

Плато результатов: почему спортсмены  
перестают прогрессировать и как с  
этим справиться?

*«Необходимо прикладывать все больше усилий для постоянного улучшения результатов российских спортсменов. Ещё одна тема – развитие спортивной науки. В этой сфере у нас решены лишь первоочередные вопросы медико-биологического обеспечения спортсменов. Слава богу, конечно, что и эти шаги сделаны. Но всё-таки ещё здесь многое нужно предпринять для того, чтобы быть на самом высоком, требуемом сегодня уровне... Нужно проанализировать и положение дел в сфере научных исследований. Их результаты напрямую связаны с совершенствованием методики подготовки спортсменов, а также с развитием спортивных технологий, что особенно важно для паралимпийцев. Мы здесь, к сожалению, пока отстаём, в том числе и по причине недостаточного финансирования этих направлений...»*

**В.В. Путин**

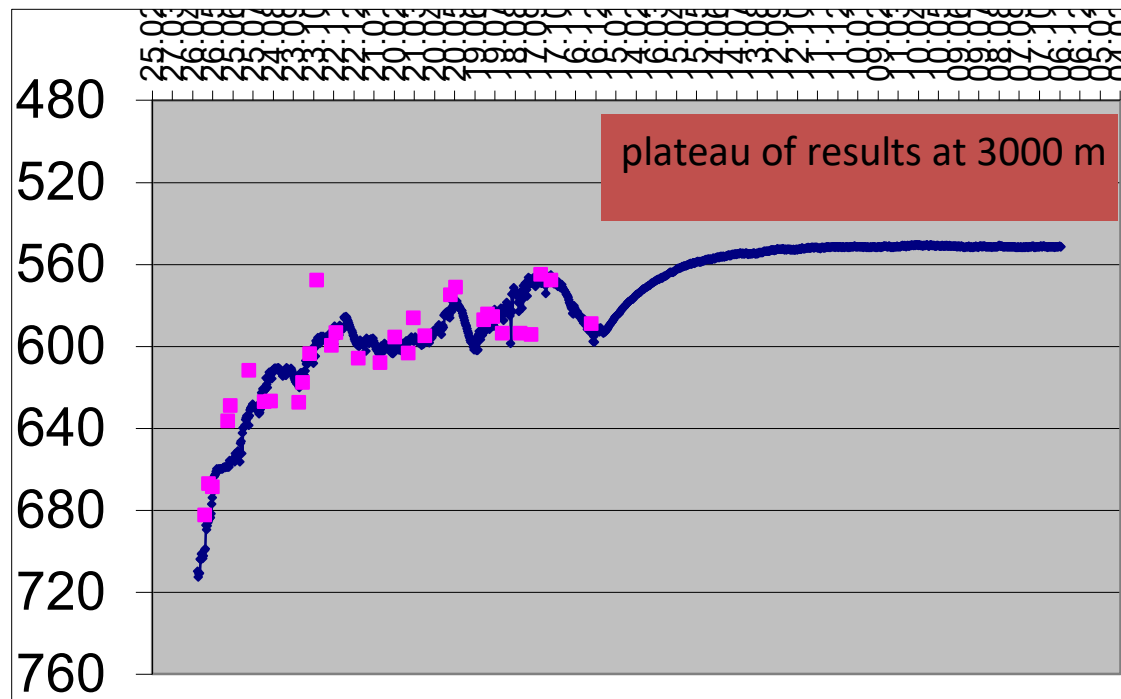
выступление на заседании Совета при Президенте  
по развитию физической культуры и спорта  
6 ноября 2012 года



- В данном семинаре вы узнаете:
  1. Основных причинах остановки роста соревновательных результатов.
  2. Способах выхода с плато результатов за счет манипуляций тренировочными переменными.
  3. Идеях выхода с плато результатов за счет воздействий, не связанных непосредственно с изменениями тренировочных переменных.

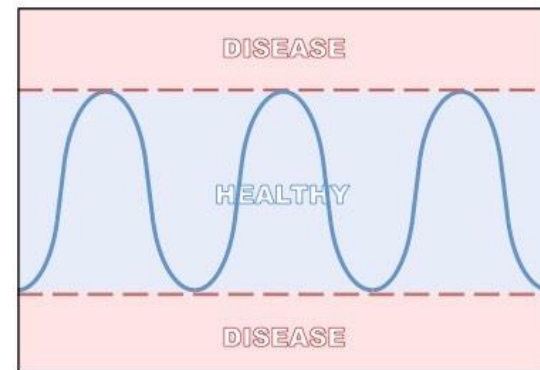
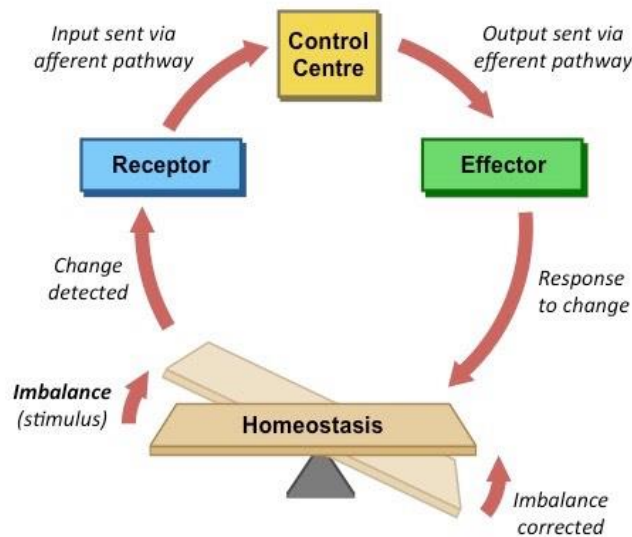
# Что такое плато результатов?

- Ситуация, когда реализация тренировочной программы не приводит к ожидаемому росту соревновательных результатов



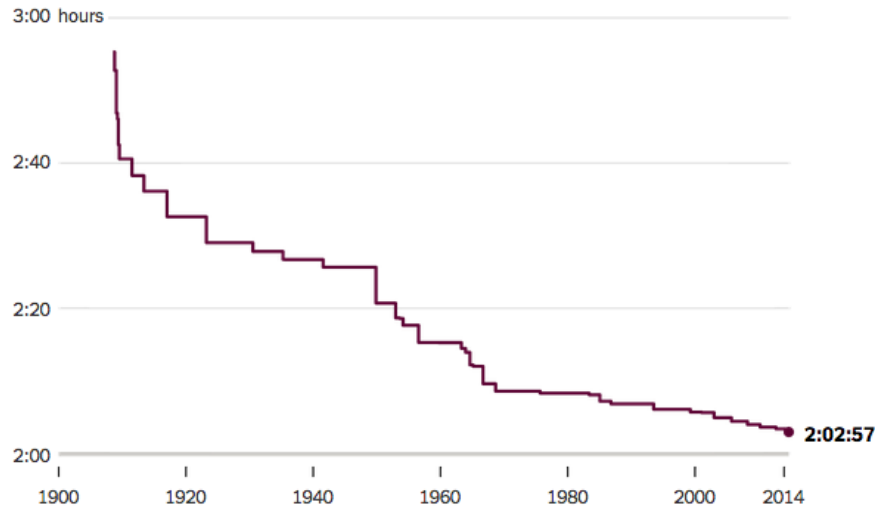
# Причины плато результатов

- Глобальная причина плато результатов кроется в свойстве организма, называемом гомеостаз



Homeostasis does **not** involve keeping conditions static  
It involves keeping conditions within tightly regulated  
physiological tolerance limits

# Достижение генетических пределов – является событием редким в практике тренеров



# Причины: высокий уровень социально-психологического стресса

- Стрессовые события в жизни

→ снижение ответа на аэробные/силовые нагрузки

frontiers in  
PHYSIOLOGY

ORIGINAL RESEARCH ARTICLE  
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## Self-rated mental stress and exercise training response in healthy subjects

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**Purpose:** Individual responses to aerobic training vary from almost none to a 40% increase in aerobic fitness in healthy subjects. We hypothesized that the baseline self-rated mental stress may influence to the training response. **Methods:** The study population included 44 healthy sedentary subjects (22 women) and 14 controls. The laboratory controlled training period was 2 weeks, including five sessions a week at heart rate for 40 min/session. Self-rated mental training period from 1 (low psychological stress) to 10 (high psychological stress) and no stress: peak oxygen uptake ( $\dot{V}O_{2peak}$ ) increased from group ( $p < 0.001$ ) and did not change in control group. Among the training group, the self-rated stress with the change in fitness after training interval power ( $r = 0.45$ ,  $p = 0.002$ , W/kg) and with  $\dot{V}O_{2peak}$  ( $r = 0.44$ ,  $p = 0.01$ ) female and male, respectively. **Conclusion:** As a result, physical training has been proposed to reduce these events by

change as an end response (Hautala low beat-to-beat  $\dot{V}O_{2peak}$  has shown to be as Myers et al., (2002) showed that low maximal aerobic capacity is closely related to an increase of outward cardiac events. Therefore, physical training has been proposed to reduce these events by

