapid HR recovery, ↓ Lac<sup>-</sup>
    - chronic fatigue, tiredness, aching joints, ↓ motivation

APATHY, REDUCED PERFORMANCE

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### Benefits of Fatigue Response

- ADAPTIVE:
  - PROMOTES withdrawal from activity
  - Profile of Mood State often early indicator
  - Communication between athlete and coach important
  - Consequences may be dire
- Full recovery from OTS may take 6-12 weeks!
  - Some people chronically relapse and never recover
  - Should only start training again when desire returns

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### How to avoid overtraining

Prevention is the best strategy!

- Monitor performance
  - Listen to your body (or your athletes)
  - HR & RPE higher for same exercise intensity, reduced Lac
  - Edgy, 'stressed', Reduced motivation
  - "heavy legs"
  - Recover within 24-48 hours = OK, if not → overreach → OTS
- Progressive program, Seasonal variety of training
- Varied (hard/light days & weeks)
- One complete day of rest per week
- Recovery techniques!

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### Overreaching and Supercompensation

Training Intensity & Volume

Weeks

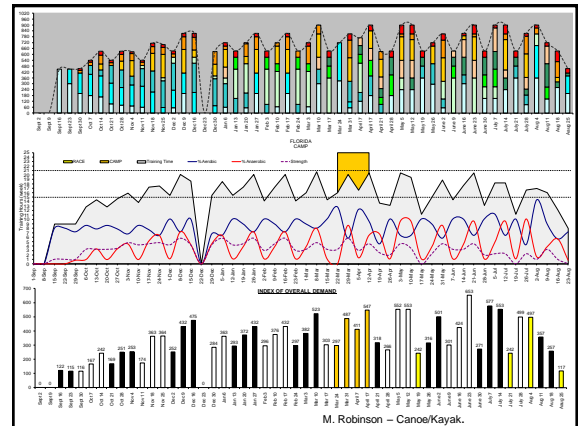
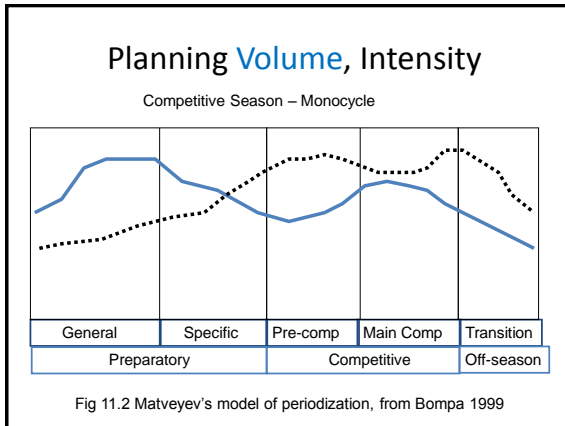
Weeks

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### Periodization - Phases

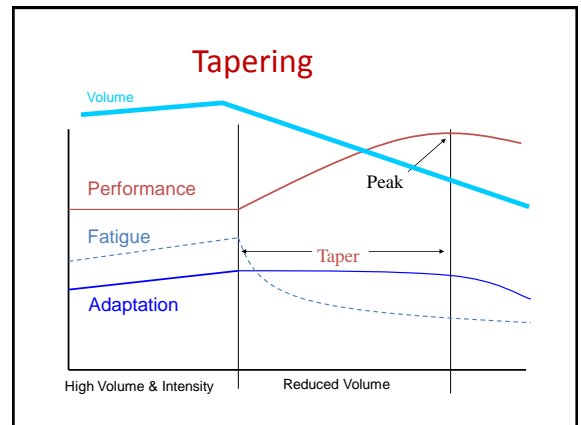
General Conditioning	}	Off-season (General prep)
Size & Strength		
Strength - Speed		
Power – Endurance*	}	Pre-season (Specific prep)
Power – Explosive**		
Maintenance	}	In-season (Competitive)
Peaking		
Active Rest	→	early off-season

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### What is Tapering?

