Principles of Monitoring

Link Between Planning and Preparedness

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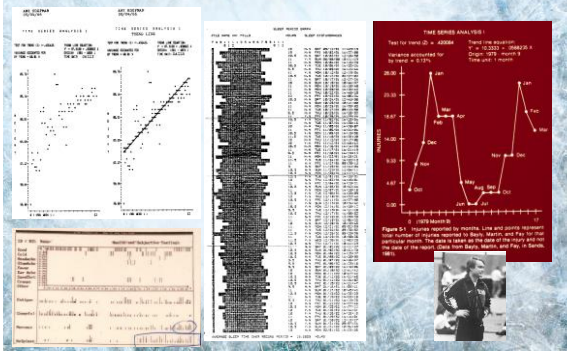
FACSM, CSCS, EMT

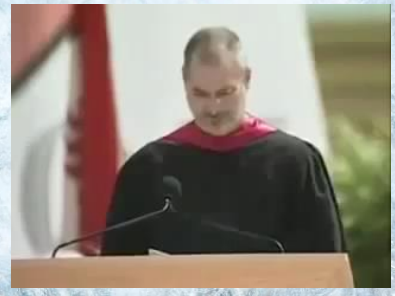
Monitoring Training

How I got interested in monitoring…

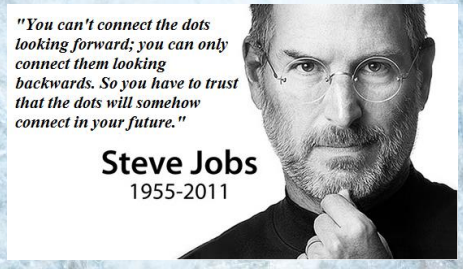


Why Monitor Training?

Connecting the Dots



Ya' gotta have dots to connect them



Why do coaches and athletes resist connecting the dots?

Monitoring

Training is Complicated

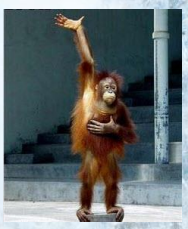
- Evidence Based Coaching
  - Requires ongoing assessment
  - Why would anyone choose ignorance over knowledge?
  - Coaches **are** in the best position to know.
    - But, information is often hidden, subtle, and fragile.

Count the Number of Fs

Finished files are the result of years of scientific study combined with the experience of years...

How many did you count?

- Show of hands…
  - 3
  - 4
  - 5
  - 6
  - 7
  - 8



Count the Number of Fs

Finished files are the result of years of scientific study combined with the experience of years...

Answer: 6

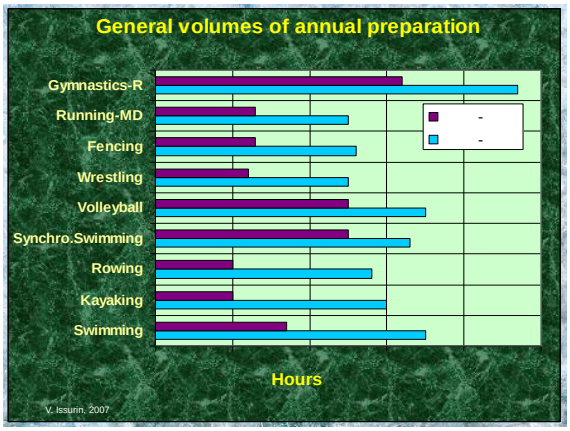
Count the Passes of Players Wearing White

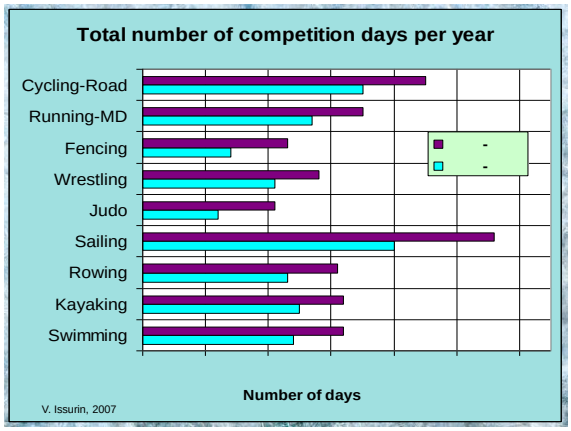
If you've already seen this please stay quiet.