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## STRENGTH GAINS AFTER RESISTANCE TRAINING: THE EFFECT OF STRESSFUL, NEGATIVE LIFE EVENTS

JOHN B. BARTHOLOMEW, MATTHEW A. STULTS-KOLHMAINEN, CHRISTOPHER C. ELROD, AND JANICE S. TODD

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### ABSTRACT

Bartholomew, JB, Stults-Kolhmainen, MA, Elrod, CC, and Todd, JS. Strength gains after resistance training: the effect of stressful, negative life events. *J Strength Cond Res* 22: 1215–1221, 2008—This study was designed to examine the effect of self-reported, stressful life events on strength gains after 12 weeks of resistance training. Participants were 135 undergraduates enrolled in weight training classes that met for 1.5 hours, two times per week. After a 2-week period to become familiar with weight training, participants completed the college version of the Adolescent Perceived Events Scale (APES), the Social Support Inventory, and one-repetition maximal lifts (1RM) for the bench press and squat. Maximal lifts were repeated after 12 weeks of training. Median splits for stress and social support were used to form groups. Results indicated that the low stress participants experienced a significantly greater increase in bench press and squat than their high stress counterparts. Strength gains were, however, unrelated to social support scores in either the low or high stress group. High life stress may lessen a person's ability to adapt to weight training. It may benefit coaches to monitor their athletes' stress both within and outside the training setting to maximize their recovery and adaptation.

**KEY WORDS:** one-repetition max, muscular hypertrophy, social support

**INTRODUCTION**  
Rarely do two athletes respond the same to training. Regardless of similarities in body composition, diet, work ethic, or age, some athletes invariably adapt better to training than others. Although there are understandable differences between these individuals (e.g., at the cellular and molecular level), variations in training response may also follow differences in their experience of life

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stress. Life stress has been conceptualized as the culmination of major change events (such as a marriage, divorce, or loss of employment) that result in a cascade of physiological events that begin with an increased activation of the sympathetic/adrenal-medullary (SAM) system and hypothalamic-pituitary-adrenal (HPA) axis (41). Unfortunately, stressful life events are often associated with a lasting stress response that lacks the opportunity for recovery, thus taking its toll on the human organism (14,35). It has been well documented that a disproportionate exposure to life stress has negative implications for people's health (16), including the number of illnesses they experience as well as rates of morbidity (16).

Although generally placed in a negative light, the stress response can be facilitative when paired with adequate recovery. Selye theorized that under these conditions, the stress response provides the means for adaptation by developing stress resistance and improving capacity (38). Indeed, the specific goal of periodized exercise training is to balance stress and recovery as a means to improve strength and fitness. Given this perspective, it is reasonable to ask how stressful life events affect this balance of stress and recovery?

That is, life stress may undermine recovery and adaptation. Potential mechanisms include decreased training effort in response to stress or differences in biological responses (34). Regardless of the mechanism, it is sensible to investigate the impact of stress on the response to strength training. This new line of inquiry represents a shift in focus from the study of fitness as the primary outcome of stress and stress-related disorders to an emphasis on the potential impairment of fitness-related constructs.

The effect of stress on health, however, is not invariant and is moderated by a number of variables (8). For example, social support, defined as the presence of people who we believe value us and on whom we can rely, has consistently been shown to reduce the health-related impact of stress (34,37). As a result, if stressful life events do lessen the response to exercise training, social support may moderate this relationship. This would be manifest through an interaction between stress and social support, in which the training response would be least for those who reported both a disproportionate number of stressful life events and low social support. The present study was designed to investigate this issue. Life stress was operationally defined as the summed total of



# Перетренированность

- Общепринятое определение перетренированности заключается в том, что спортсмен, сохраняя или увеличивая тренировочную нагрузку, сталкивается с падением спортивных результатов при присутствии таких признаков как постоянное ощущение утомления (чувство гнетущей усталости даже после обычных тренировок), нарушения сна, перепады настроения и др.



# Предотвращение перетренированности

- Индивидуализация тренировочных программ
- Фиксация и обработка данных по тренировочной нагрузке, соревновательным результатам восстановлению, а также биохимическим анализам крови



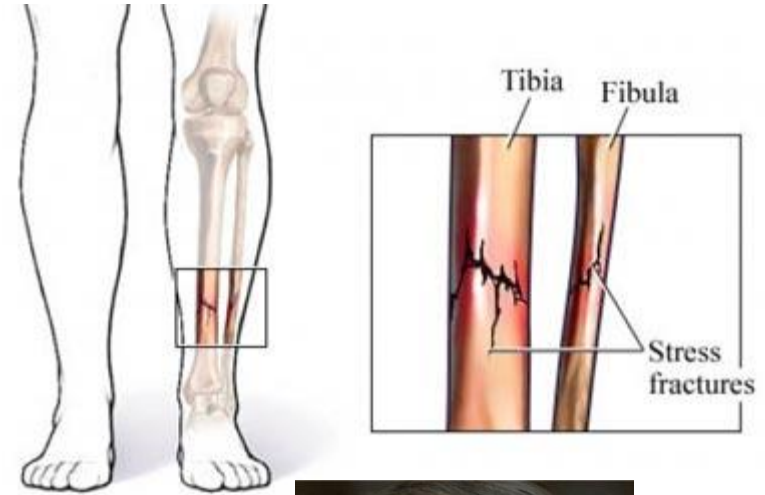
# Предотвращение перетренированности

- Оптимальное питание и гидратация
- Избегать чрезмерной монотонности в тренировках.
- Полноценный сон и систематическое планирование восстановления
- Очень важно дать спортсмену время восстановиться после болезни или травмы.

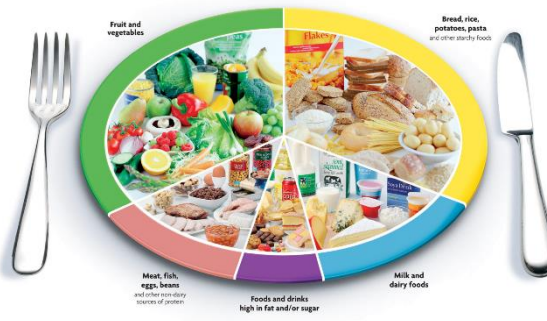


# Хронические проблемы со здоровьем

- Систематические травмы и хронические заболевания могут сделать невозможным прогресс в соревновательных результатах



# Пренебрежение восстановлением





# Избыточное восстановление

- Liz Yelling (GBR), бронза на марафоне на Играх Содружества-2006
- После начала использования ледяных ванн вырос объем выполняемой тренировочной нагрузки
- Однако результаты остались без изменений!



# Тренировки с ограничением углеводов (экзогенные углеводы; гликоген)

Улучшают адаптационный ответ в  
ответ в тренировках на  
выносливость

- Тренировки 2-3 раза в день с ограничением приема углеводов после 1-й сессии
- Утренняя тренировка натошак
- Длительная тренировка без приема углеводов
- Отказ от приема углеводов во время восстановления
- Train High – Sleep Low

