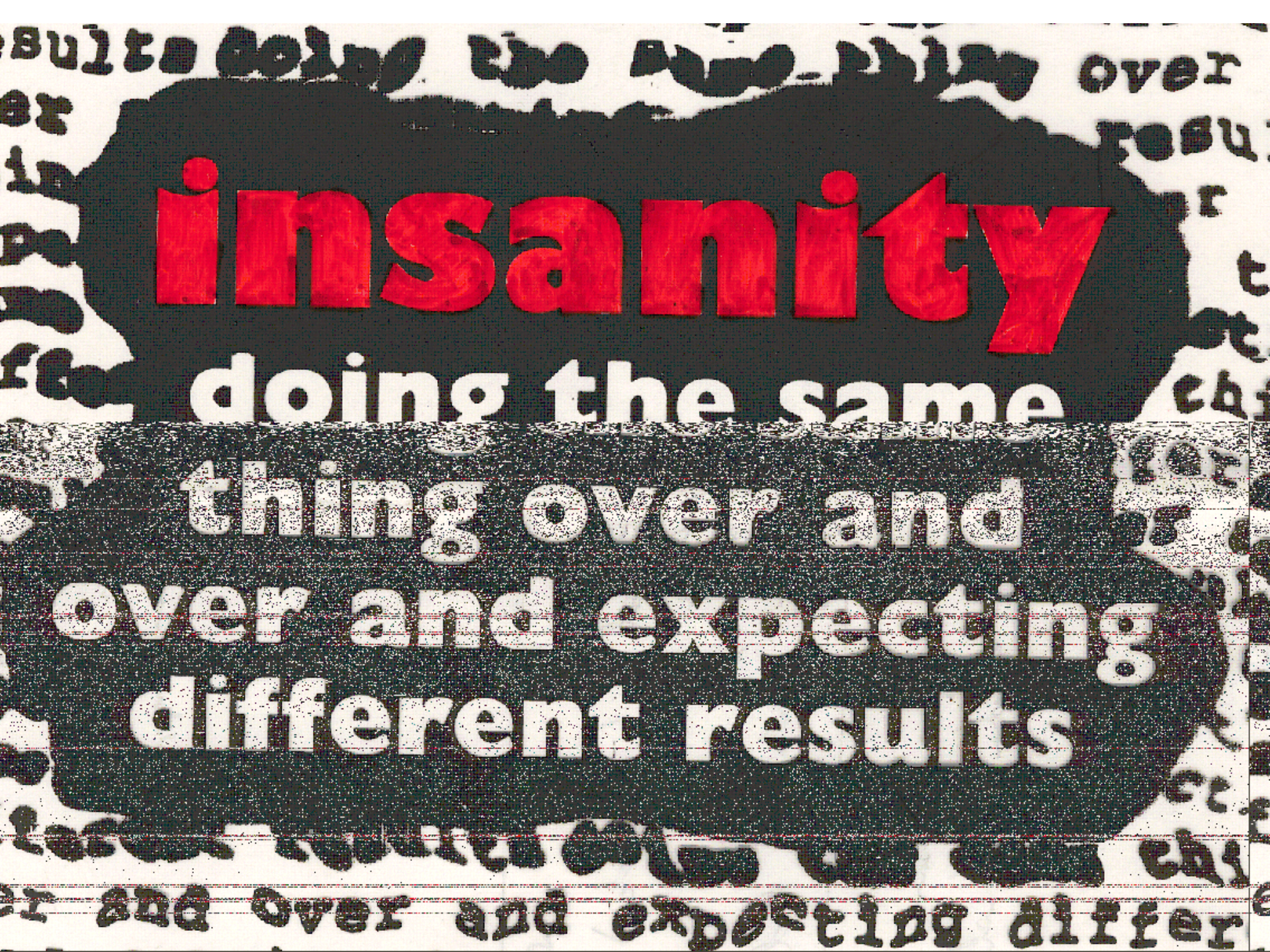
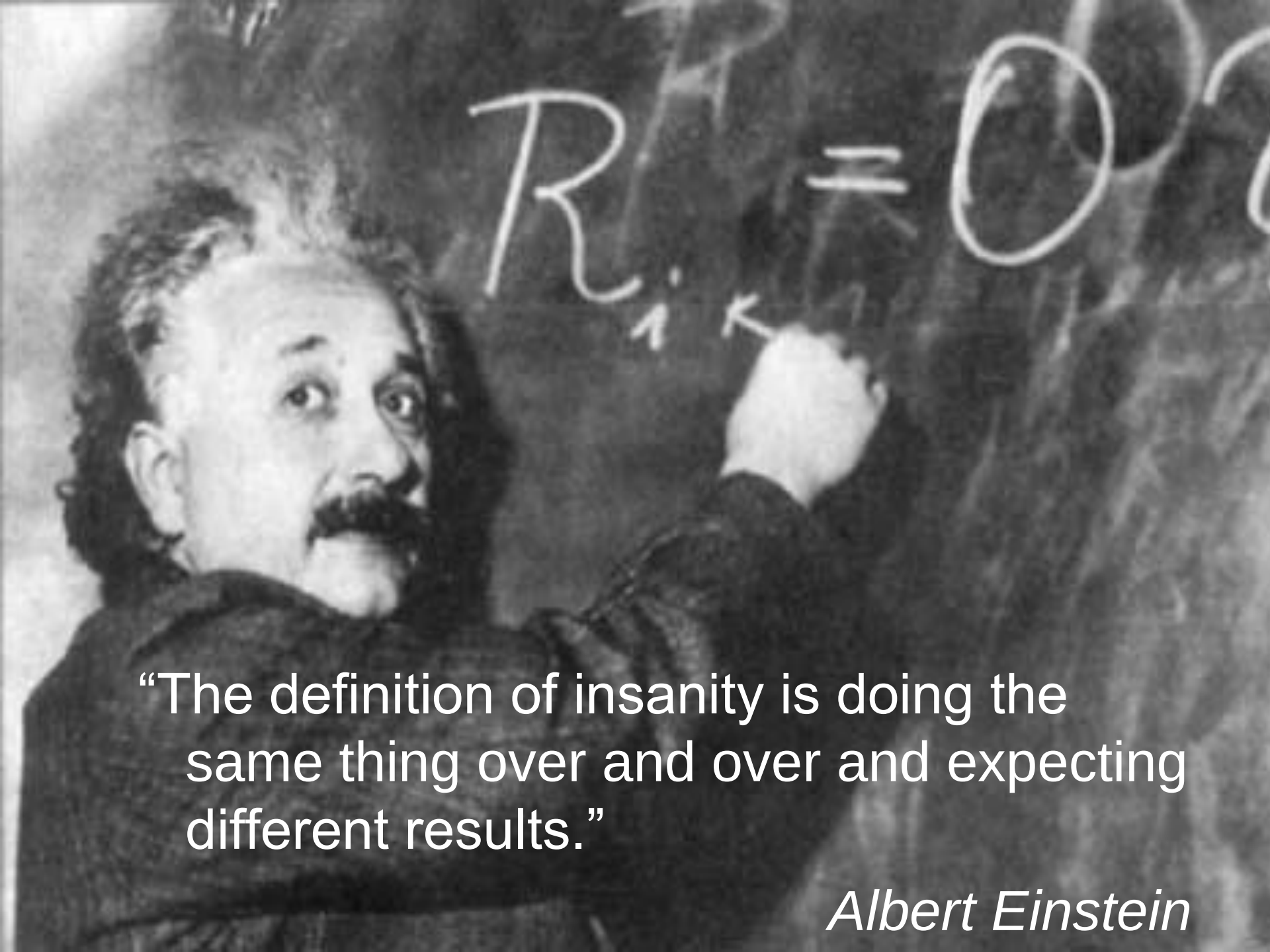
Coaching the Adolescent Athlete, Interpreting Growth Data, Implementing Reactive Periodization in the T2T Stage

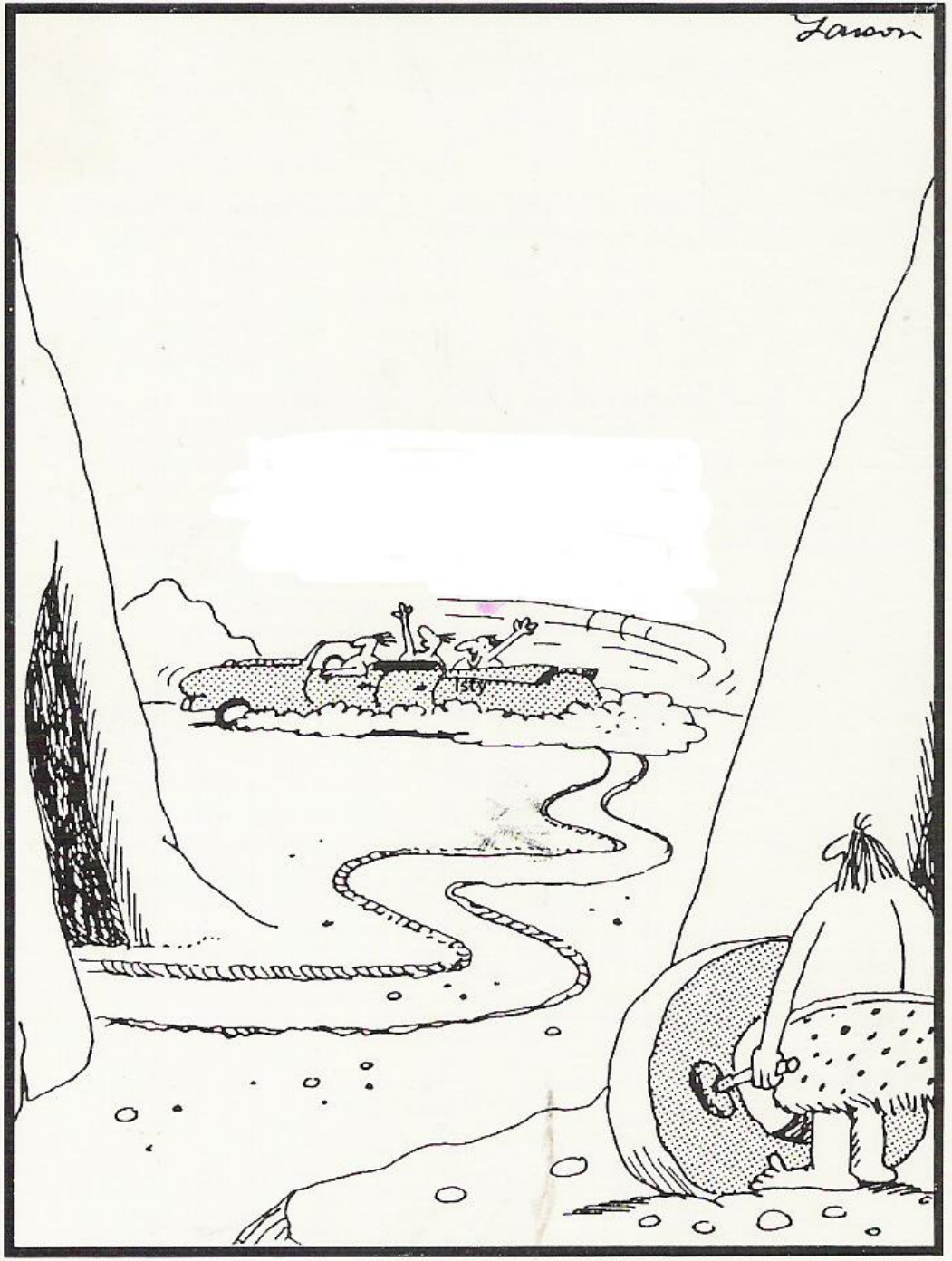
Istvan Balyi
National Coaching Institute BC
Sport Canada

Objectives

- Introduction
- Monitoring growth – why?
- Biomarkers
- Trainability
- What is reactive periodization
- How to do it? Program planning


insanity
doing the same
thing over and
over and expecting
different results

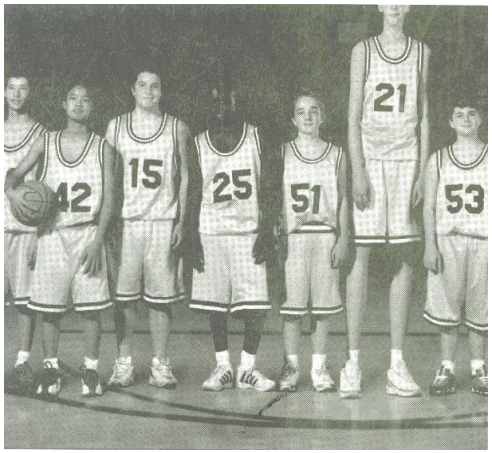

"The definition of insanity is doing the same thing over and over and expecting different results."
Albert Einstein


Jason
1st!