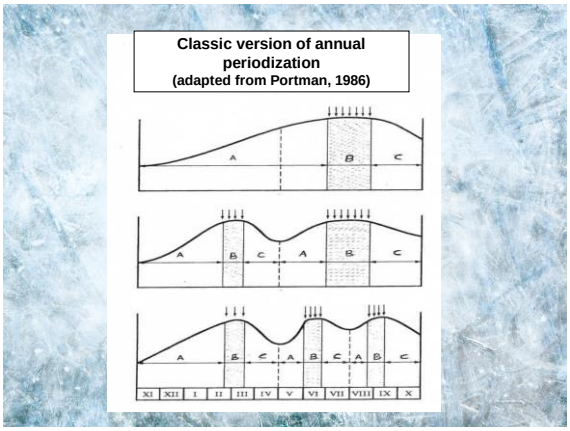
Why Monitor?

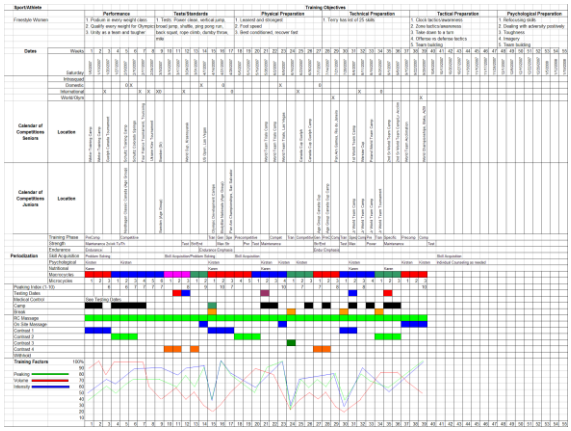
- Training is a process
  - to characterize the process.
- Long-term development
- Training is not entirely predictable.
  - Mistakes are expensive
- Avoid overtraining
- Avoid injury

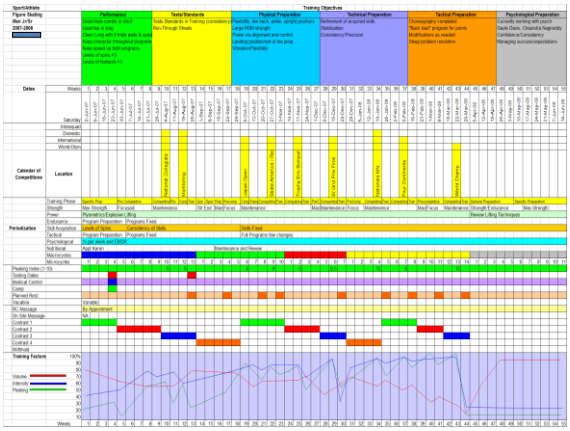

Why Monitor?
theguardian
World news
Datablog
Is skiing the world's most dangerous sport?
Severity
All injuries (n=705)
Injuries in percentage
Severe injuries >28 days
n=196
Injuries*100 athletes per season
Alpine
Freestyle
Snowboard


General volumes of annual preparation
Gymnastics-R
Running-MD
Fencing
Wrestling
Volleyball
Synchro.Swimming
Rowing
Kayaking
Swimming
Hours
V. Issurin, 2007


Total number of competition days per year
Cycling-Road
Running-MD
Fencing
Wrestling
Judo
Sailing
Rowing
Kayaking
Swimming
Number of days
V. Issurin, 2007


Classic version of annual periodization
(adapted from Portman, 1986)
A
B
C
XI
XII
I
II
III
IV
V
VI
VII
VIII
IX
X





Transferability – Men's Triple Jump

TABLE 65
Correlational Interrelationship of Preparatory Results of Men Triple Jumpers of Various Qualifications in Several Specialized-Preparatory, Specialized-Developmental and Competitive Exercises

Exercise	Sports Result, Coefficient of Correlation				
	17.00-16.50m	16.50-16.00m	16.00-15.50m	15.50-15.00m	15.00-14.00m
30m run with a flying start	0.765	0.780	0.689	0.720	0.690
30m run from the blocks	0.680	0.720	0.654	0.680	0.646
60m run from the blocks	0.876	0.790	0.824	0.756	0.700
100m run from the blocks	0.705	0.745	0.650	0.688	0.624
Long jump from place	0.678	0.645	0.705	0.605	0.643
Triple jump from place	0.788	0.856	0.765	0.780	0.724
5-fold jump from place	0.856	0.905	0.885	0.804	0.783
10-fold jump from place	0.924	0.867	0.900	0.845	0.786
Jump from a short run-up	0.934	0.906	0.924	0.890	0.906
Barbell snatch	-0.178	0.188	0.226	0.200	0.286
Half squat with a barbell	0.398	0.324	0.454	0.370	0.356
Throwing the shot forward	0.124	0.103	0.225	-0.165	0.207
Throwing the shot backward	-0.212	-0.167	0.187	0.214	0.288

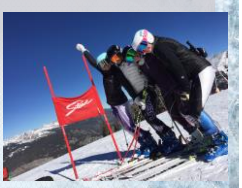
Bondarchuk, 2007

How should we cope with these demands?