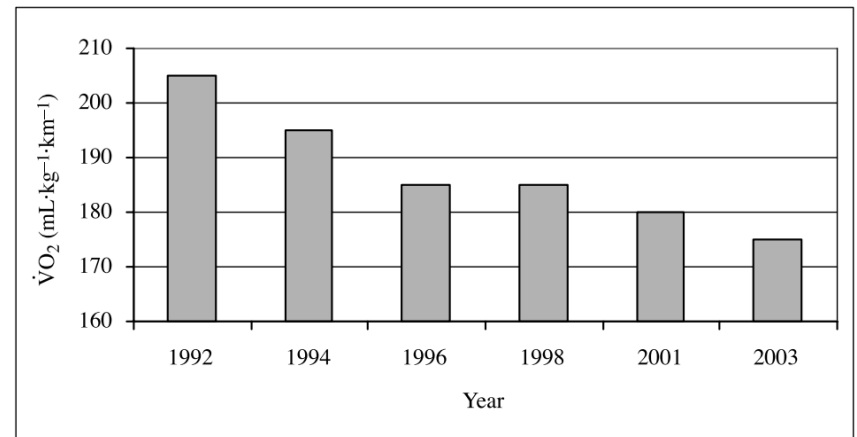
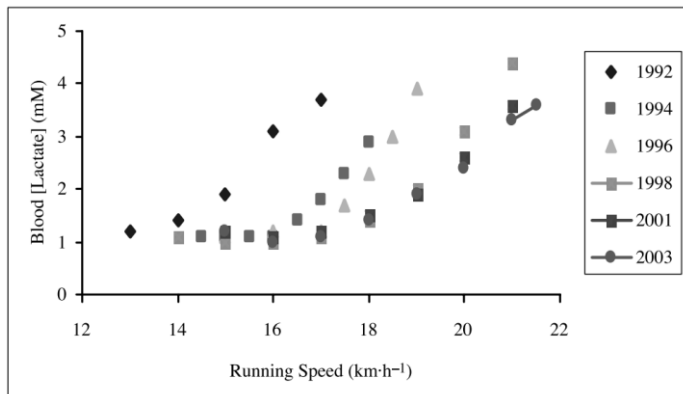
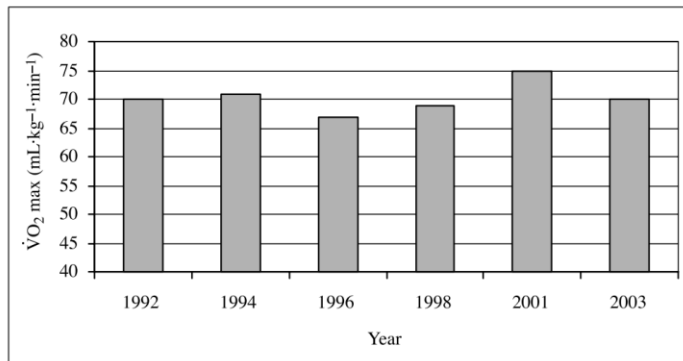


# Несбалансированная система физиологических детерминантов соревновательных результатов

- $\text{Vo2max}=62 \text{ ml/min/kg}$
- $\text{MLSS}=89\% \text{ VO2max}$
- $\text{Running economy}=191 \text{ ml/kg/km}$
- $\text{Oxygen Uptake kinetics, } \tau=11 \text{ sec}$
- $\text{Buffering capacity } 248.1 \mu\text{mol H}^+ /(\text{g muscle dw pH})$



# Пример успешного использования концепции слабых мест: Пола Рэдклифф

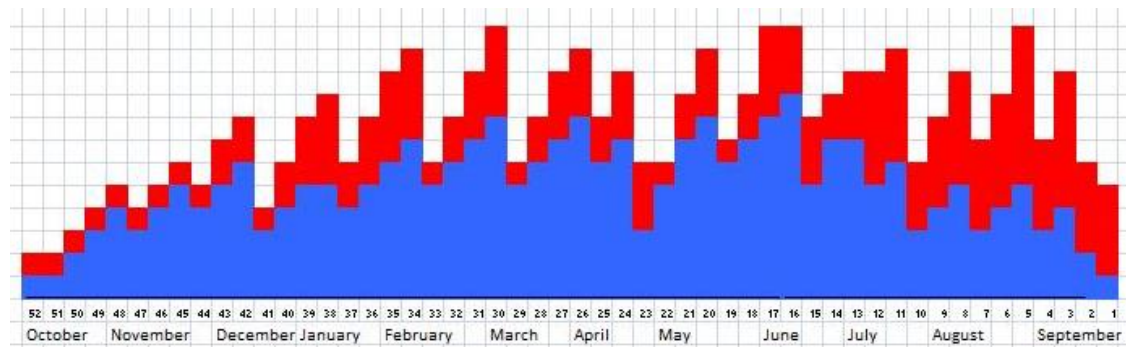


- МПК (1992-2003)  $\sim 70$  мл/кг/мин
- Скорость АНП – с 16,0 км/час (1992) до 20,0 км/час (2003)



# Принцип перегрузки (overload)

- Создание тренировочного стимула за счет увеличения тренировочной нагрузки сверх привычного уровня за счет одной из переменных:
  1. объём,
  2. интенсивность,
  3. частота тренировок.



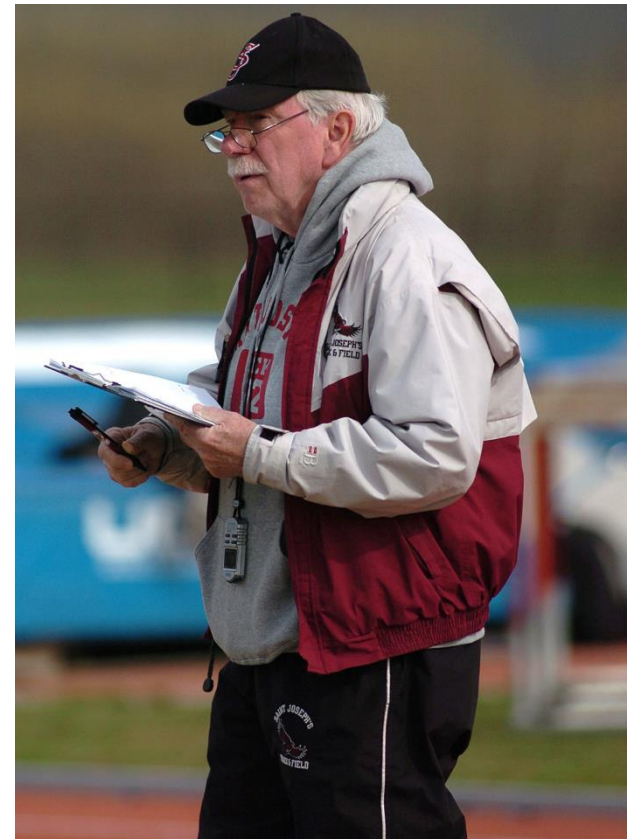
# Достижение лимита при доступном времени на тренировки



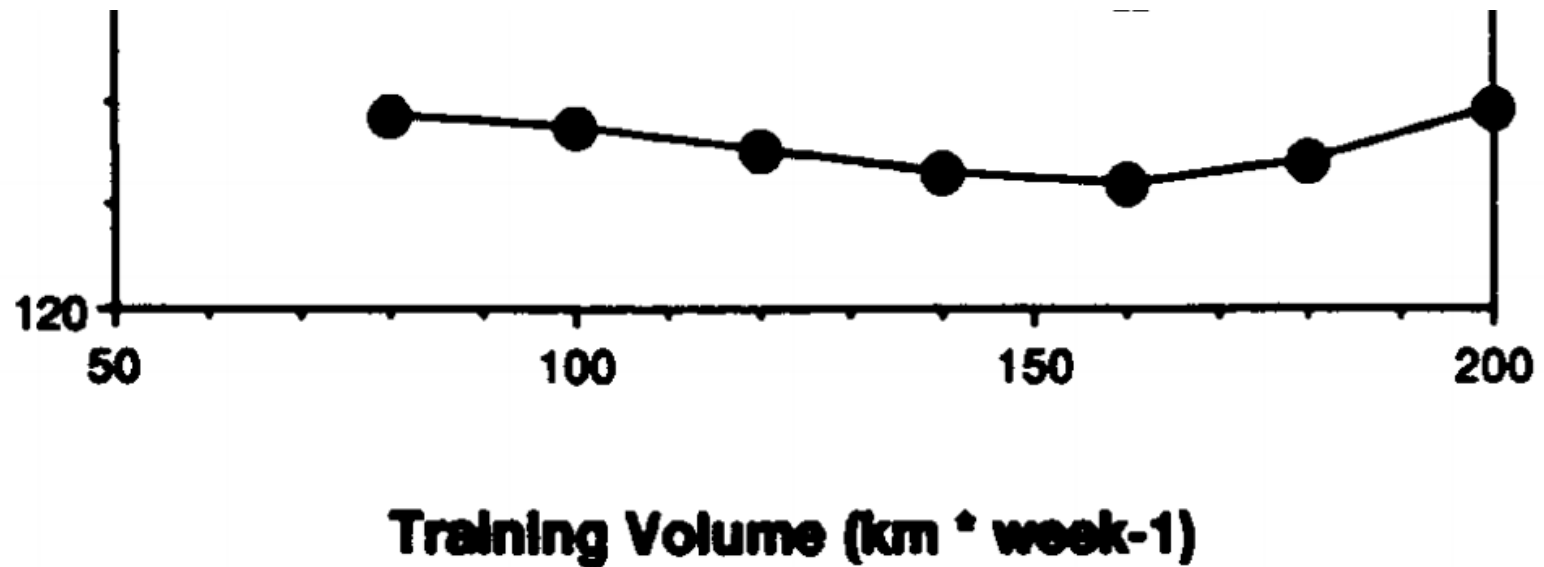
Days	Mon.	Tue	Wed.	Th.	Fri.	Sat.	Sun.
Available training time	X	X	<1 hour	X	X	<1 hour	<2 hours