I can't smell a damn thing.

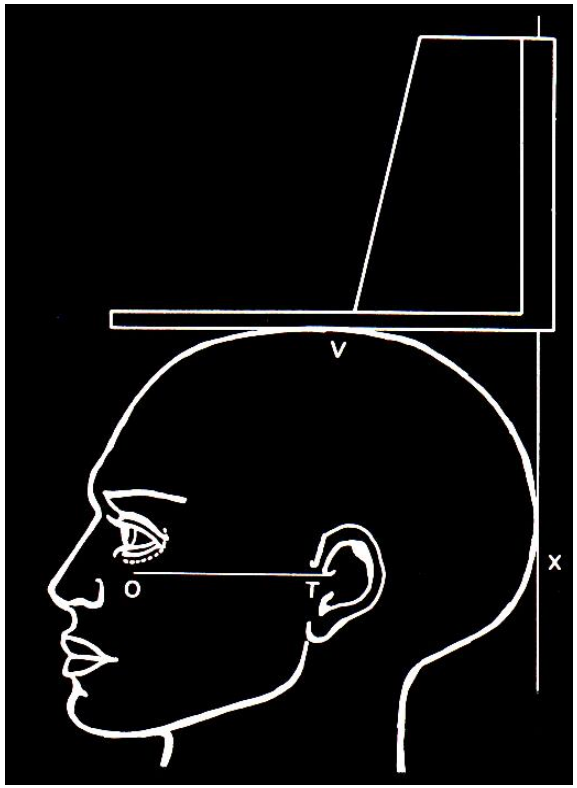

I can't smell a damn thing.

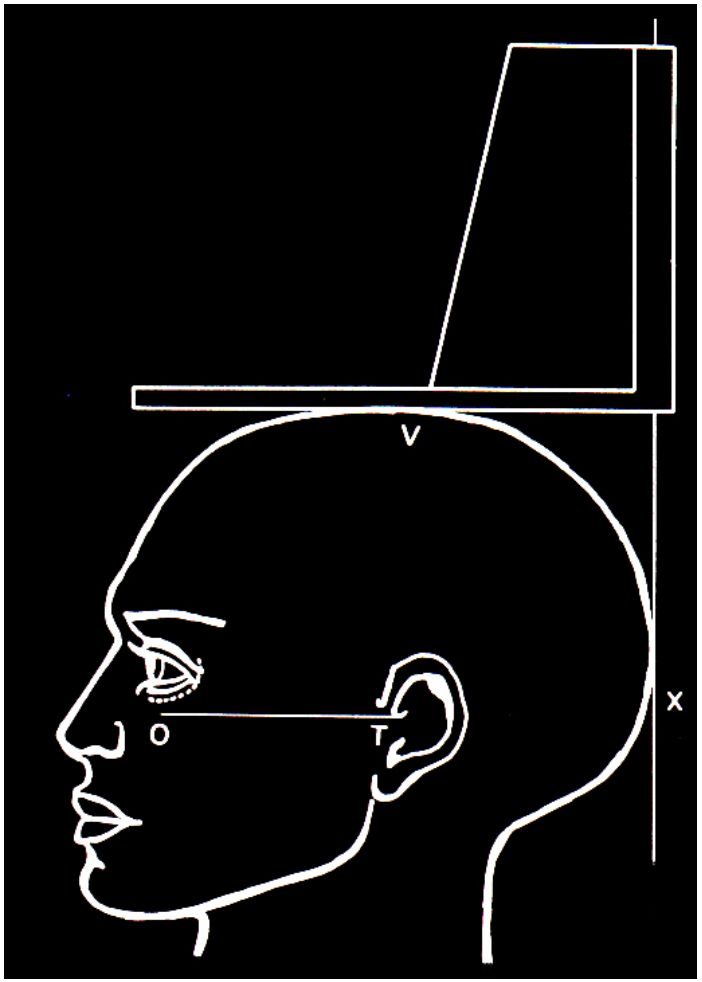
Growth & Development, Maturation



- **Age**
- **Chronological age**
- **Relative age**
- **Skeletal age**
- **Developmental age**
- **Training age**
- **Sport-specific training age**

Measuring and interpreting PHV
(How to PHV ?)





The orbitale (O) is located on the lower or most inferior margin of the eye socket. The tragion (T) is the notch above or superior to the tragus or flap of the ear, at the superior aspect of the zygomatic bone. This position corresponds almost exactly to the visual axis when the subject is looking directly ahead.

- **Standing height**
- **Sitting height**
- **Arm span**

- **Which part of the body is growing?**
- **Legs**
- **Arms**
- **Trunk**
- **Peak weight velocity**

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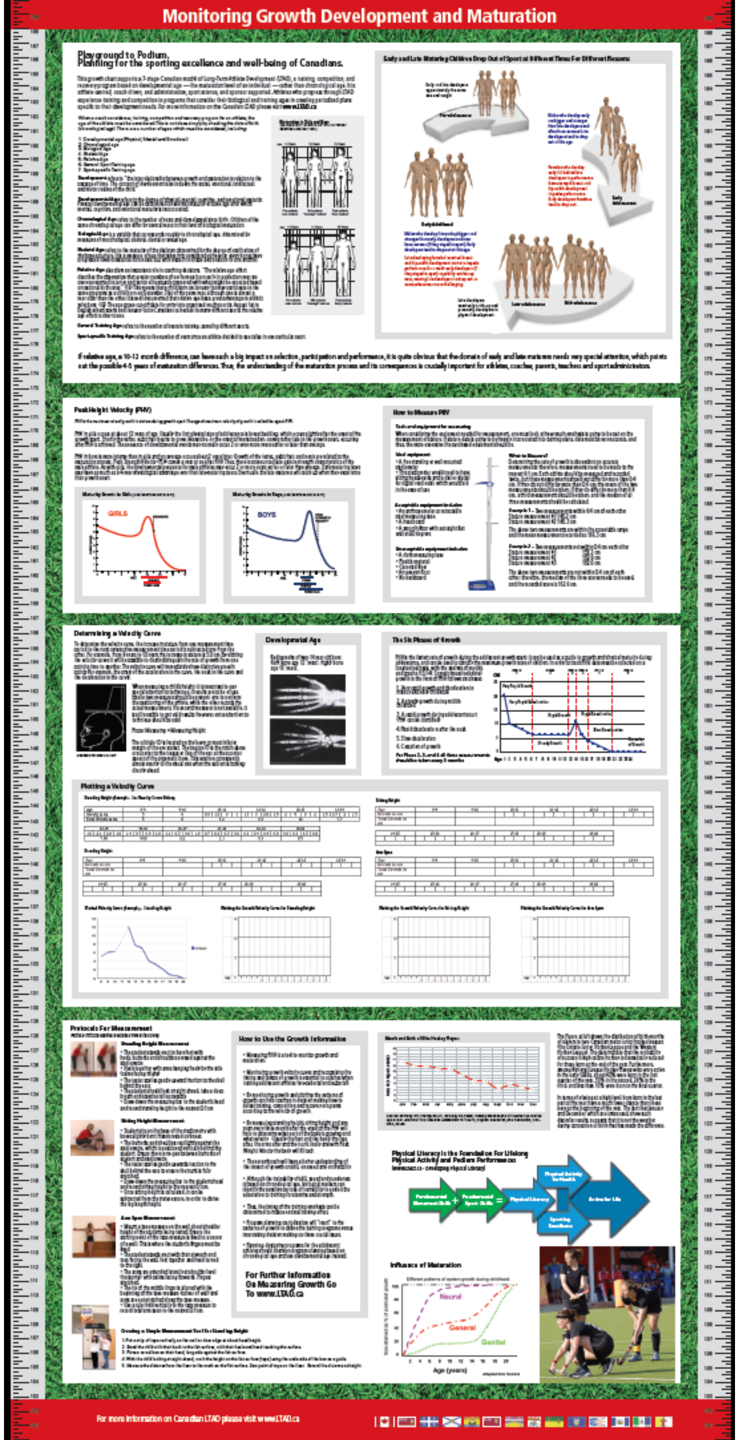
Canadian Sport For Life