- It's not a problem (the consensus-trance)…
  - Anticipate that athletes will only last one or a few Olympiads and plan for it.
  - JIT approach – heavy emphasis on TID(youngsters) and natural attrition
  - Emphasize optimizing the final year of the quad
- Try to extend the career of veteran athletes (paradigm shift)
  - Keep athletes going at a world level longer.
  - Prepare athletes more patiently and develop better training methods (and understanding) for mature athletes.
  - Emphasize long-term development with junior and "near" world level athletes.
    - Develop better understanding and training for young athletes to keep them developing on a longer and higher preparation arc.
  - Develop multiple teams for those with deep talent
  - Plan competitions more carefully
  - Recycle Athletes and Talent-ID in College for late maturing sports

Monitoring Training

- What is worth monitoring?
  - Dose – Response relationship
    - What are skiing "doses?"
  - Training diaries
  - Regular tests
  - Individuals vs Groups/Teams
  - Others



What is worth monitoring?

- "Although researchers have suggested an impressive array of sophisticated tests to detect overtraining, the best measures continue to be the simplest changes in performance and self-rated perception of fatigue and well-being.
- …A training diary which records and assesses all of these elements in a systematic fashion would seem essential." (Schiffer, J. Overtraining, New Studies in Athletics, 16(4), p 81).

What is worth monitoring?

- The search for markers…
  - Lactate, heart rate variability, ammonia, glutamine, morning heart rate, immune system, POMs, etc.
- Why univariate approaches haven't worked.
  - Anomaly detection
  - The data are actually in the noise…
- What are we really trying to find out?
  - Departures from stability
- Ideographic vs nomothetic approaches
  - Group vs Single-Subject Designs
- Are you willing to devote the time and energy?

Response to Stress – Characteristic but Idiosyncratic

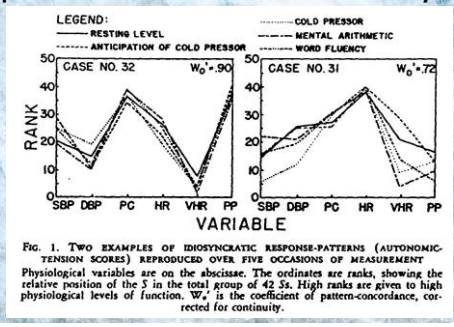
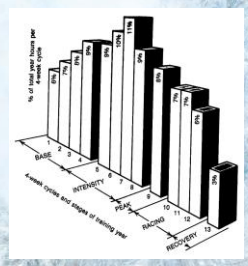


FIG. 1. TWO EXAMPLES OF IDIOSYNCRATIC RESPONSE-PATTERNS (AUTONOMIC-TENSION SCORES) REPRODUCED OVER FIVE OCCASIONS OF MEASUREMENT
Physiological variables are on the abscissae. The ordinates are ranks, showing the relative position of the 5 in the total group of 42 Ss. High ranks are given to high physiological levels of function. W_0' is the coefficient of pattern-concordance, corrected for continuity.

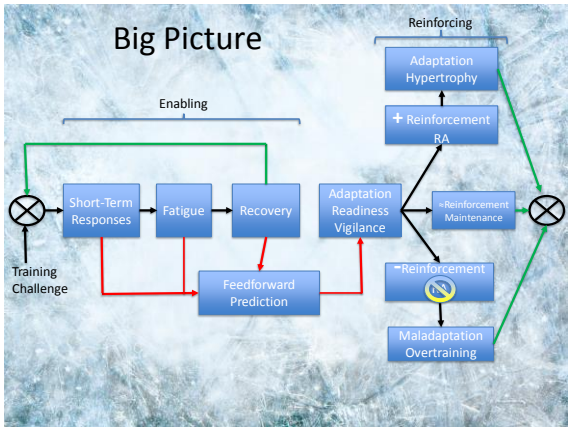
Lacey,JI; Bateman,DE; VanLehn,R (1953): Autonomic response specificity: An experimental study. Psychosomatic Med. 15(1), 8-21.

Training Models Lots of ideas...