# Тренировочные ошибки

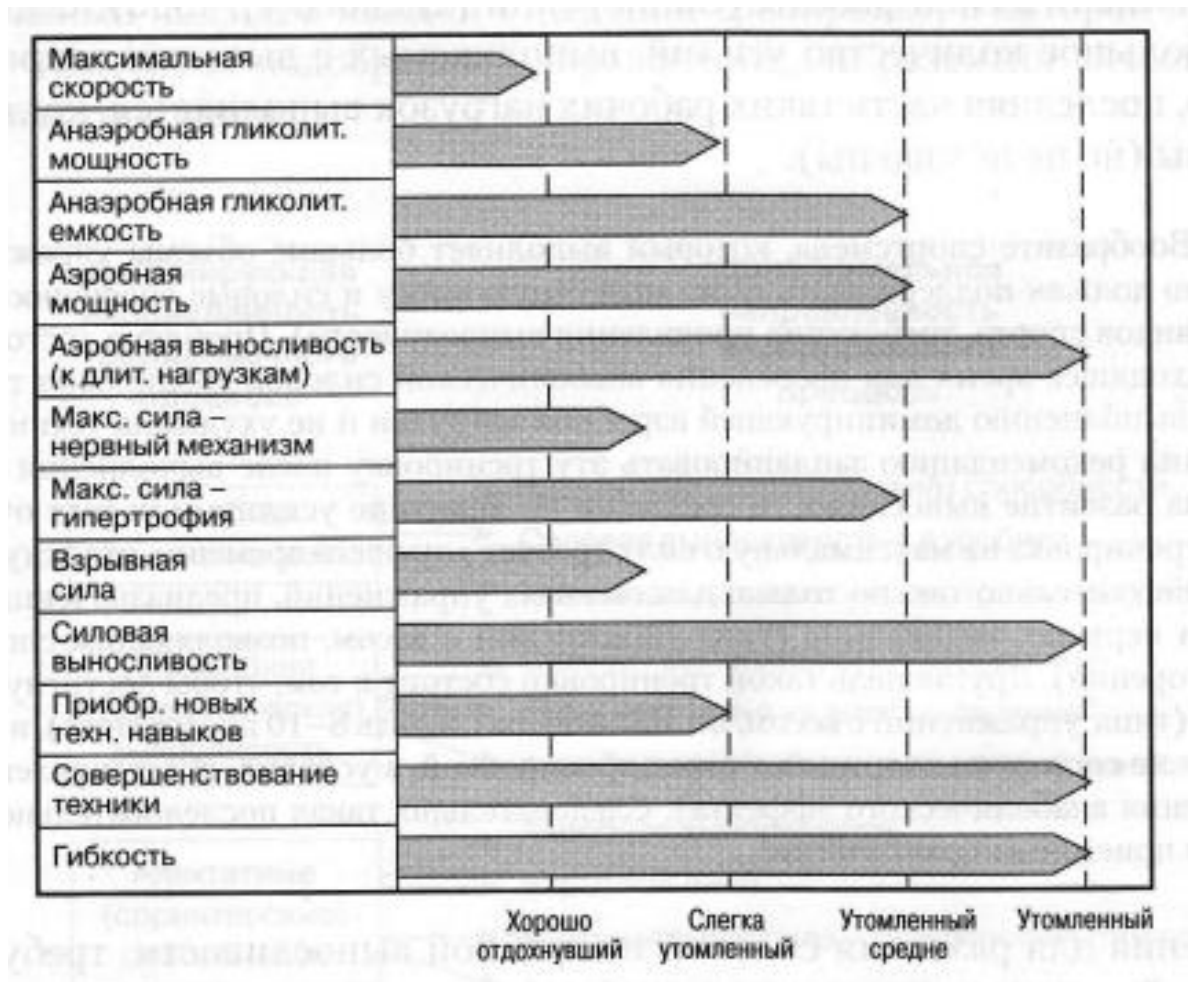
- Высокий объем тренировок в максимальной и субмаксимальной интенсивностях
- Чрезмерное число соревнований
- Избыточная монотонность тренировочной программы



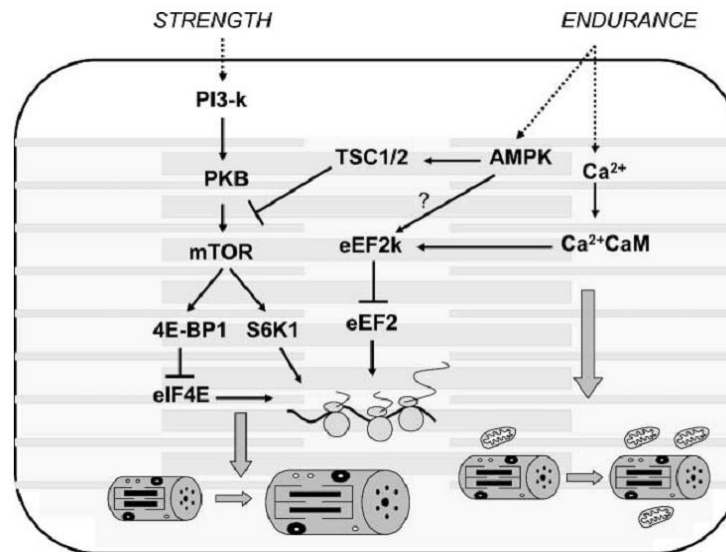
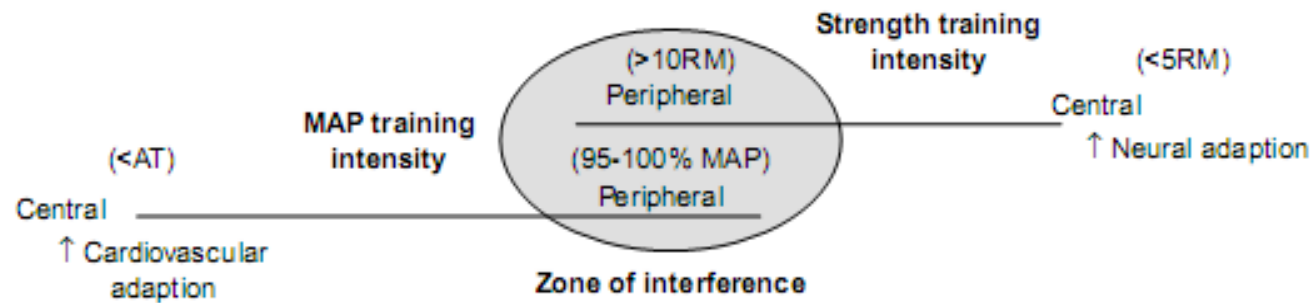
# Избыточный/недостаточный тренировочный объем