- Defn: A progressive, typically non-linear reduction in training load, intended to reduce physiological and psychological stress on the athlete with the goal of restoring training tolerance and enhancing training-induced adaptations... (paraphrased from Mujika, 2009)
- Typical performance improvements: 1-7% (avg 2.5%)
  - Sport and athlete dependent



### Tapering Considerations

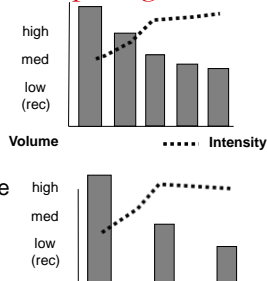
- Type of Taper – volume reductions
  - Linear (neural power sports)
  - Exponential (fast, slow) (endurance run, swim)
  - Step Taper (unloading) (cycling)
- Exponential tapers shown to be most effective in most sports
- Step tapers effective in high volume sports, or when unloading required for 'supercompensation'.

### Tapering Considerations

- Duration
  - Range 4-40 days (↑volume / week, ↑ duration of taper)
  - Greatest effect 8-14 d\*\* (N.B. > 15 h/week ~ 21-30 days)
- Intensity
  - Intensity maintained, or increased
- Volume
  - Typically reduced 40-60% (swim,cycle), although higher and lower reductions (e.g. 20-40% run)
- Frequency
  - can be reduced 1/3 to 2/3 (non-elite)
  - Can do 2-3 tapers per Number of tapers/year

## Sport Specificity in Tapering

- Taper Mesocycle for **Metabolic sports**
  - volume reduction only
  - Exponential taper
- Linear Taper Microcycle for **Neural Sports**
- Volume and frequency reduction



Maintaining Intensity is essential to maintain performance adaptations

## Questions

- What is the typical 'Tapering & Peaking' involved with preparations in the last 6-8 weeks before major competition or playoffs?
  - High school athletes?
  - Provincial level
  - University level
  - National Level
- What are the challenges involved with monitoring and managing tapering/peaking in team vs individual sports?

## Peaking Techniques

- Reduce volume, maintain or ↑ intensity
- transition long-term to short-term adaptations
  - resistance: peripheral to central (size to strength)
  - aerobic: central to peripheral (CV to muscle)
  - anaerobic: quickly developing (H+ buffer)
- reduce general conditioning, ↑ sport involvement, sport-specific training
  - i.e. agility drills, plyo's, taper into sport-specific
  - Greater emphasis on 'coach' directed training

## Question

- What are the challenges involved in maintaining peak performance during a period of competition?
  - Playoffs
  - Tournaments
  - Multiple, heats, prelims, quarter, semis, finals

## Maintaining a Peak

- A fine balance between:
  - Maintaining or enhancing training adaptations
  - Limiting overstress
  - Monitoring and limiting fatigue levels
  - Maintaining or enhancing recovery processes
- GOAL:
  - optimal physical and psychological state




## Maintain Adaptations: How Much Is Enough?

- Aerobic: 10min continuous (>80-100%); 2x/week
- Anaerobic Capacity: 3 sets ~1min; 1x/week
- Strength: 3 sets, 2-8 reps (>85%); 1-2x/week
- Endurance: continuous (duration), 1x/week
- Power: 3-5 sets, 2-5 reps; 2x/week
  - Speed (1-2x/week) & Agility (1-2x/week)
- Flexibility: 2 sets x 15s; everyday

**N.B. MAINTENANCE: 1-2x per week INTENSE**

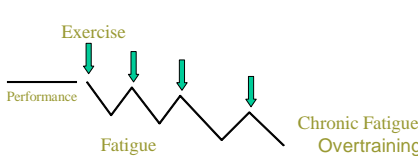
### Limiting Overstress

- Monitoring HR, RPE, Work:rest
- Use of pre-cooling, post-cooling
- Use of prophylactic taping, bracing, compression garments




### Enhancing Recovery

In-adequate Rest & Recovery



Factors in recovery

1. Sleep, Rest, Relaxation & Emotional Support
2. Active Rest & Stretching
3. Advanced recovery techniques
4. Nutrition and hydration



### Active Recovery & Stretching

'Active': low-moderate aerobic activity & stretching the day after intense exercise

Application: Warm-up!!