The Role of Monitoring Growth in Long-Term Athlete Development

Istvan Balyi & Richard Way



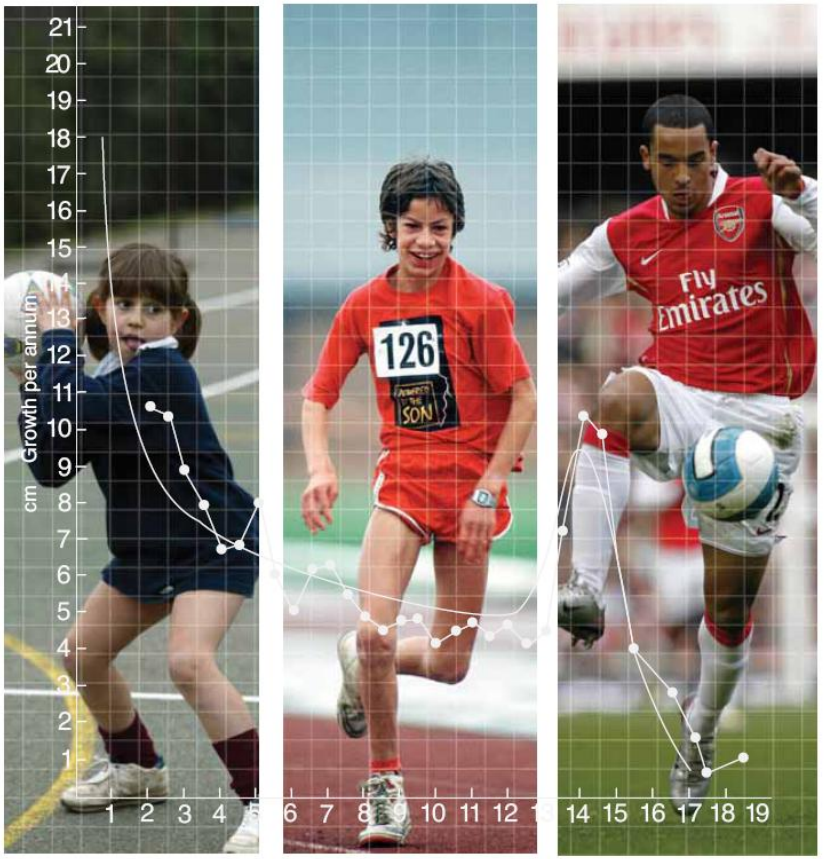
Canadian Sport for Life

ISBN: 978-1-905540-37-2

COACHING THE YOUNG DEVELOPING PERFORMER

Tracking Physical Growth and Development to Inform Coaching Programmes

Istvan Balyi and Assoc. Prof. Craig Williams



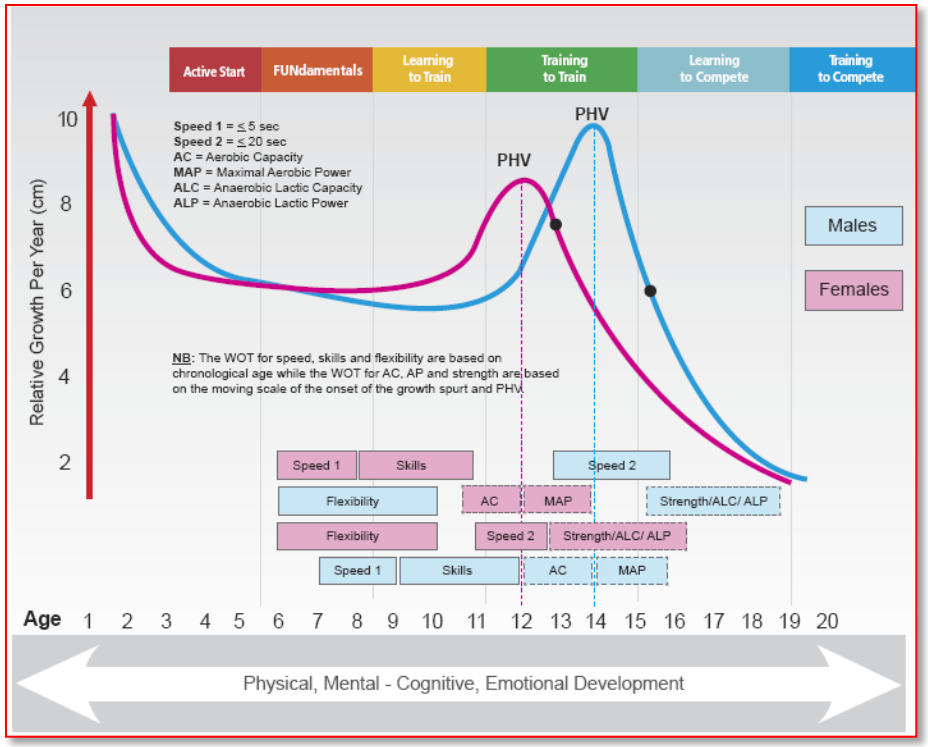
Canadian Sport for Life

ltad
long-term athlete development

sports coach UK
The National Coaching Foundation
Great Coaches...Great Sport

Trainability

- **Accelerated adaptation to training**
- **"Sensitive" Periods**



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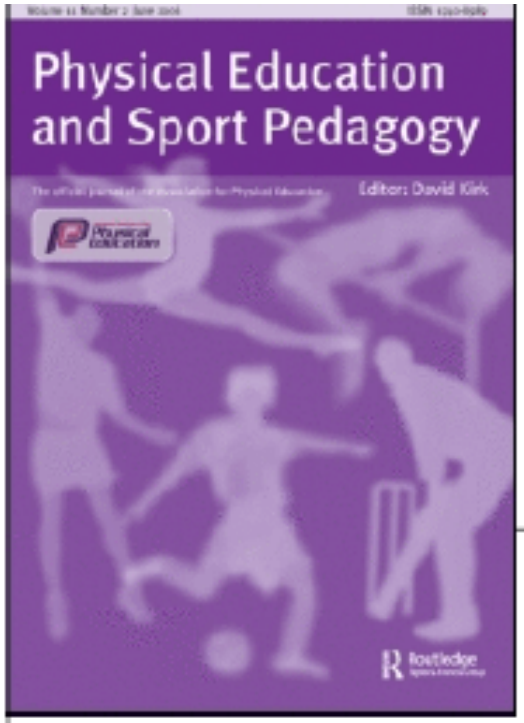
Trainability:

- **Based on chronological age:**
  - **Speed**
  - **Suppleness**
- **Based on developmental age**
  - **Skill**
  - **Stamina**
  - **Strength**
- **Biomarkers**
  - **onset of PHV**
  - **PHV**
  - **onset of menarche**

- **Sensitive periods are a time of increased opportunity to positively affect development**

- **Window of opportunity for "accelerated adaptation to training" – Viru, 1998 & 1999**



Physical Education & Sport Pedagogy

Publication details, including instructions for authors and subscription information:
http://www.informaworld.com/smpp/title~content=t713674664

Critical Periods in the Development of Performance Capacity During Childhood and Adolescence

Atko Viru; Jaan Loko; Maarike Harro; Anne Volver; Livian Laaneots; Mehis Viru

Online Publication Date: 01 January 1999

To cite this Article: Viru, Atko, Loko, Jaan, Harro, Maarike, Volver, Anne, Laaneots, Livian and Viru, Mehis (1999) 'Critical Periods in the Development of Performance Capacity During Childhood and Adolescence', Physical Education & Sport Pedagogy, 4:1, 75 — 119

To link to this article: DOI: 10.1080/1740898990040106

URL: http://dx.doi.org/10.1080/1740898990040106

The Trainability of the Five S's
Endurance

- **Always trainable**
- **Sensitive period - window of accelerated adaptation to stamina**
- **On-set of PHV = aerobic capacity**
- **PHV peak (deceleration of growth) aerobic power**

Kobayashi et al.

Aerobic power as related to body growth and training in Japanese boys: a longitudinal study

Journal of Applied Physiology, Issue 5, 666-672, 1978

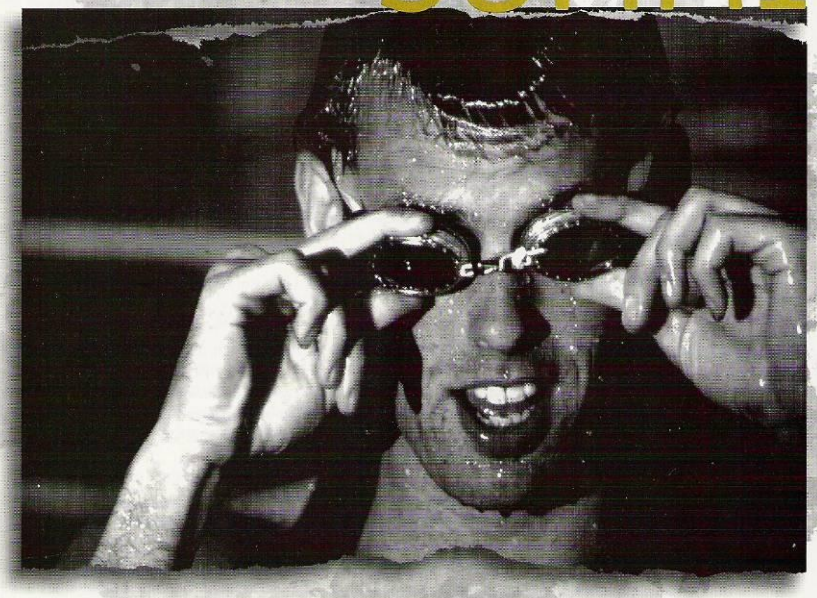
- **A remarkable increase in aerobic power was not observed in trained boys before the age of PHV.**
- **Beginning approximately 1 yr prior to the age of PHV and thereafter, training effectively increased aerobic power above the normal increase attributable to age and growth.**

Rushall, B. The Growth of Physical Characteristics in Male and Female Children.

In: Sports Coach, Australia. Vol.20. No 64, Summer, 1998. pp. 25 – 27.
(Electronic Version)

- **"… studies at the International Centre for Aquatic Research in Colorado Springs have shown that swimmer's aerobic capacity reaches its ceiling level at the time of the onset of the adolescent growth spurt."**

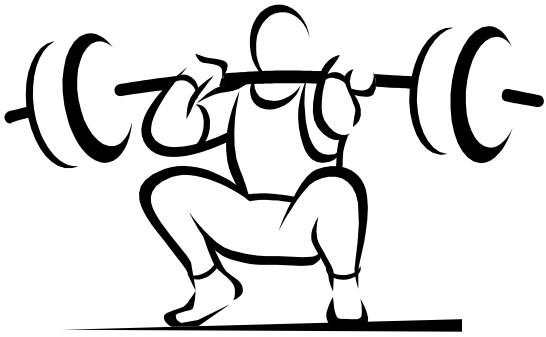
SPORT science SUMMIT



USA SWIMMING

The Trainability of the Five S's Strength:

- **Always trainable**
- **Sensitive period - window of accelerated adaptation to strength training:**
- **Window 1 for females immediately after PHV**
- **Window 2 for females with the onset of menarche**
- **12 – 18 month after PHV for males**



The Trainability of the Five S's Speed:

- **Always trainable but declines with age**
- **Sensitive period - window of accelerated adaptation to speed training (Viru, 1995: Borms, 1986):**
- **Males:**
  - **Window 1: 7 - 9 years of age**
  - **Window 2: 13 – 16 years of age**
- **Females:**
  - **Window 1: 6 – 8 years of age**
  - **Window 2: 11 – 13 years of age**
  - **(Chronological age)**
- **Paradigm shifts in coaching – speed all year ro**

Speed

- **Window 1 is agility, quickness window.**
- **Change of direction, linear, lateral and multi directional speed**
- **Segmental speed**
- **Duration of intervals less then 5 seconds**

- **Window 2 is anaerobic alactic power and capacity window**
- **Linear, lateral, multi directional and chaotic speed**
- **Duration of intervals 5 – 20 seconds**

- **It should be noted that speed should be trained all year round regardless of the annual phases of training**
- **It should be trained at the end of the warm-up (no CNS or metabolic fatigue) – thus, no interference with any other training activity and the volume should be low**
- **Appropriately periodized “block” speed training should be implemented within the annual cycle**
- **These speed training blocks should be longer during the sensitive periods for speed training**

The Trainability of the Five S's Skill

- **Always trainable but significantly declines with age**
- **Window of accelerated adaptation to motor coordination**
- **Age 8 – 11 females**
- **Age 9 – 12 males**

- **More precisely before the onset of the Growth Spurt – 11, 12, 13, 14, 15….**

- **The best age for acquiring sports skill is considered to be 8-12 for girls and 8-13 for boys (Adams, 1981; Nadori, 1985, Singer, 1970)**

- **High possibilities for acquiring various motor skills are revealed at the ages of 10 to 12. (Korobkov et al., 1962)**

- **Afterwards (the onset of PHV) the acquiring of motor skills is complicated by disorders in motor coordination during Peak Height Velocity, and later by the formation of individual forms of motor coordination after puberty. (Viru, 1995)**

Review Article

Jan Borms - The child and exercise: an overview
Journal of Sports Sciences, 1986, 4, 3-20

- **Numerous publications have emphasized the importance of a “golden age” period to learn all kinds of movement patterns”**

- **"Most authors agree that this sensitive period can be located between 9 and 12 years of age."**