# Неподходящее время тренировочных сессий

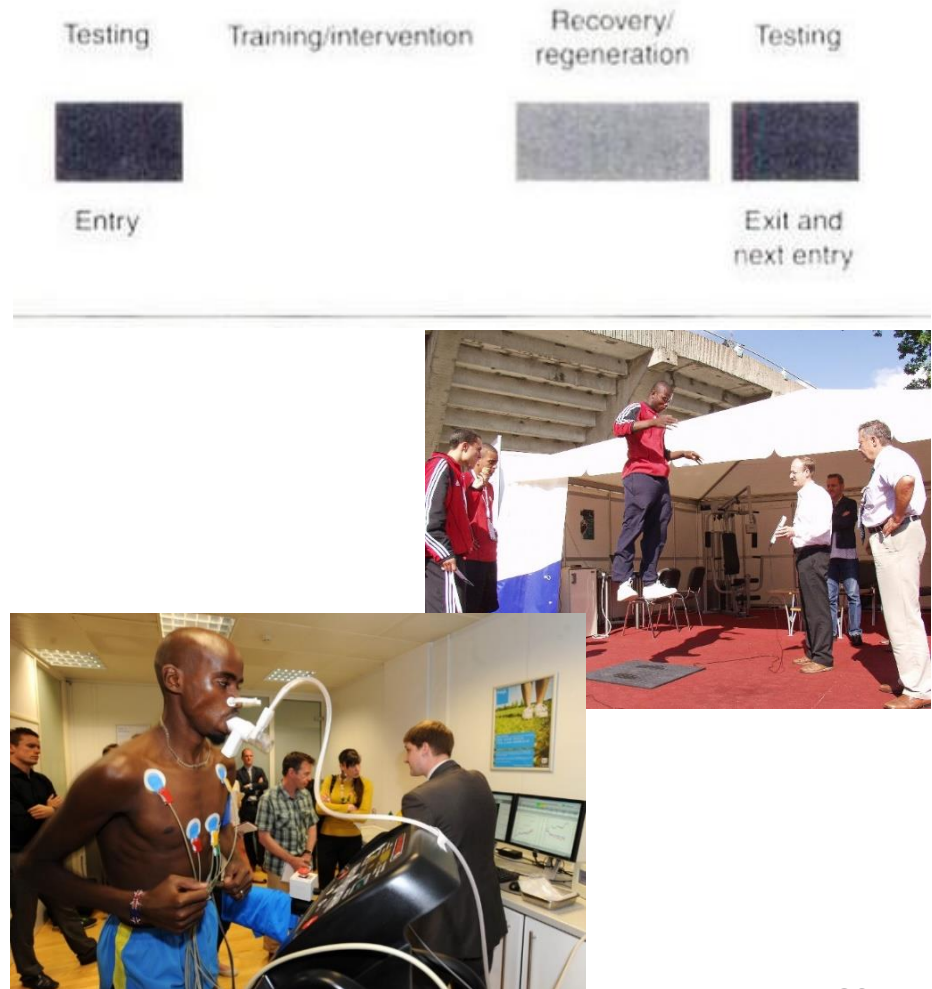


# Конфликтные механизмы адаптации



# Недостаток индивидуализации

- Полевое и лабораторное тестирования
- Тестирования на входе и выходе





# Как понять характер тренировочной программы с позиций реакций спортсмена?



## Garkavi's markers of non-specific reactions

		LEUKOCYTES (n x10 <sup>9</sup> )	LYMPHOCYTES/ LEUKOCYTES (% )	PMN NEUTROPHILES/ LEUKOCYTES (% )
TRAINING REACTION		4 - 6.5	20 - 27.5%	55 - 65%
ACTIVATION REACTION	CALM ACTIVATION	4 - 6.5	28 - 33.5%	47 - 55%
	HIGH ACTIVATION	4 - 6	More than 33.5 until 40 - 45%	less than 50%
	OVER- ACTIVATION	In the limits of norm	More than 40 - 45%	less than 50%
STRESS REACTION	ACUTE STRESS	More than 7	Less than 20%	More than 70%
	CHRONIC STRESS	Various	Less than 20%	More than 70%



# Как понять характер тренировочной программы с позиций реакций спортсмена?

Garkavi's markers of non-specific reactions with the levels of their tension

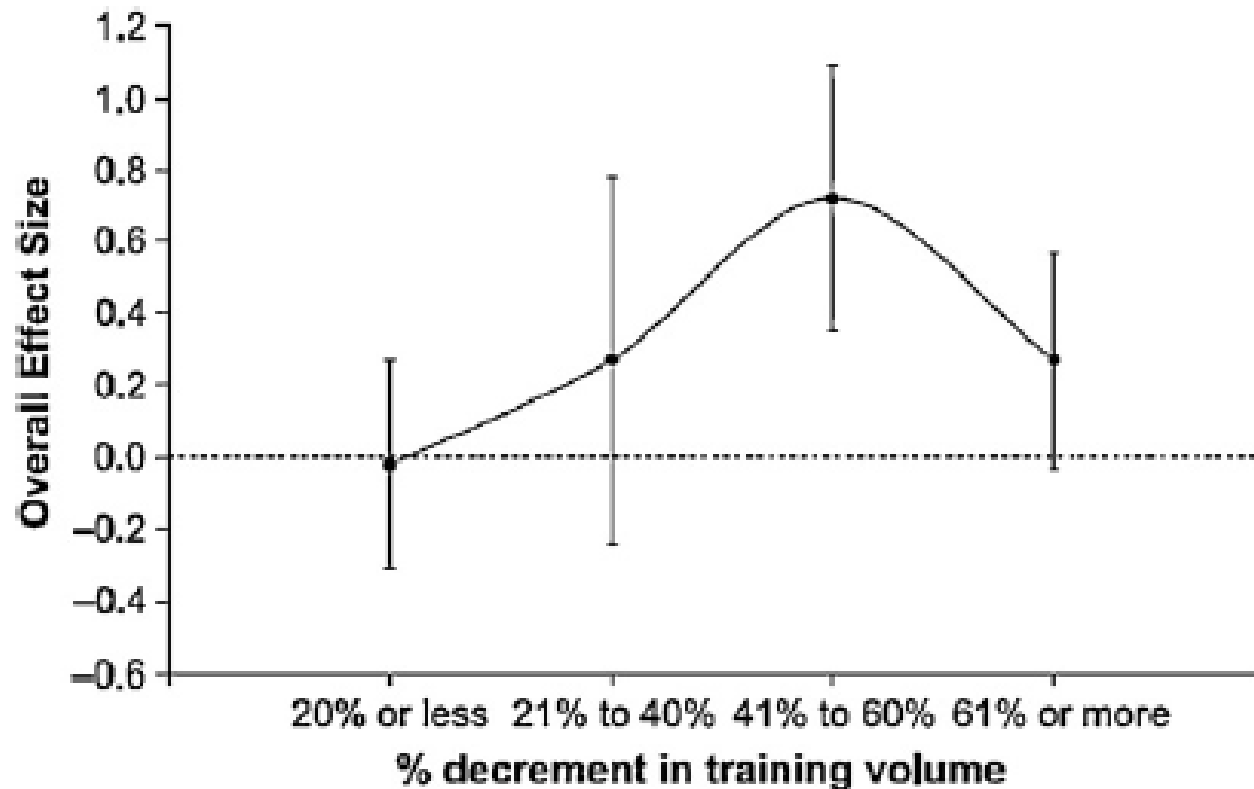


The WBC markers of non-specific reactions

The markers of their tension

	WBC DIFFERENTIAL COUNTS (%)						PMN NEUTROPHILS / LYMPHOCYTES (%)	
	BASOPHILS	EOSINOPHILS	BAND NEUTROPHILS	PMN NEUTROPHILS	LYMPHOCYTES	MONOCYTES	NORMAL FORM OF REACTION	REACTION WITH SIGNS OF TENSION
<b>TRAINING REACTION</b>	0-1	1-4	1-5	54-73	20-27	4-7	0.27-0.52	0.26-0.27 0.52-1.17
<b>ACTIVATION REACTION</b>	0-1	1-4	1-4	40-65	28-45	4-6.5	0.45-1.12	0.44-0.45 1.12-3.0
<b>CALM ACTIVATION</b>	0-1	1-4	1-4	49-65	28-33.5	4-6.5	0.45-0.64	0.44-0.45 0.64-1.43
<b>HIGH ACTIVATION</b>	0-1	1-4	1-4	40-49	34-40 (45)	4.6	0.7-1.12	0.57-0.7 1.12-3.0
<b>STRESS REACTION</b>	0-1	0-4	1-7	62-82	6-19.5	4-8	0.07-0.31	0.31-0.58

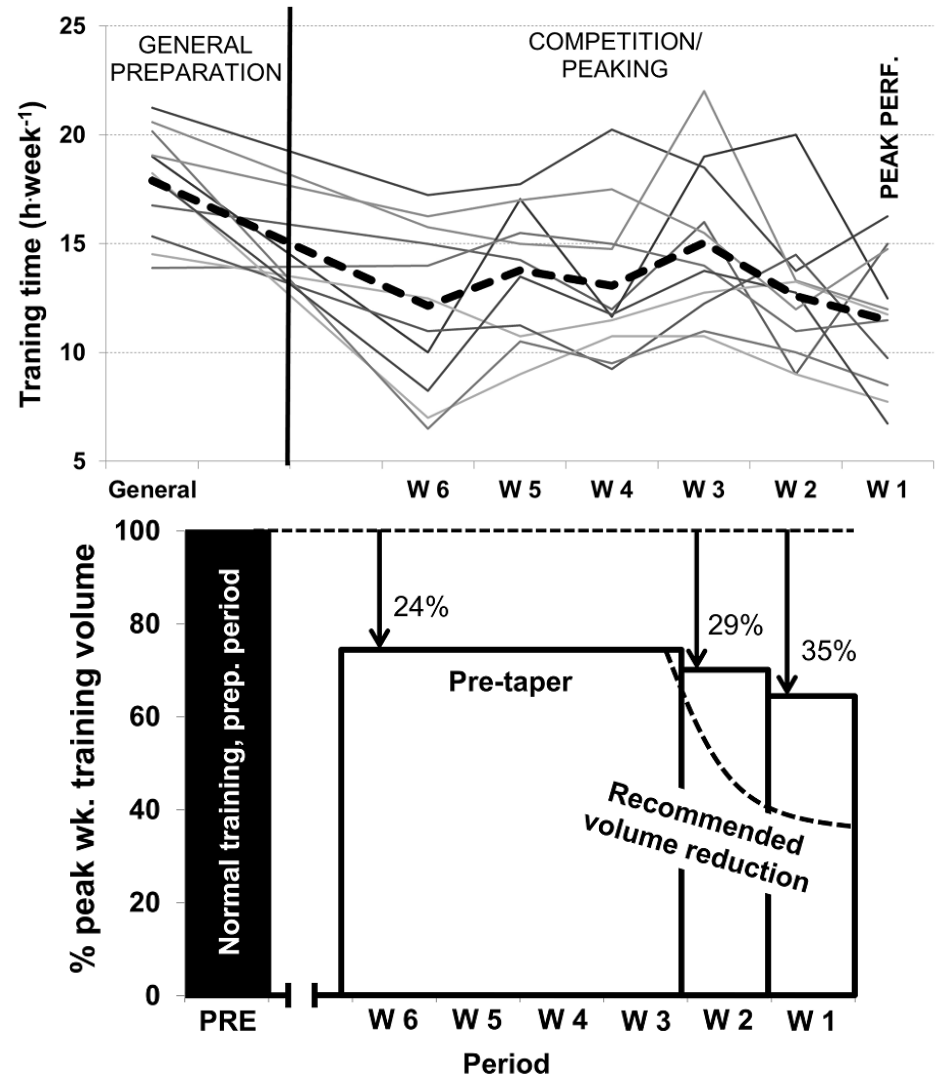
# Ключевые параметры подводки: объем – 40-60%