- Sleamaker
- Verhoshansky
- Matveyev
- Zatsiorsky
- Nadori
- Bompa
- Bondarchuk
- Counsilman

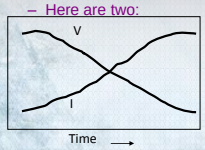


Big Picture

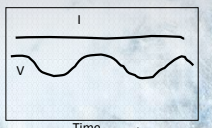


Training Theory - Models

- At least a dozen training models
  - A "big picture" approach to training management
  - Control of volume (how much) and intensity (how hard). And lots of other stuff.
  - Here are two:

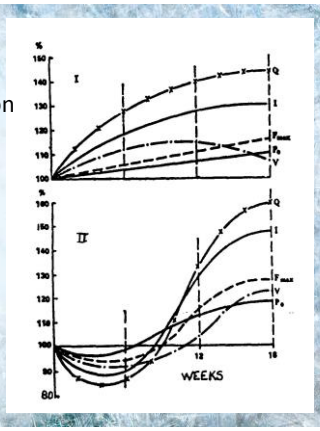


Matveyev (1977)



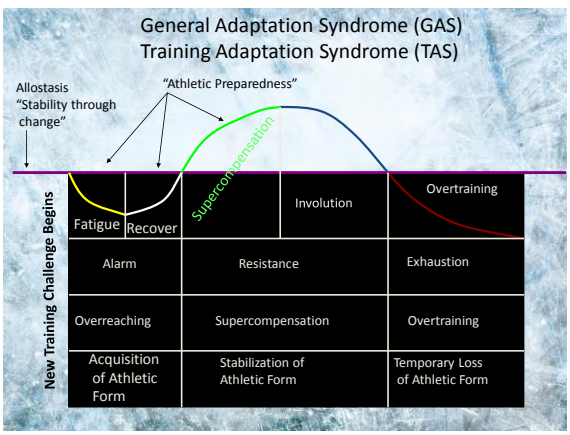
Zatsiorsky (1995)

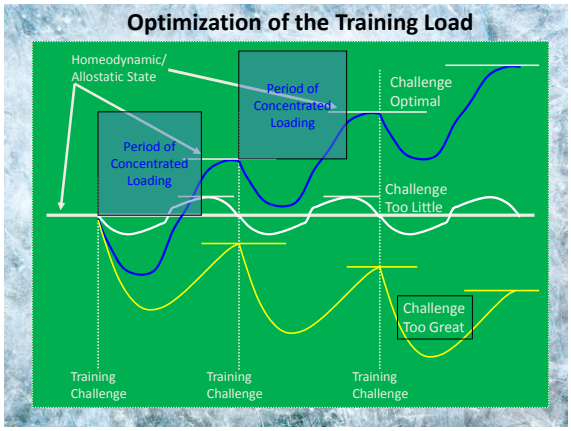
What are the typical patterns of adaptation to training?

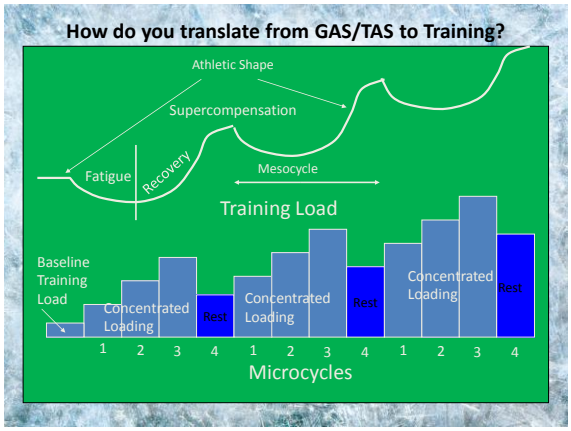


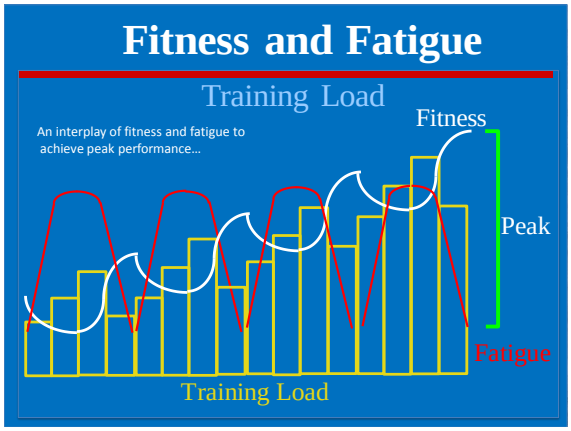
Verkhoshansky,YV (1985): Programming and organization of training. (Translated by A. Charniga, Published by Sportivny Press, Livonia, MI, 1988.) Fizkultura i Spovt, Moscow, U.S.S.R.