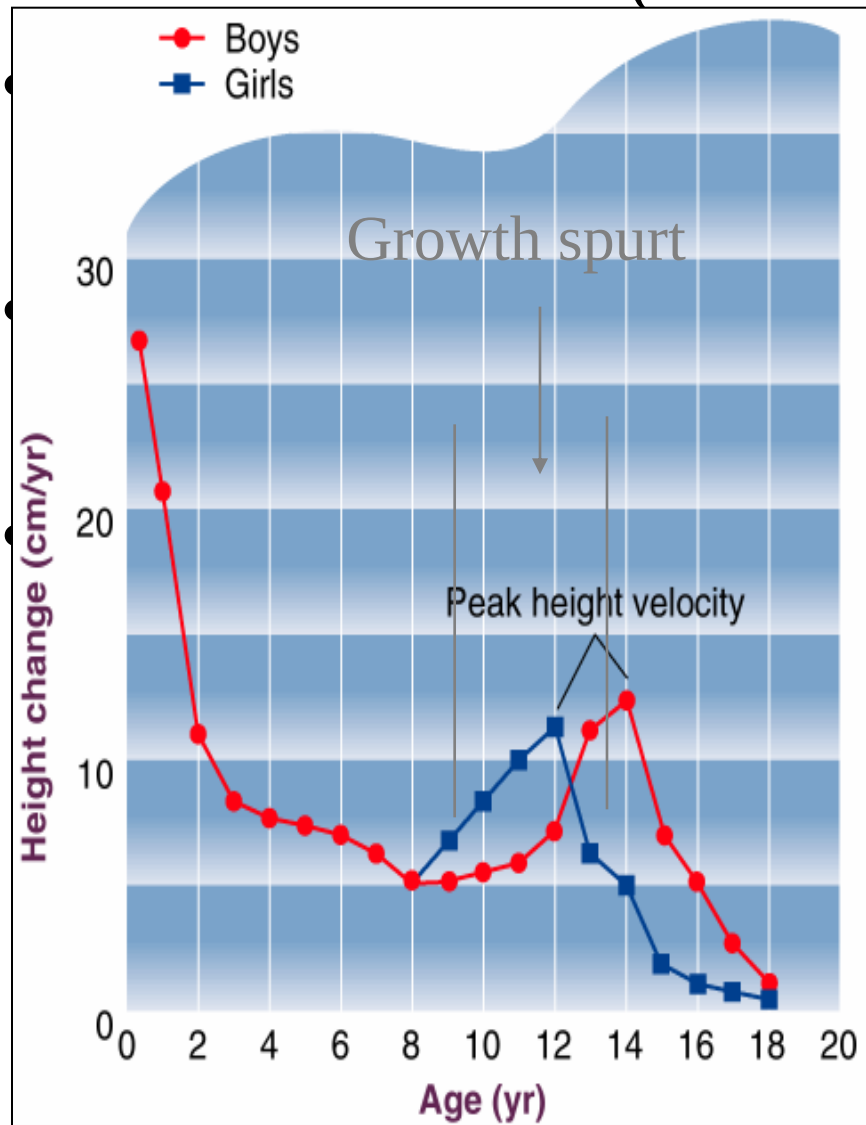
- **In late specialisation sports the window is open longer, (until the onset of PHV) especially when the fundamental motor and sports skills have been acquired**

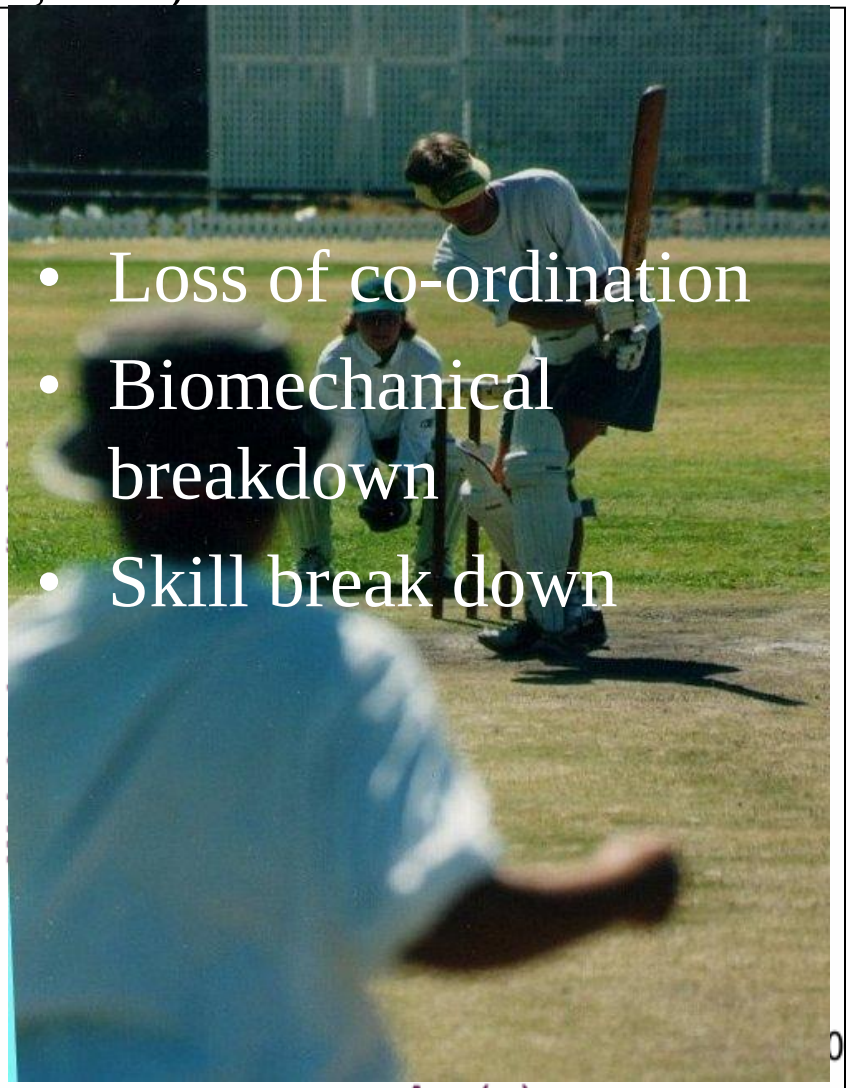
- **The onset of PHV will have a strong negative impact on skill acquisition**

- **However, as a policy, we want to encourage all sports to develop fundamental movement and sports skills before age 12-13**

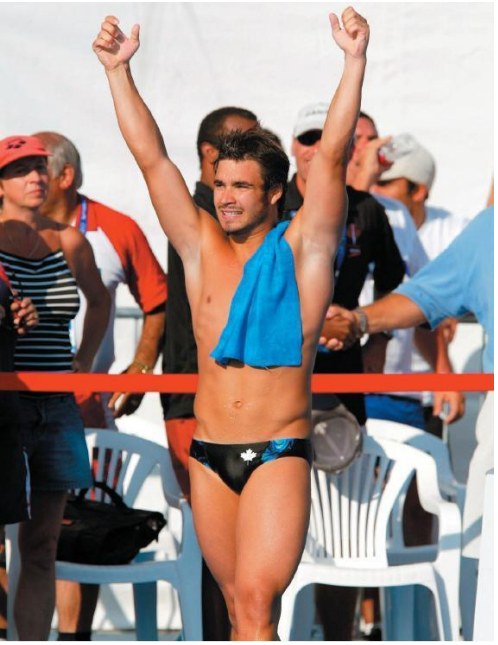
Consequences of the Growth Spurt Training and Children

(C. Williams, 2005)





- Loss of co-ordination
- Biomechanical breakdown
- Skill break down



“Adolescent maintenance”

- Flexibility
- 6 – 10 years of age
- ORoM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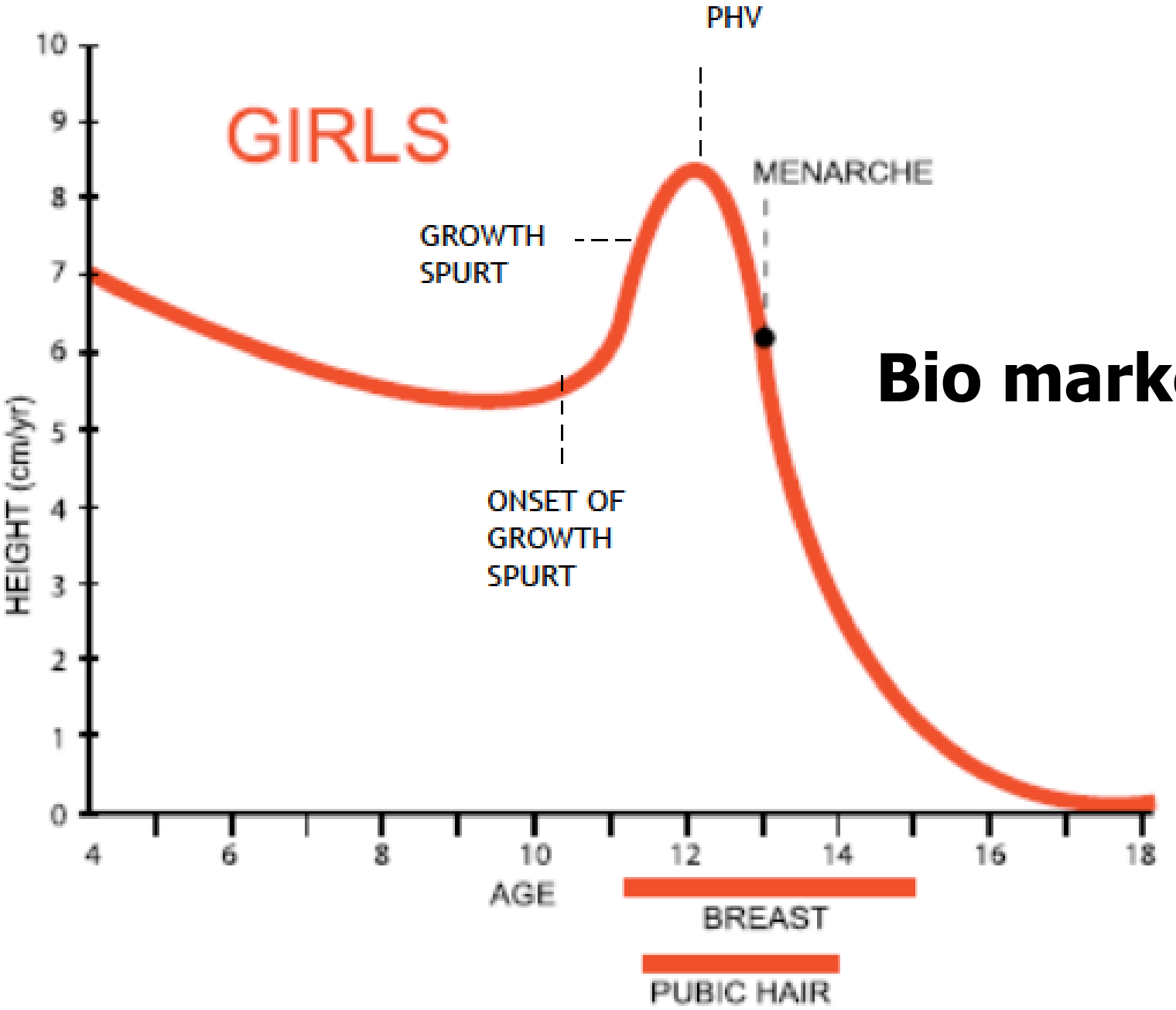
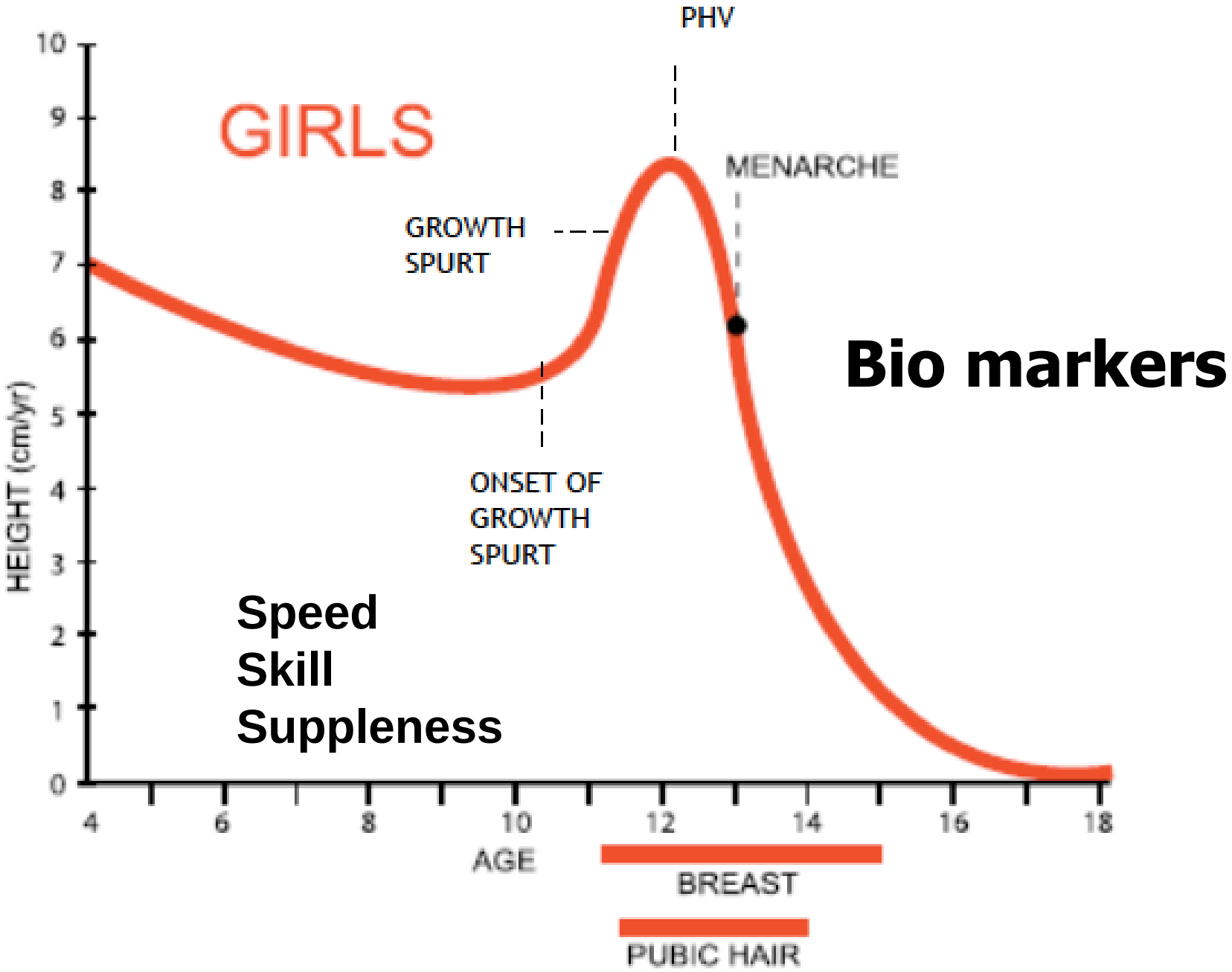
club.chinaren.com