- Bosquet, L., et al. (2007). "Effects of tapering on performance: a meta-analysis." Med Sci Sports Exerc **39**(8): 1358-1365

# Подводка норвежских олимпийских чемпионов в биатлоне лыжных гонках

- Две фазы.
- В 1 фазе (за 6 недель до главного старта) - некоторое снижение объема на ~24% (и дальнейшее его удержание) при сохранении практически неизменными других тренировочных переменных.
- На 2 фазе подводки объем сокращался еще на 30%



# Ключевые параметры подводки:

## продолжительность

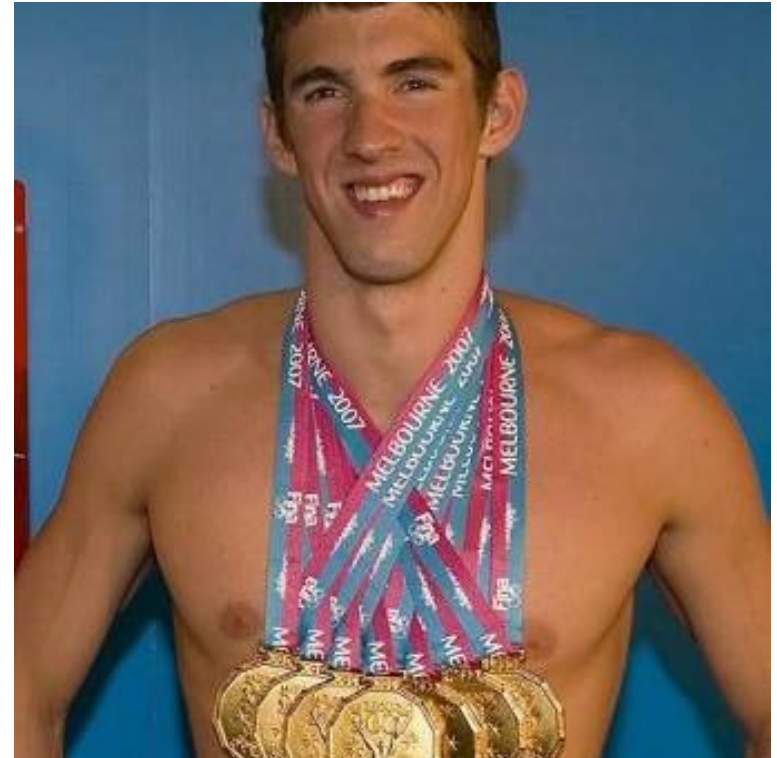
- оптимальная продолжительность подводки - от 7 до 14 дней.
- Однако эта продолжительность определяется главным образом характером и напряженностью предшествующей подводке тренировочной программы.
- Если подводке предшествовал ударный блок тренировок с повышенными тренировочными нагрузками, то продолжительность подводки должна возрасти



# Ключевые параметры подводки:

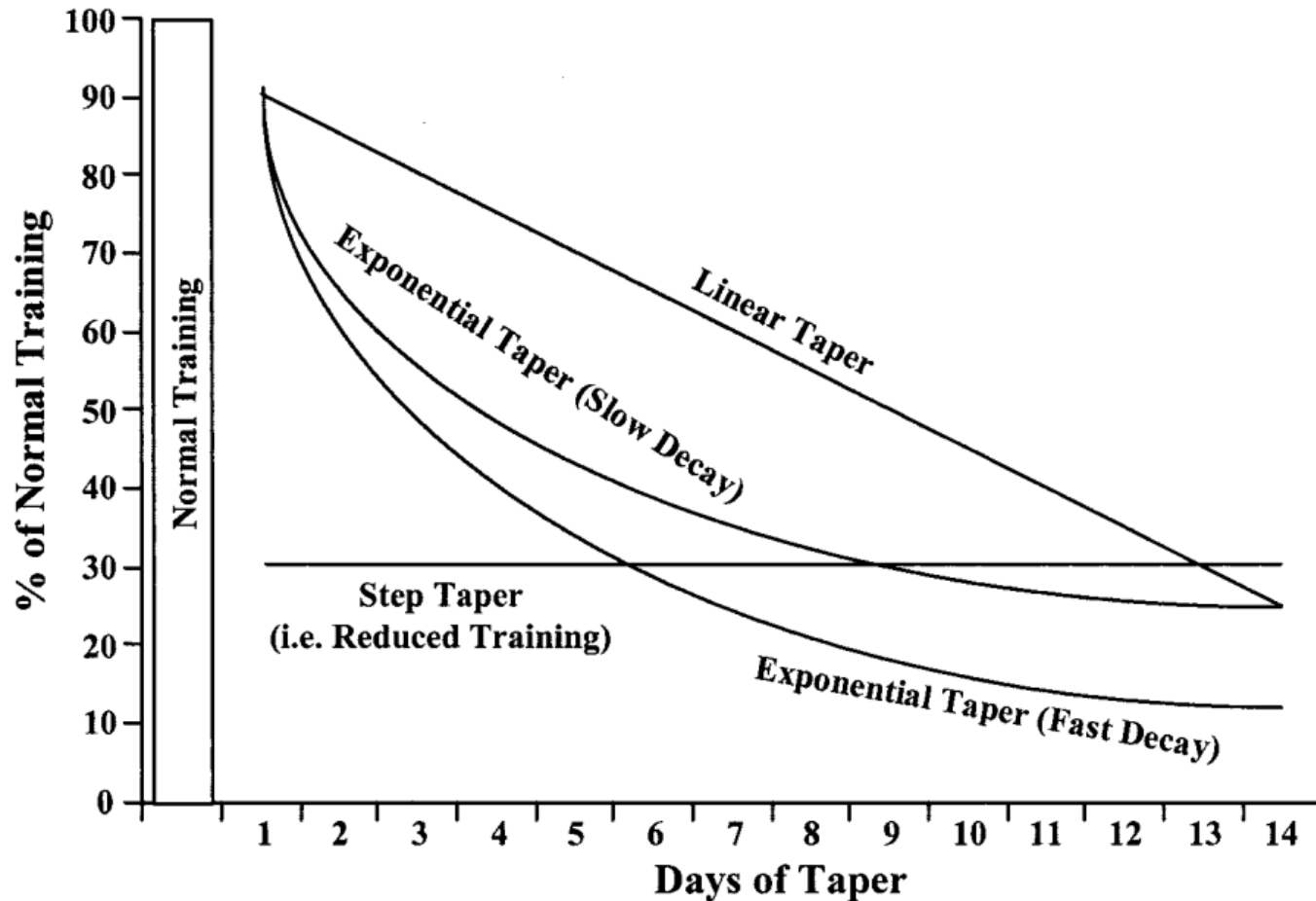
## частота

- частота занятий должна остаться неизменной или немного сократиться
- Важно поддержать частоту занятий особенно для видов спорта, где задействуются сложные координационные навыки или локомоции (маунтинбайк, лыжные гонки, плавание и т.п.). Существенное снижение частоты занятий при общем снижении тренировочного объема привело бы у элитных спортсменов к частичной утрате «чувства воды», некоторой утрате навыков.
- Норвежские олимпийские чемпионы: Небольшое снижение в частоте (10%)