General Adaptation Syndrome (GAS) Training Adaptation Syndrome (TAS)



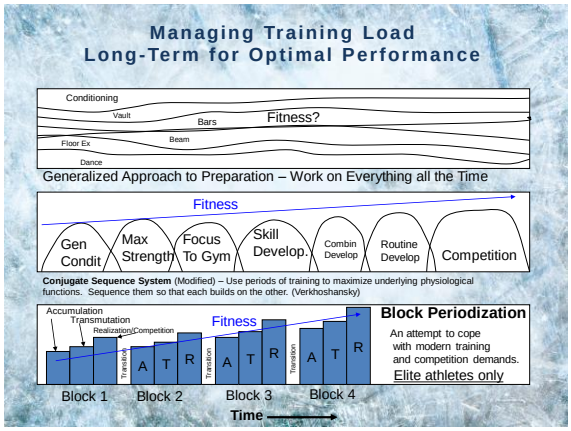

Optimization of the Training Load
Homeodynamic/ Allostatic State
Period of Concentrated Loading
Period of Concentrated Loading
Challenge Optimal
Challenge Too Little
Challenge Too Great
Training Challenge
Training Challenge
Training Challenge


How do you translate from GAS/TAS to Training?
Athletic Shape
Supercompensation
Fatigue
Recovery
Mesocycle
Training Load
Baseline Training Load
Concentrated Loading
Rest
Concentrated Loading
Rest
Concentrated Loading
Rest
1 2 3 4 1 2 3 4 1 2 3 4
Microcycles

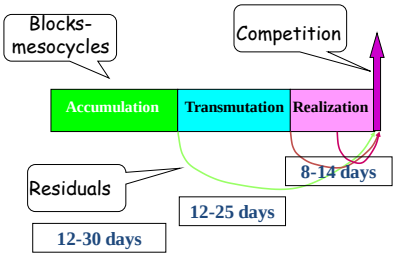

Fitness and Fatigue
Training Load
An interplay of fitness and fatigue to achieve peak performance…
Fitness
Peak
Fatigue
Training Load


Block Periodization
Proposed Method to Cope with These New Demands


Paradigm Shift
•Do not train concurrently; train in sequence
• Follow the sequence :
basic abilities → more specific abilities → tapering → Competition


Managing Training Load
Long-Term for Optimal Performance
Conditioning
Vault
Bars
Fitness?
Floor Ex
Beam
Dance
Generalized Approach to Preparation – Work on Everything all the Time
Fitness
Gen Condit
Max Strength
Focus To Gym
Skill Develop
Combin Develop
Routine Develop
Competition
Conjugate Sequence System (Modified) – Use periods of training to maximize underlying physiological functions. Sequence them so that each builds on the other. (Verkhoshansky)
Accumulation
Transmutation
Realization/Competition
Fitness
A T R
Transition
Block Periodization
An attempt to cope with modern training and competition demands.
Elite athletes only
Block 1
Block 2
Block 3
Block 4
Time

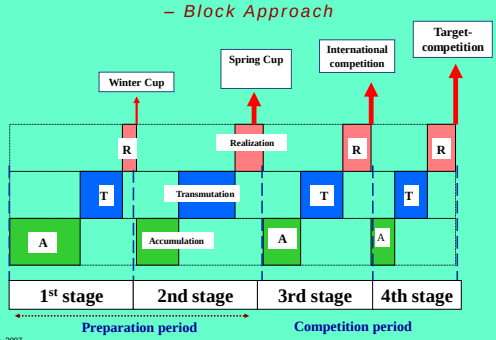
Superposition of Residual Training Effects – Timing



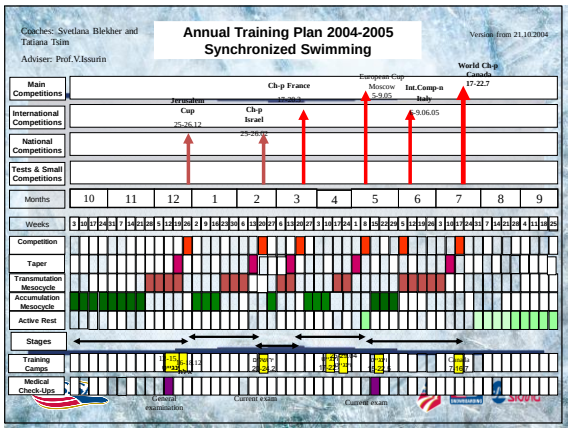
V. Issurin, 2007

Annual Preparation Chart

– Block Approach



V. Issurin, 2007



Know the athlete See their future…

- What is the athlete going to face in the next quad, or the quad after that?
- What drives the athlete's development?
- Where are the components of performance headed?
  - Physical
  - Technical
  - Tactical
  - Psychological
  - Theoretical/Logistical