- Process

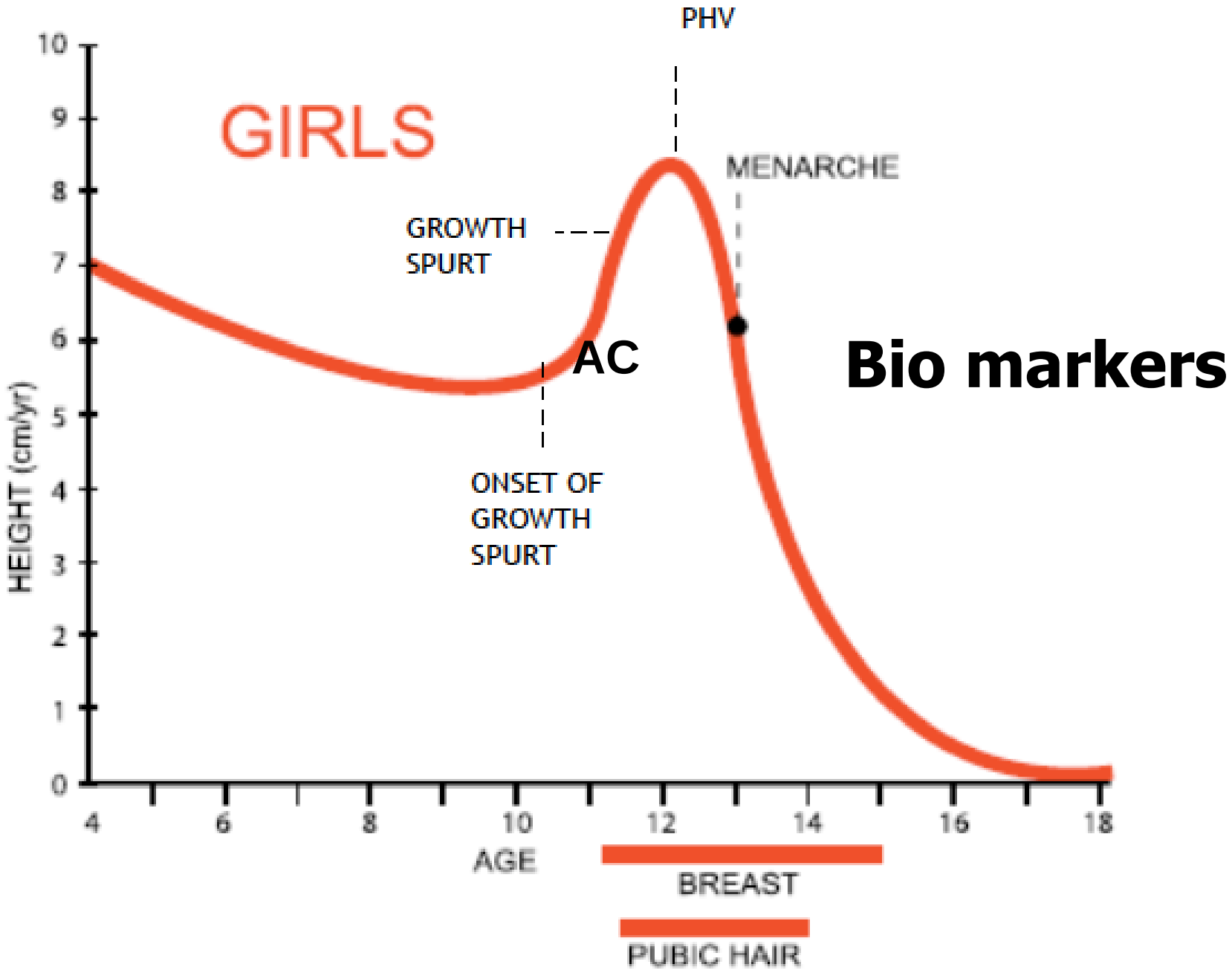

PHV
GIRLS
MENARCHE
GROWTH
SPURT
ONSET OF
GROWTH
SPURT
HEIGHT (cm/yr)
10
9
8
7
6
5
4
3
2
1
0
4
6
8
10
12
14
16
18
AGE
BREAST
PUBIC HAIR

Bio markers

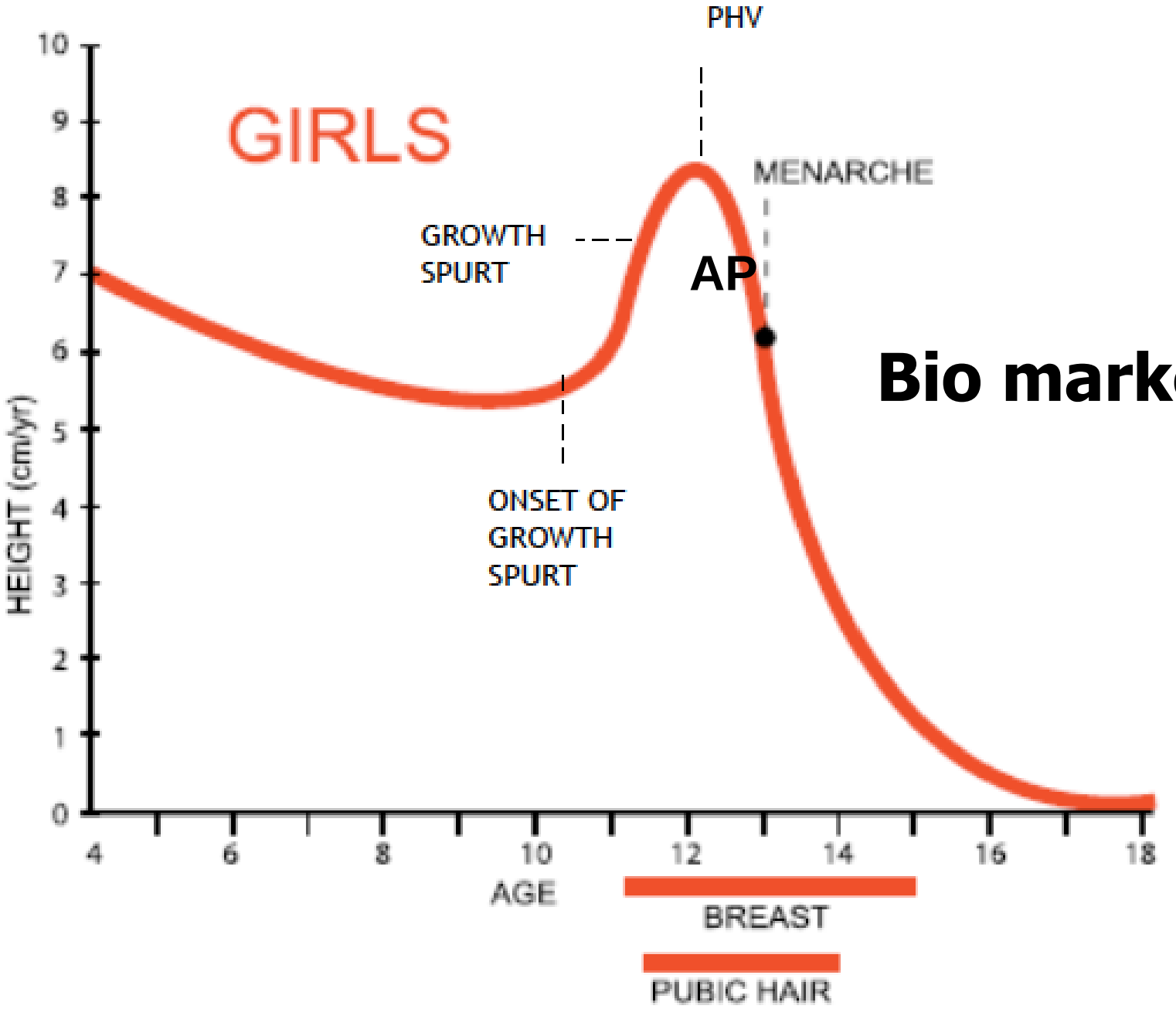


Bio markers

Speed
Skill
Suppleness


PHV
GIRLS
MENARCHE
GROWTH
SPURT
AC
ONSET OF
GROWTH
SPURT
HEIGHT (cm/yr)
10
9
8
7
6
5
4
3
2
1
0
4
6
8
10
12
14
16
18
AGE
BREAST
PUBIC HAIR