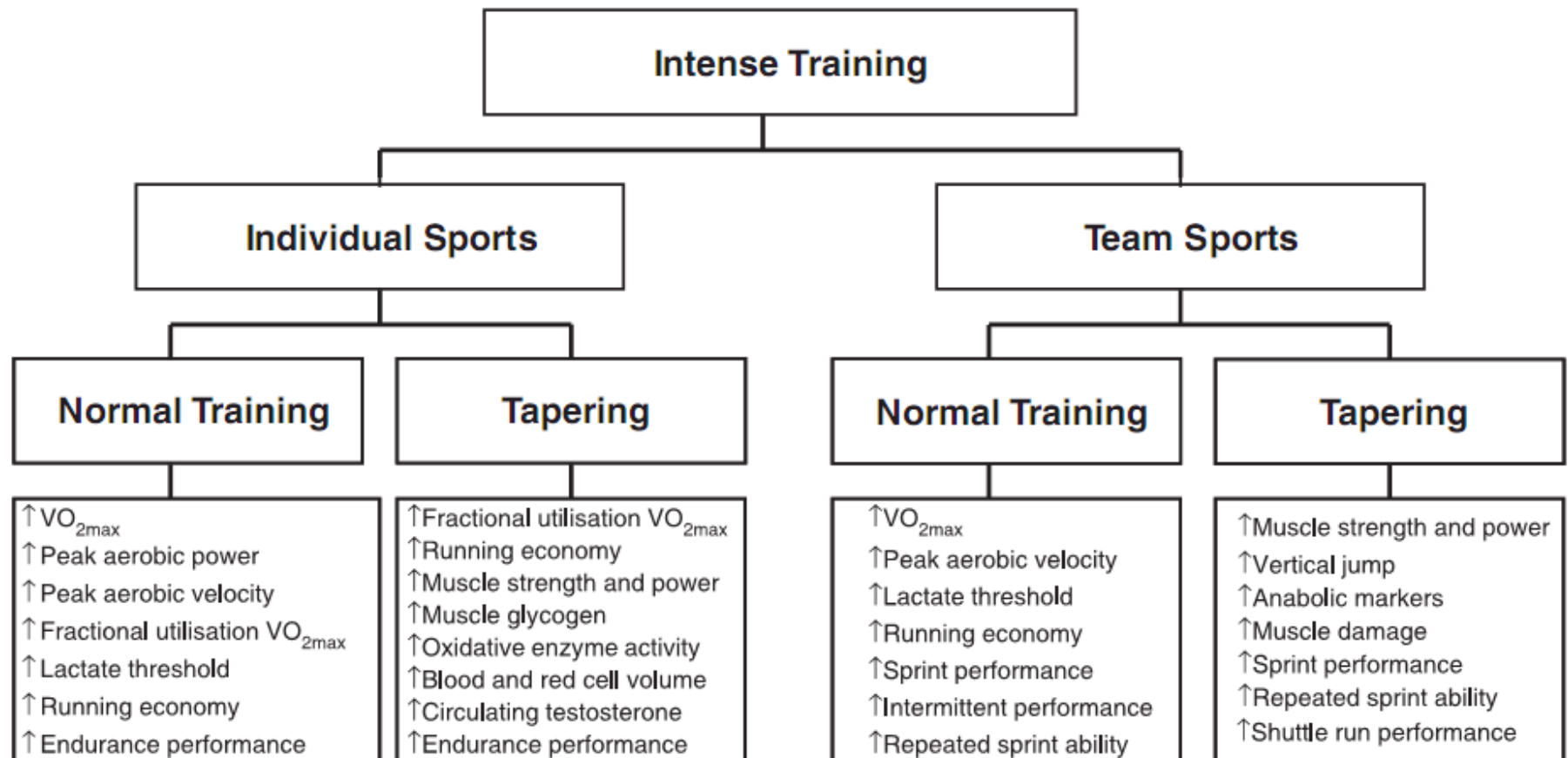
# Ключевые параметры подводки: тип ПОДВОДКИ

- Большая эффективность экспоненциальной подводки по сравнению со ступенчатым сбросом объема



# Ключевые параметры подводки:

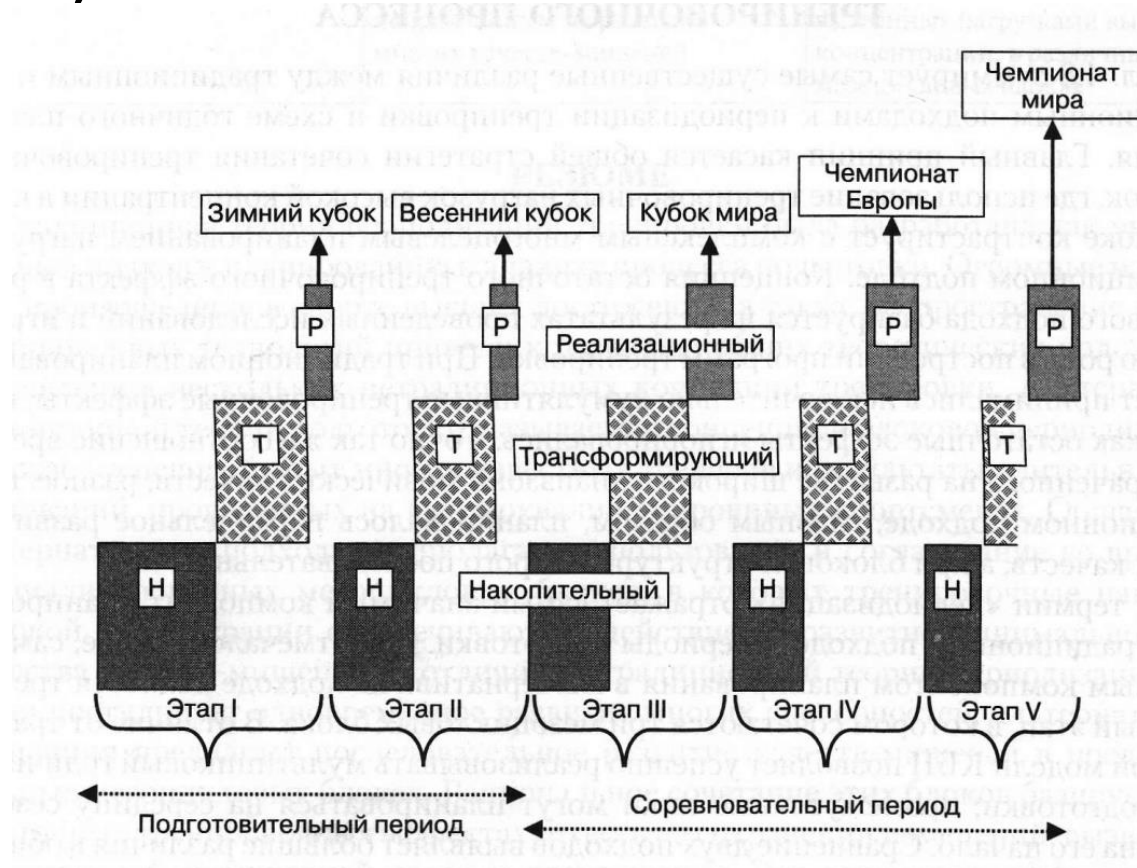
## ИНТЕНСИВНОСТЬ – ключевое значение



Mujika, I. (2010). "Intense training: the key to optimal performance before and during the taper." Scandinavian Journal of Medicine & Science in Sports **20 Suppl 2**: 24-31.

# Способы уйти с плато результатов

- Блоковая периодизация (Верхошанский, Иссурин)





# «Ударные» микроциклы

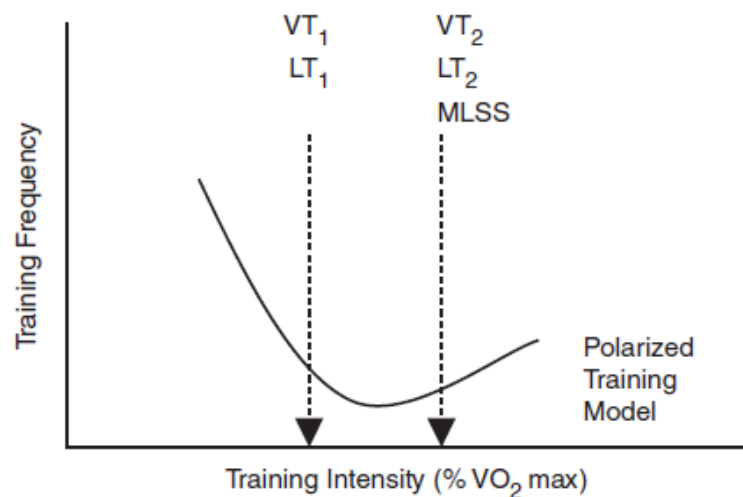
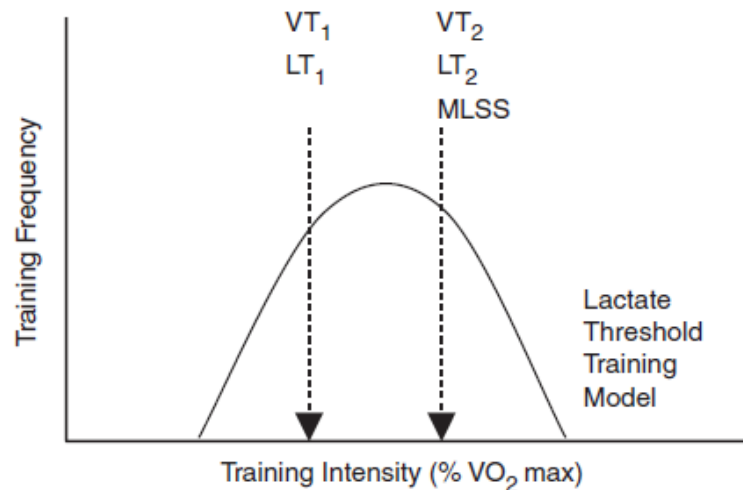
- Высокоинтенсивные шоковые блоки (*crash training*), продолжительностью до 13 дней, представляют собой возможный способ сдвинуть результаты с плато для хорошо тренированных и элитных спортсменов.
- Однако за подобным шоковым блоком обязательно должен следовать восстановительный микроцикл как минимум сходной продолжительности