Know the athlete

- What is the athlete going to face in the next quad, or the quad after that?
- What drives the athlete's development?
- Where are the components of performance headed?
  - Physical
  - Technical
  - Tactical
  - Psychological
  - Theoretical/Logistical
  - Educational

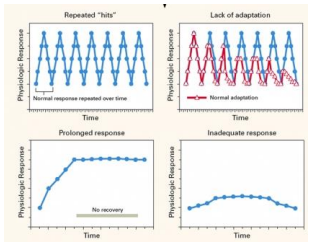
Know your training…

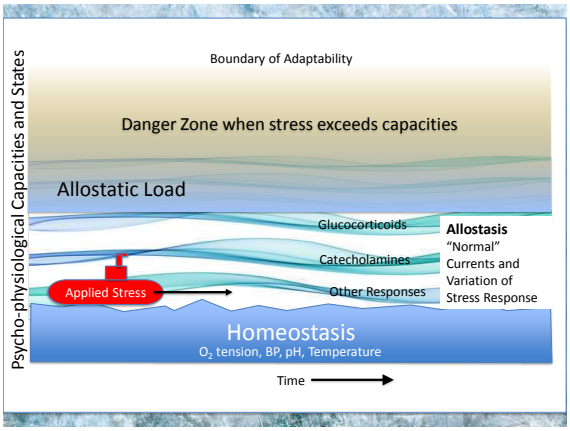
- Training Design
- Monitoring
- Transferability of Training Tasks to Performance
- The Garden of Performance
  - Career Advancement and Development Plans
  - Quad Plans
  - Annual Plans
  - Mesocycle (monthly) plans
  - Microcycle (weekly) plans
  - Training lesson plans
  - The roles of volume, intensity, density, frequency, recovery/adaptation

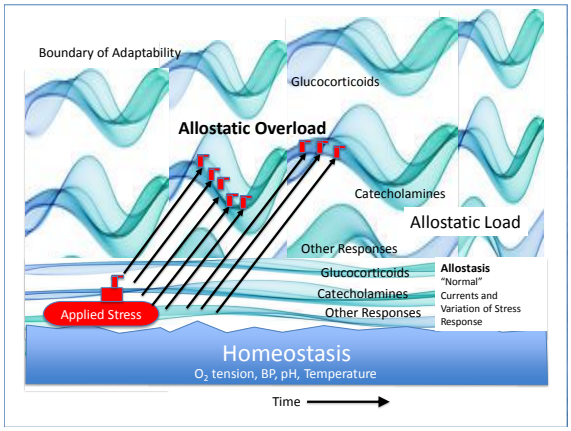
Stone, M.H., Stone, M.E., Sands, W.A., (2007). Principles and practice of resistance training. Champaign, IL., Human Kinetics. 376 pages.

What about process?

- Homeostasis
  - Set point regulation
  - Narrow range of change
  - Survival importance
  - Reactive
- Allostasis
  - Internal viability through bodily change
  - Feedforward
  - Predictive
- Allostatic State
  - Chronic over-activation, beyond set points
- Allostatic Overload
  - Pathological overstimulation

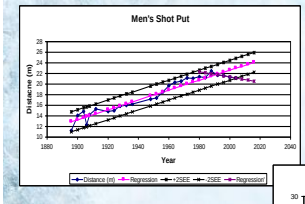






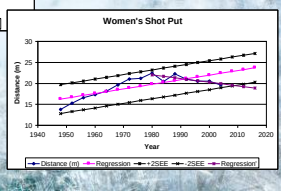
You need to monitor…Everything

Track and Field Examples



r = 0.961888
Intercept -163.982
Slope 0.093285
SEE 0.939621

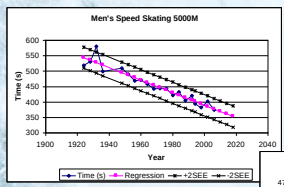
r = -0.97529
Intercept 118.5018
Slope -0.04858
SEE 0.06699