- improves blood flow & energy status
  - removal waste, supply substrates
  - assist protein turnover?
- reduces stiffness
  - joint effusion, reflex feedback




### Massage for Performance?

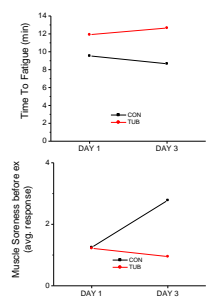
Weerapong P, Hume PA, Kolt GS. Sports Med. 2005;35(3):235-56.  
*The mechanisms of massage and effects on performance, muscle recovery and injury prevention.*

- Expected to help athletes enhance performance
  - limited research of pre-exercise massage on performance and injury prevention.
- massage might help to enhance recovery
  - little scientific data supports this claim
  - massage produces positive effects on recovery (psychological mechanisms).
  - Reduce the severity of feelings of muscle soreness but massage has no effects on muscle functional loss.

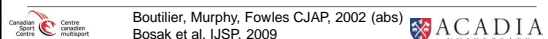


### Cold-Water Immersion

- After a complete cool-down & stretch
- submerge to the waist, in 10-12°C water
  - its cold (~55 -60 F) cold out of tap is ~50-65)
- Optimal is 10-15 min, minimum is 5 min
- Repeats are better
- Enhanced recovery from high intensity exercise

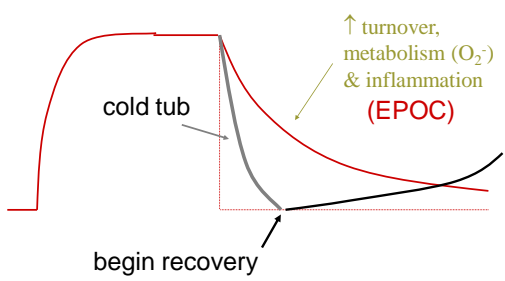



Boutillier, Murphy, Fowles CJAP, 2002 (abs)  
Bosak et al. IJSP, 2009



### Post-exercise cold tub

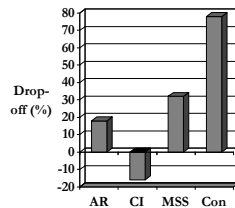
Reduce post-exercise effect

## Post-workout effects on Performance

Lane & Wenger, J Strength Cond Res. 2004 Nov;18(4):855-60

- Two bouts of intense interval cycling (18 min total) repeated 24 hours apart with intervention between
  - 12 reps x 5 s max sprint w 25 s rest
  - 6 reps x 10 s max sprint w 50 s rest
  - 3 reps x 15 s max sprint w 75 s rest
- Active recovery, cold water immersion, massage compared to control
- Control only *significantly* decreased work after 1<sup>st</sup> bout
- Enhanced performance CI



## Newer Technique – Contrast showers

- Athlete alternates between Cold and hot showers (2:1 min, total 20 minutes)
- Done after a workout or the next day
- Purported 'psychological and hormonal effects'. (i.e. neuro-humoral)

## Rest & Recovery Application

- Rest is relative
  - problem muscles (soleus, back, hamstrings)
  - active rest (low intensity increase blood flow)
- Reduce inflammation (overshoot)
  - post-workout cooling (free radicals, LFF)
  - Use of anti-inflammatories?
- Relaxation
  - massage, emotional support, reduce screen time
- Nutrition - requirements
  - post-workout, supplementation?



GOT MILK? CHOCOLATE MILK  
AS A RECOVERY AID FROM  
FATIGUING EXERCISE

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Acadia University

March 27<sup>th</sup>, 2010  
Supervisor: Dr. Jonathon Fowles

## Overall Program Design: The little things that matter

- Efficiency and Effectiveness
  - Periodization, tapering, peaking
- Warm-up, Cool-down & Stretching
- Recovery techniques
- Nutrition

Thank-you

Questions?