Bio markers


PHV
GIRLS
MENARCHE
GROWTH
SPURT
AP
ONSET OF
GROWTH
SPURT
HEIGHT (cm/yr)
10
9
8
7
6
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1
0
4
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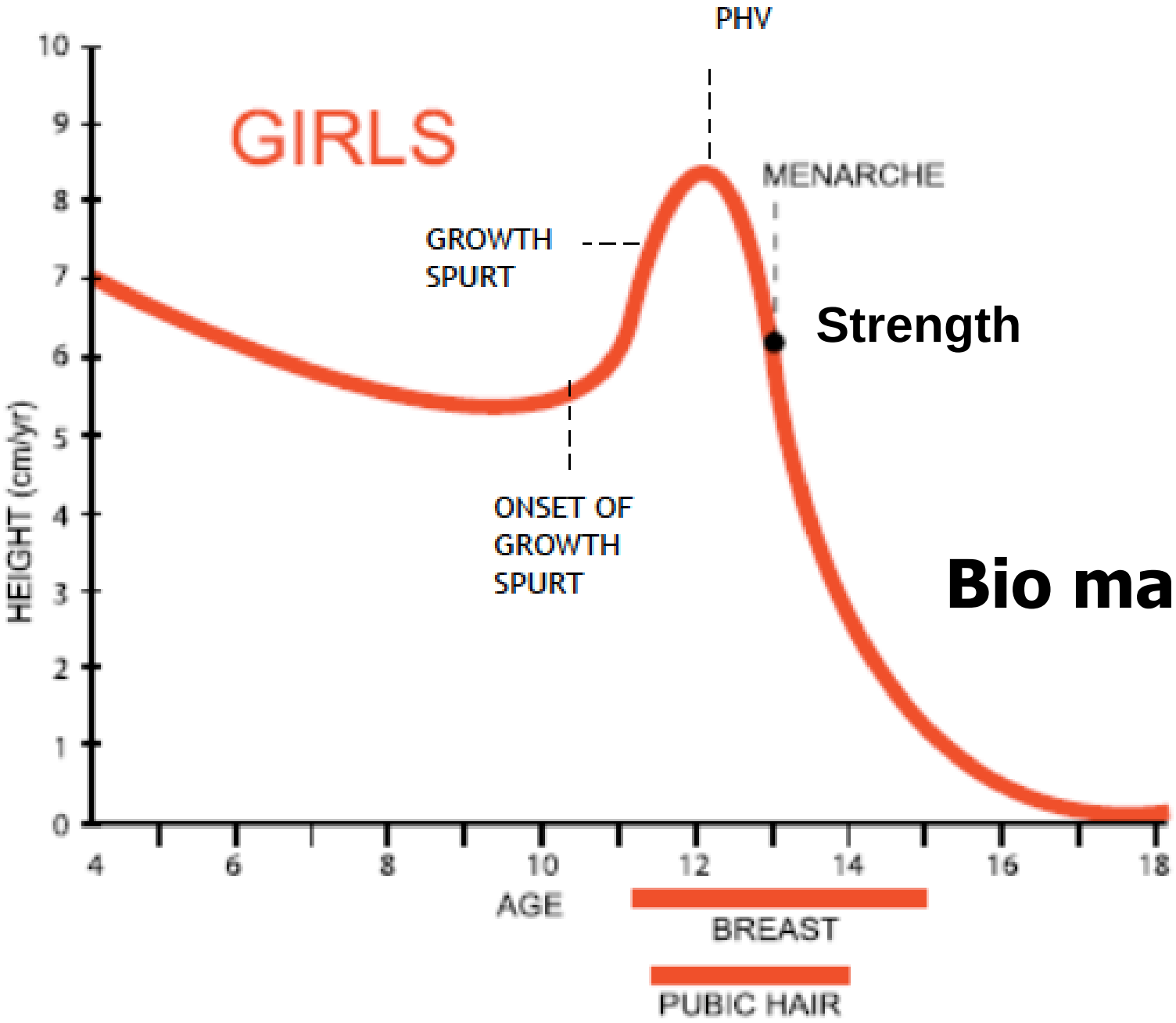
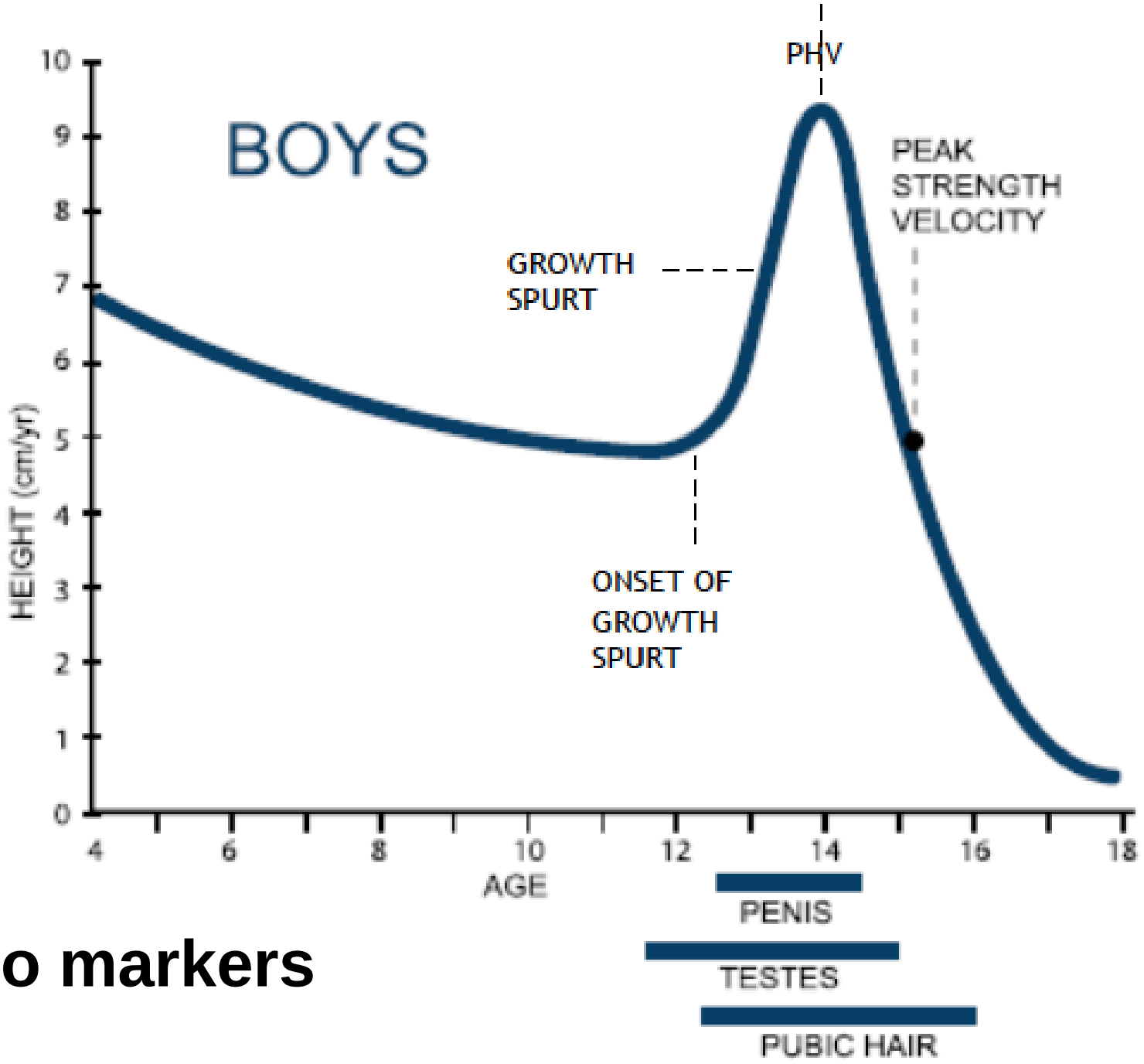
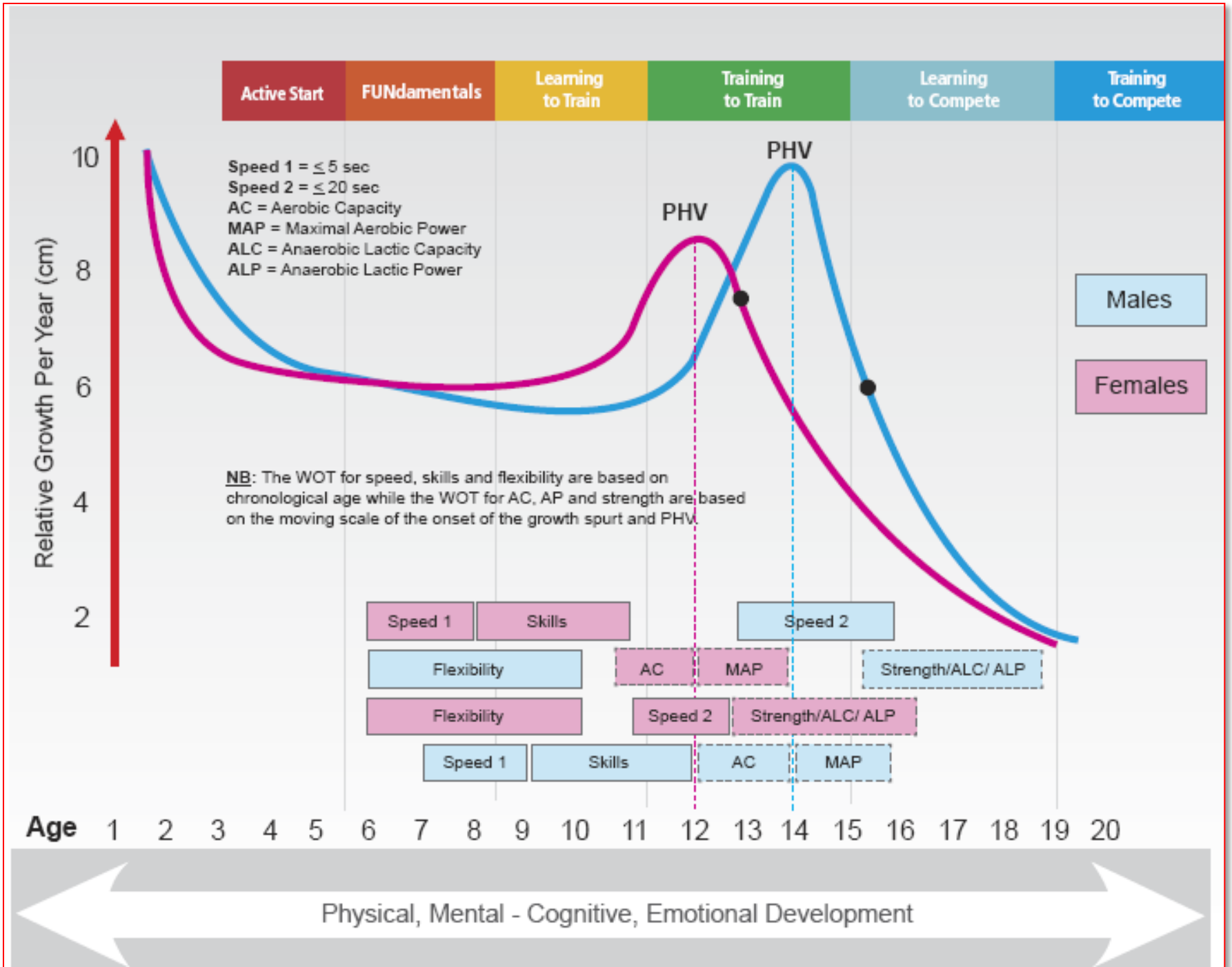
8
10
12
14
16
18
AGE
BREAST
PUBIC HAIR

Bio markers


PHV
GIRLS
MENARCHE
GROWTH
SPURT
Strength
ONSET OF
GROWTH
SPURT
Bio markers
HEIGHT (cm/yr)
10
9
8
7
6
5
4
3
2
1
0
4
6
8
10
12
14
16
18
AGE
BREAST
PUBIC HAIR