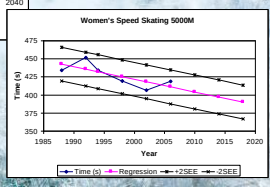
r = 0.76428
Intercept -197.28
Slope 0.10962
SEE 1.71702

r = 0.6111
Intercept 198.414
Slope -0.0891
SEE 0.72489

Winter Sports: Different Pattern



r = -0.96668
Intercept 264.476
Slope -0.11425
SEE 0.736479



r = -0.74263
Intercept 3919.852
Slope -1.74904
SEE 11.73269

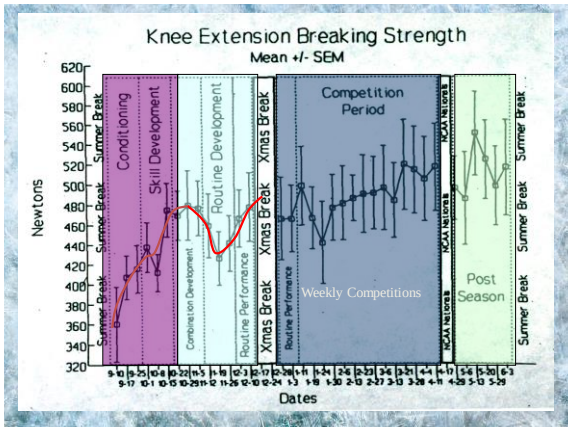
Monitoring Isometric Breaking Strength and Body Composition

Isometric knee extension breaking strength
Sum of Four Skinfolds

University of Utah Women's Gymnastics Team (2nd NCAA)

1. Weekly tests
2. One academic year
3. Entire team

Sands,WA; Irvin,RC; Major,JA (1995): Women's gymnastics: The time course of fitness acquisition. A 1-year study. J. Str. and Cond. Res. 9(2), 110-115.

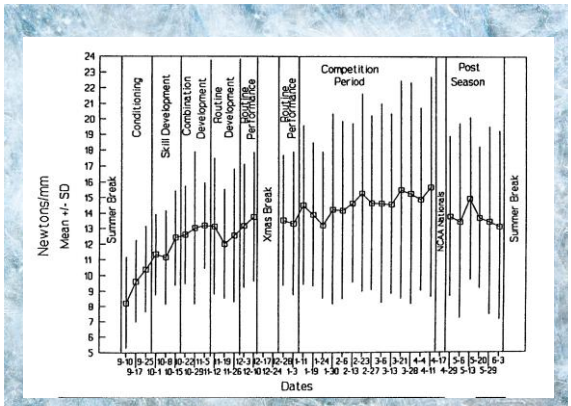


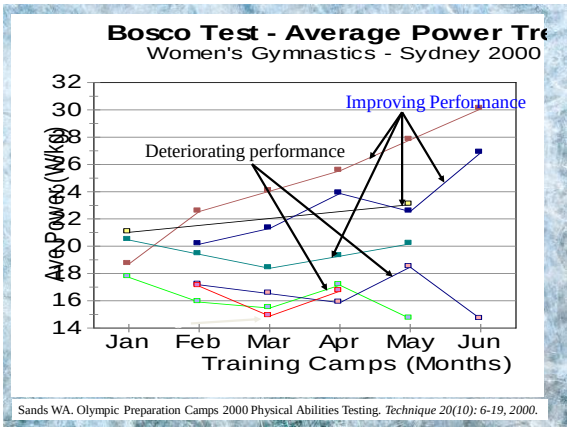
Skinfold Sums

Four sites
Sum the mm

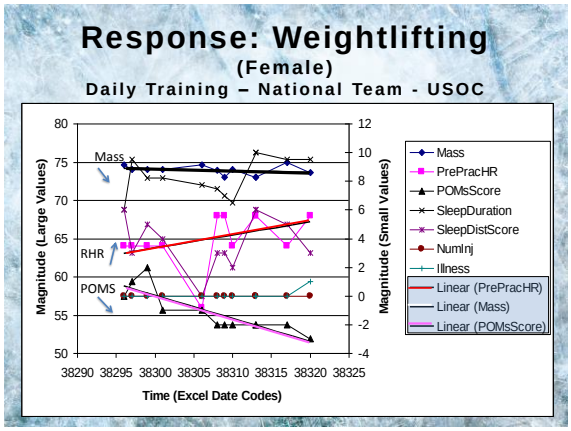
Reflective of Change in body composition

Wilmore, JH (1985). Ross Conferences on Medical Research 6. Body composition assessments in youth and adults. Ross Laboratories, Columbus, OH. 6. 78-86.