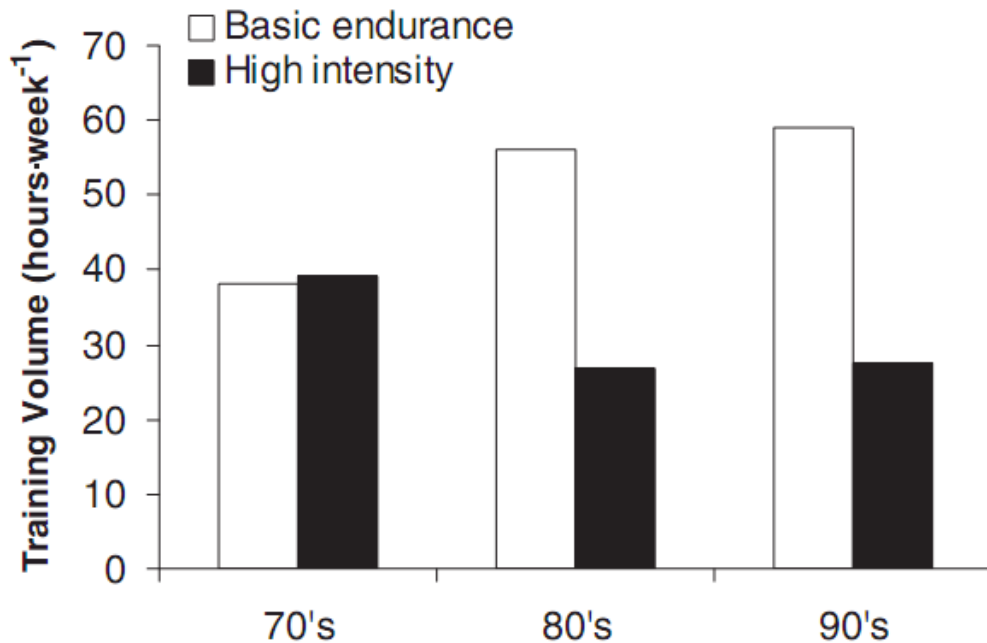
Wahl P, Güldner M, Mester J: Effects and Sustainability of a 13-Day High-Intensity Shock Microcycle in Soccer. *Journal of sports science & medicine* 2014, 13(2):259.

Breil FA, Weber SN, Koller S, Hoppeler H, Vogt M: Block training periodization in alpine skiing: effects of 11-day HIT on VO<sub>2</sub>max and performance. *Eur J Appl Physiol* 2010, 109(6):1077-1086.

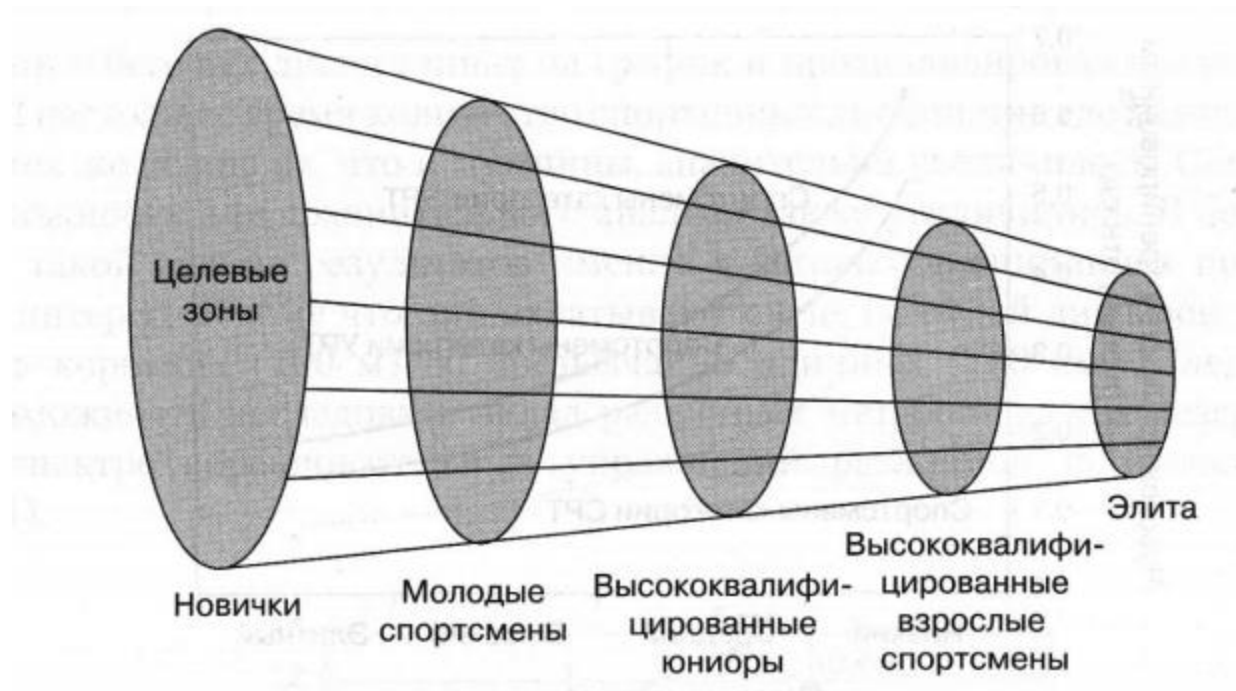
# Пороговая и поляризационная тренировочные модели



# Общее распределение тренировочных объемов норвежских гребцов по десятилетиям



# Принцип сужения



# Принцип специфичности: Симуляторы





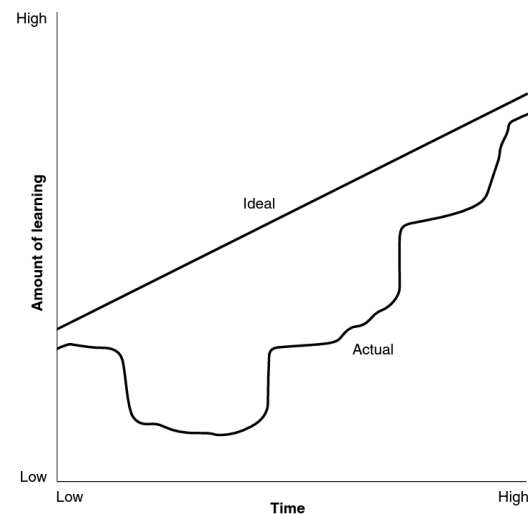
# Способы уйти с плато результатов

- Использование инновационных технических решений



# Плато результатов из-за застоя в технике

- Превращение любых тренировок и соревнований в просмотрные пагубно для прогресса
- Прогресс останавливается при достижении автоматизации навыка, т. н. точки ОК.



# Для сдвига нужны «ОСМЫСЛЕННЫЕ тренировки»

- Наличие точно сформулированных специфичных задач
- Информативная обратная связь
- Возможность повтора и исправления ошибки
- Фокус на сложных, плохо получаемых моментах
- Полная концентрация внимания





- Плато результатов является феноменом, с которым сталкиваются практически все спортсмены в своей карьере
- Причины плато результатов многогранны
- Существуют подходы, которые способны «сдернуть» спортсмена с плато результатов



- Самостоятельное применение данных рекомендаций может нанести вред вашему здоровью.
- Для грамотного применения данных рекомендаций обращайтесь к специалистам ***Центра спортивных инновационных технологий и подготовки сборных команд***