BOYS
PHV
PEAK
STRENGTH
VELOCITY
GROWTH
SPURT
ONSET OF
GROWTH
SPURT
HEIGHT (cm/yr)
AGE
0
1
2
3
4
5
6
7
8
9
10
4
6
8
10
12
14
16
18
PENIS
TESTES
PUBIC HAIR

Bio markers


Active Start
FUNdamentals
Learning to Train
Training to Train
Learning to Compete
Training to Compete
Relative Growth Per Year (cm)
10
8
6
4
2
Speed 1 = ≤ 5 sec
Speed 2 = ≤ 20 sec
AC = Aerobic Capacity
MAP = Maximal Aerobic Power
ALC = Anaerobic Lactic Capacity
ALP = Anaerobic Lactic Power
PHV
PHV
Males
Females
NB: The WOT for speed, skills and flexibility are based on chronological age while the WOT for AC, AP and strength are based on the moving scale of the onset of the growth spurt and PHV
Speed 1
Skills
Speed 2
Flexibility
AC
MAP
Strength/ALC/ ALP
Flexibility
Speed 2
Strength/ALC/ ALP
Speed 1
Skills
AC
MAP
Age
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20
Physical, Mental - Cognitive, Emotional Development

Periodisation

Integration and Sequencing of Sport Science, Sport Medicine and Sport-Specific Technical-Tactical Activities

Athletics – Jumps - Annual Plan Stage 5 Training to Compete

Stage 5 Annual Plan Triple - Jumps

Dates

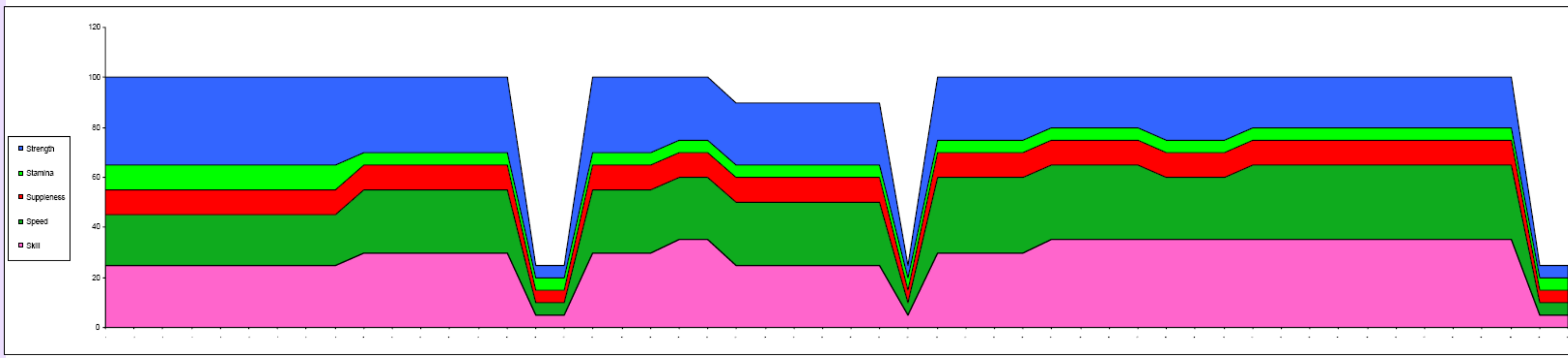
MONTHS	Sept				Oct					Nov				Dec				Jan					Feb			
Saturday	3	10	17	24	1	8	15	22	31	7	14	21	28	3	10	17	25	1	8	15	22	29	5	12	19	26
MICROCYCLE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

MONTHS	Mar				Apr					May				Jun				Jul					Aug			
Saturday	5	12	19	26	2	9	16	23	30	7	14	21	28	4	11	18	25	2	9	16	23	30	6	13	20	27
MICROCYCLE	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52

Microcycles	PHASE	Periods	Events (COMPS)	Prophylactic Break / Field testing / Camps
1–9	GENERAL →	PREP →		Field testing (5)
10–15	SPECIFIC	PREP		
16–17		PREP		Xmas
18–20	SPECIFIC	PREP		Field testing (18)
21–22	PRE	PREP		
23–28	COMPETITION	INDOORS	Comps	Spring Break
29				Prophylactic Break
30–33	SPECIFIC			
34–37	COMPETITION	OUTDOORS	Comps	
38–39	PRE COMP			
40–50	COMPETITION →	OUTDOORS →	Comps	
51–52	TRANS			

Physica Preparation (% of time)

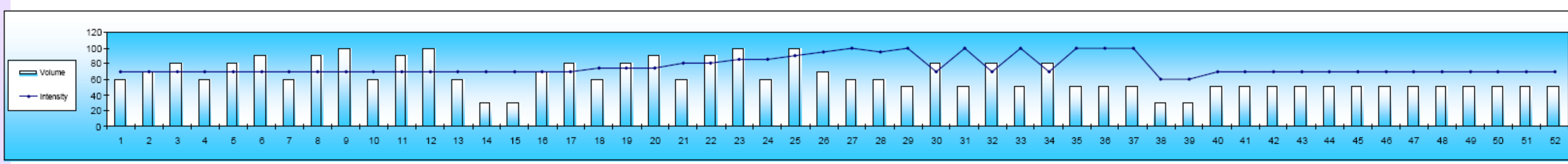
	GENERAL	SPECIFIC		SPECIFIC	PRE	COMPETITION		SPECIFIC	COMPETITION	PRE COMP	COMPETITION	TRANS
Strength	35	30	M	30	25	25	R	25	20	25	20	R
Stamina	10	5	M	5	5	5	R	5	5	5	5	R
Suppleness	10	10	M	10	10	10	R	10	10	10	10	R
Speed	20	25	M	25	25	25	R	30	30	25	30	R
Skill	25	30	M	30	35	25	R	30	35	35	35	R



Load

Microcycle	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26
Volume	60	70	80	60	80	90	60	90	99	60	90	99	60	30	30	70	80	60	80	90	60	90	99	60	99	70
Intensity	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	70	75	75	75	80	80	85	85	90	95

Microcycle	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
Volume	60	60	50	80	50	80	50	80	50	50	50	30	30	50	50	50	50	50	50	50	50	50	50	50	50	50
Intensity	99	95	99	70	99	70	99	70	99	99	99	60	60	70	70	70	70	70	70	70	70	70	70	70	70	70



PHASE | GENERAL → | SPECIFIC | | SPECIFIC | PRE | COMPETITION | | SPECIFIC | COMPETITION | PRE COMP | COMPETITION → | TRANS

Le plan annuel d'entraînement

Exemple d'un plan annuel d'entraînement

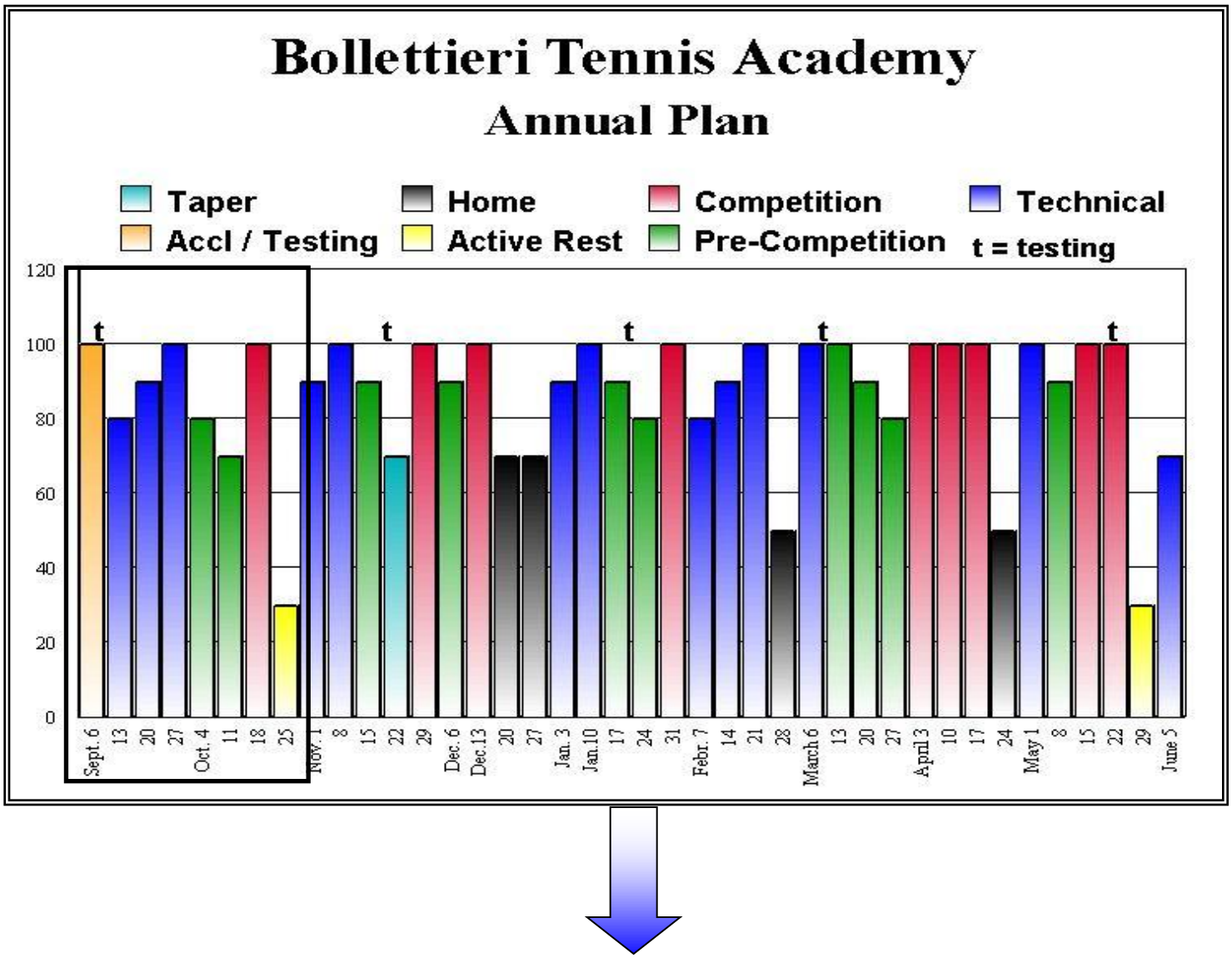
Athlète/équipe	Nom																									
Objectifs annuel	Performance sportive :						Réussir à marquer sur 50 % des attaques effectuées														Facteurs de performance :					
Dates	15-mai	22-mai	29-mai	05-juin	12-juin	19-juin	26-juin	03-juil	10-juil	17-juil	24-juil	31-juil	07-août	14-août	21-août	28-août	04-sept	11-sept	18-sept	25-sept	02-oct	09-oct	16-oct	23-oct	30-oct	06-nov
Compétition																					1	1		1	2	2
Camp entraînement																	■	■	■	■						
Examen																							■			
Relâche	Semestre d'été																							■		
Éval. physique																	■									
Éval. tech.-tact.																	■	■	■	■						
Éval psycho.																				■						
Macrocycle	1																									
Période	Préparation 1																				Compétition 1					
Phase	Préparation générale 1							Préparation spécifique 1													Précompétition 1				Compétition 1	
Mésocycle	Mise cond.			B. générale 1				B. spéc. 1			B. spéc. 2			B. spéc. 3			B. spécifique 4				Précompétition 1				Compétition 1	
Microcycle	1	2	3	1	2	3	4	1	2	3	1	2	3	1	2	3	1	2	3	4	1	2	3	4	1	2
Filières énergétiques																										
Endurance aérobie	Dévelop.																									
P.A.M. (Intervalles)				Dévelop.				Dévelop.			Dévelop.			Dévelop.			Maintien				Intégration				Intégration	
Vitesse et agilité (P.A.A.)								Dévelop.			Dévelop.			Dévelop.			Maintien				Intégration				Intégration	
Volume	1,5	2,0	1,5	1,5	2,0	2,0	1,5	2,0	2,0	1,5	2,0	2,0	1,5	2,0	2,0	1,5	1,0	1,0	1,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0
Qualités musculaires																										
Force-endurance																										
Hyprtrophie	Dévelop.																									
Force maximale				Dévelop.																						
Force-vitesse								Dévelop.			Dévelop.			Dévelop.			Maintien				Maintien				Maintien	
Force-vitesse endurance											Dévelop.			Dévelop.			Maintien				Maintien				Maintien	
Amplitude articulo-musc.	Dévelop.			Dévelop.				Dévelop.			Dévelop.			Dévelop.			Maintien				Maintien				Maintien	
Volume	4,5	4,5	3,0	4,5	4,5	4,5	3,0	4,5	4,5	3,0	4,5	4,5	3,0	4,5	4,5	3,0	1,5	1,5	1,5	1,5	0,8	1,5	2,0	1,5	1,5	1,0
Habiletés sportives																										
Habiletés tech. de base								Maintien			Maintien			Maintien			App./dévelop.				Développement				Consolidation	
Hab. tech. avancées/variantes								Maintien			Maintien			Maintien			App./dévelop.				Développement				Consolidation	
Habiletés tactiques ind.											Maintien			Maintien			App./dévelop.				Développement				Développement	
Hab. tact. équipe																	App./dévelop.				Développement				Développement	
Systèmes de jeux																	App./dévelop.				Développement				Développement	
Volume																	8,0	8,0	8,0	8,0	4,0	6,0	8,0	6,0	6,0	6,0
Habiletés mentales																										
Cohésion																	Développemement				Développemement				Développemement	
Gestion des émotions											Dévellopement			Dévellopement			Développement				Développement				Perfect. / intégrat.	
Gestion des pensées														Dévellopement			Développement				Développement				Perfect. / intégrat.	
Plan de précompétition																	Développement				Développement				Consolidation	
Plan de compétition																	Développement				Développement				Consolidation	
Volume											0,5	0,5	0,5	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0
Volume d'entraînement	6,0	6,5	4,5	6,0	6,5	6,5	4,5	6,5	6,5	4,5	7,0	7,0	5,0	7,5	7,5	5,5	11,5	11,5	11,5	11,5	5,8	8,5	11,0	8,5	8,5	8,0
Volume de compétition																					8,0	2,0	0,0	4,0	2,0	4,0
Volume total	6,0	6,5	4,5	6,0	6,5	6,5	4,5	6,5	6,5	4,5	7,0	7,0	5,0	7,5	7,5	5,5	11,5	11,5	11,5	11,5	13,8	10,5	11,0	12,5	10,5	12,0