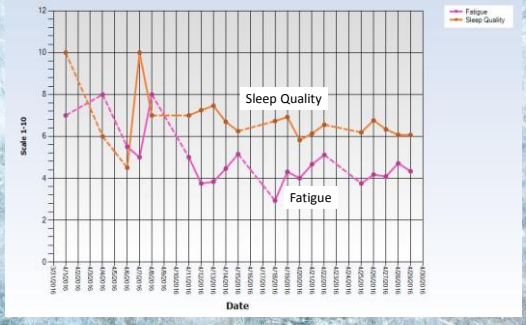




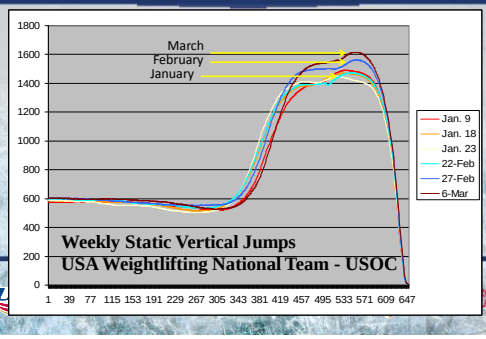
Sands WA. Olympic Preparation Camps 2000 Physical Abilities Testing. *Technique 20(10): 6-19, 2000.*



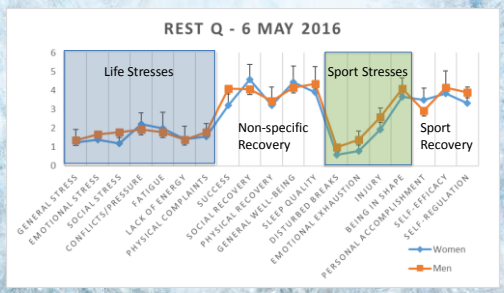
Aerials Skiers National Team



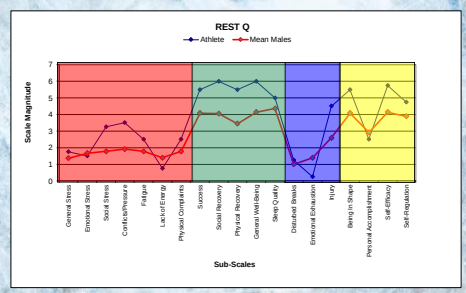
Response: Force-Time Curves Weightlifting



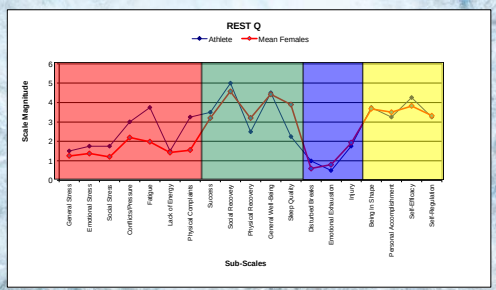
RESTQ - Aerials



Individual Athlete



Individual Athlete



Local Monitoring

- Monitoring Local Dose/Response is also important
- Dose
  - Runs counts
    - Attempted vs completed
  - Turns counts
    - Attempted vs completed
  - Altitude change
  - Compliance with drills
- Response

Weightlifting (M/W)

<u>Bilaterally symmetrical</u>
Note: Quads>Back

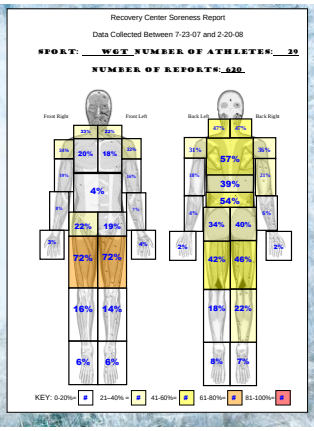
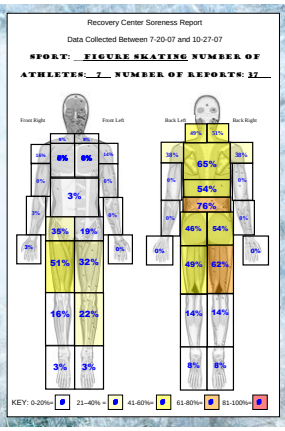
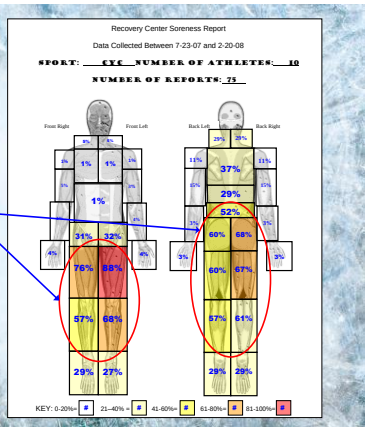


Figure Skating



Track Cycling

<u>NOT</u> bilaterally Symmetrical!!!



Obesa contavit

Questions?

Once they're serious athletes…

- How much/long should they improve (Bondarchuk, 2007)
  - 20 cycles = Olympic level
  - 15 cycles = high national, low international level
  - 10 cycles = national level
  - <10 cycles = developing or no talent