Athlète/équipe																										
Objectifs annuel			Améliorer son impulsion verticale de 5 centimètres																							
Dates	13-nov	20-nov	27-nov	04-déc	11-déc	18-déc	25-déc	01-janv	08-janv	15-janv	22-janv	29-janv	05-févr	12-févr	19-févr	26-févr	05-mars	12-mars	19-mars	26-mars	02-avr	09-avr	16-avr	23-avr	30-avr	07-mai
Compétition	2	2							2	2	2	2	3	3	3	4										
Camp entraînement																										
Examen					■	■									■								■	■		
Relâche							■	■								■										
Éval. physique									■													■				
Éval. tech.-tact.									■													■				
Éval psycho.									■																	
Macrocycle																										
Période			Préparation 2						Compétition 2								Préparation 3						Transition			
Phase			Prép. Spécifique 2				P.S. 2		Compétition 2								Prép. spécifique 3						Transition			
Mésocycle			B. spéc. 5				B.S. 6		Compétition 2				Compétition 3				T.1	B.S. 7		B.S. 8			Transition 2			
Microcycle	3	4	1	2	3	4	1	2	1	2	3	4	1	2	3	4	1	1	2	1	2	3	1	2	3	4
Filières énergétiques																										
Endurance aérobie																	M.						Maitien			
P.A.M. (Intervalles)			Maitien						Intégration				Intégration					Develop.								
Vitesse et agilité (P.A.A.)			Maitien				Maint.		Intégration				Intégration							Develop.						
Volume	0,0	0,0	0,0	1,5	1,5	1,0	1,0	1,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	1,5	1,0	1,0	1,0	1,0	1,0	1,5	1,5	1,5	1,5
Qualités musculaires																										
Force-endurance			Maitien														M.						Maintien			
Hyprtrophie																		Develop.								
Force maximale																				Develop.						
Force-vitesse							Maint		Maintien				Maintien													
Force-vitesse endurance							Maint		Maintien				Maintien													
Amplitude articulo-musc.			Maintien				Mtn.		Maintien				Maintien				M.	Dév.		Dével.			Maintien			
Volume	0,8	1,0	1,5	1,5	1,5	1,5	1,5	1,5	1,0	0,8	1,0	1,0	0,8	1,0	1,0	1,0	1,5	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0	3,0
Habiletés sportives																										
Habiletés tech. de base			Consolidation				Perfect.		Perfectionnement				Perfect.					Dével.		Dével.						
Hab. tech. avancées/variantes			Consolidation				Perfect.		Perfectionnement				Perfect.					Dével.		Dével.						
Habiletés tactiques ind.			Consolidation				Consol.		Perfectionnement				Perfect.					Dével.		Dével.						
Hab. tact. équipe			Développement				Consol.		Perfectionnement				Perfect.					Dével.		Dével.						
Systèmes de jeux			Développement				Consol.		Perfectionnement				Perfect.													
Volume	4,0	6,0	6,0	6,0	4,0	2,0	6,0	6,0	8,0	4,0	8,0	6,0	5,0	6,0	6,0	4,0		6,0	4,0	6,0	6,0	4,0	0,0	0,0	0,0	0,0
Habiletés mentales																										
Cohésion			Développemement				Perfect.		Perfectionnement				Perfectionnement					Develop.		Develop.						
Gestion des émotions			Perfect. / intégrat.				Perf. / int.		Perfect. / intégrat.				Perfect. / intégrat.					Develop.		Develop.						
Gestion des pensées			Perfect. / intégrat.				Perf. / int.		Perfect. / intégrat.				Perfect. / intégrat.					Develop.		Develop.						
Plan de précompétition									Perfectionnement				Perfectionnement													
Plan de compétition									Perfectionnement				Perfectionnement													
Volume	1,0	1,0	0,5	0,5	0,5	0,5	0,5	0,5	1,0	1,0	1,0	1,0	1,0	1,0	1,0	1,0		1,0	1,0	1,0	1,0	1,0	0,0	0,0	0,0	0,0
Volume d'entraînement	5,8	8,0	8,0	9,5	7,5	5,0	9,0	9,0	10,0	5,8	10,0	8,0	6,8	8,0	8,0	6,0	3,0	11,0	9,0	11,0	11,0	9,0	4,5	4,5	4,5	4,5
Volume de compétition	8,0	2,0							4,0	8,0	4,0	4,0	6,0	4,0	2,0	6,0										
Volume total	13,8	10,0	8,0	9,5	7,5	5,0	9,0	9,0	14,0	13,8	14,0	12,0	12,8	12,0	10,0	12,0	3,0	11,0	9,0	11,0	11,0	9,0	4,5	4,5	4,5	4,5

Figure 2. Illustration d'un plan annuel d'entraînement en volley-ball au niveau universitaire, Martin Roy

■ (vert foncé)	Importance prioritaire
■ (vert clair)	Importance élevée
■ (jaune)	Importance modérée

Planning…


Bollettieri Tennis Academy
Annual Plan
Taper
Home
Competition
Technical
Accl / Testing
Active Rest
Pre-Competition
t = testing
120
100
80
60
40
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Dec. 6
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Jan. 3
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March 6
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April 3
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May 1
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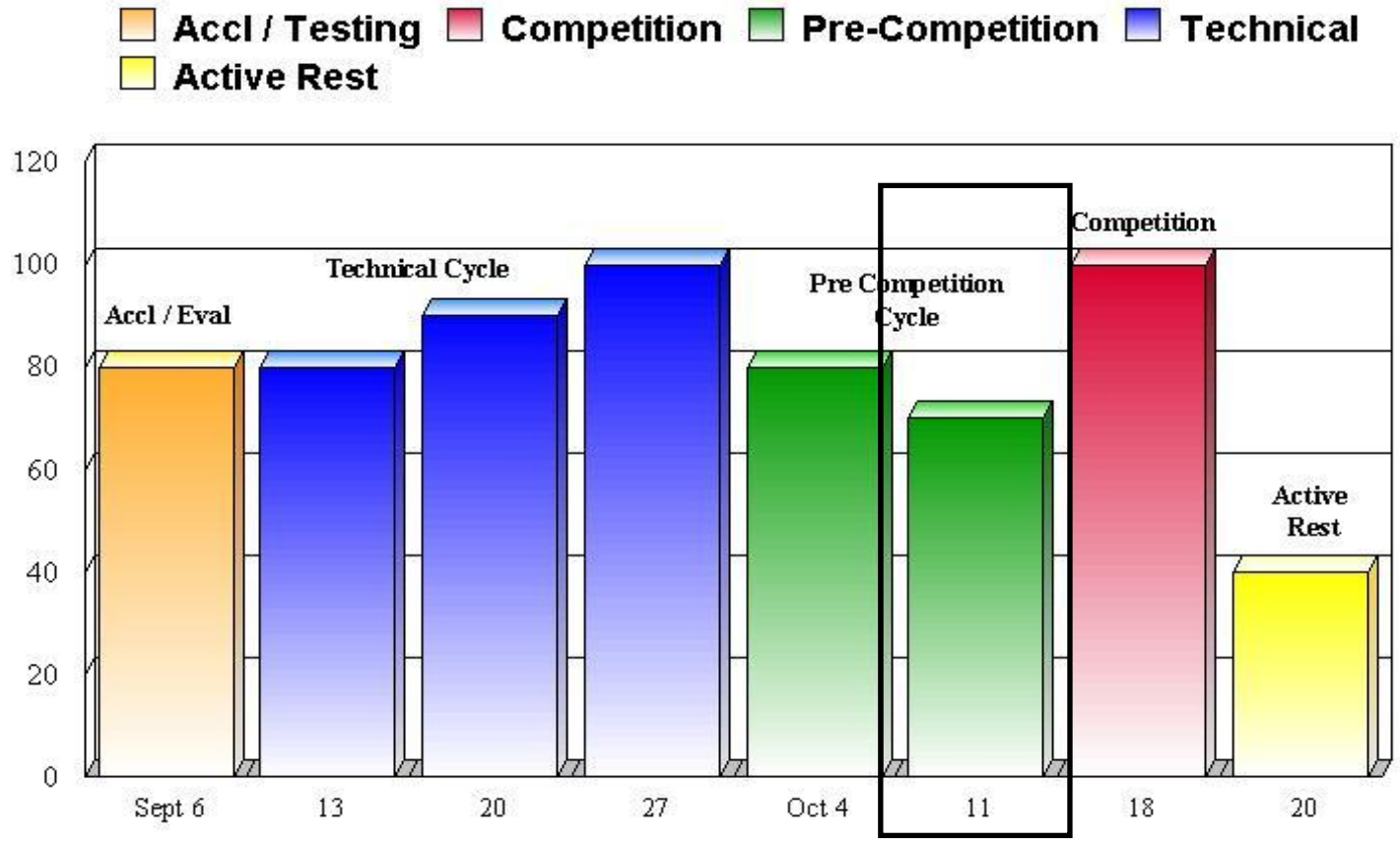
22
29
June 5

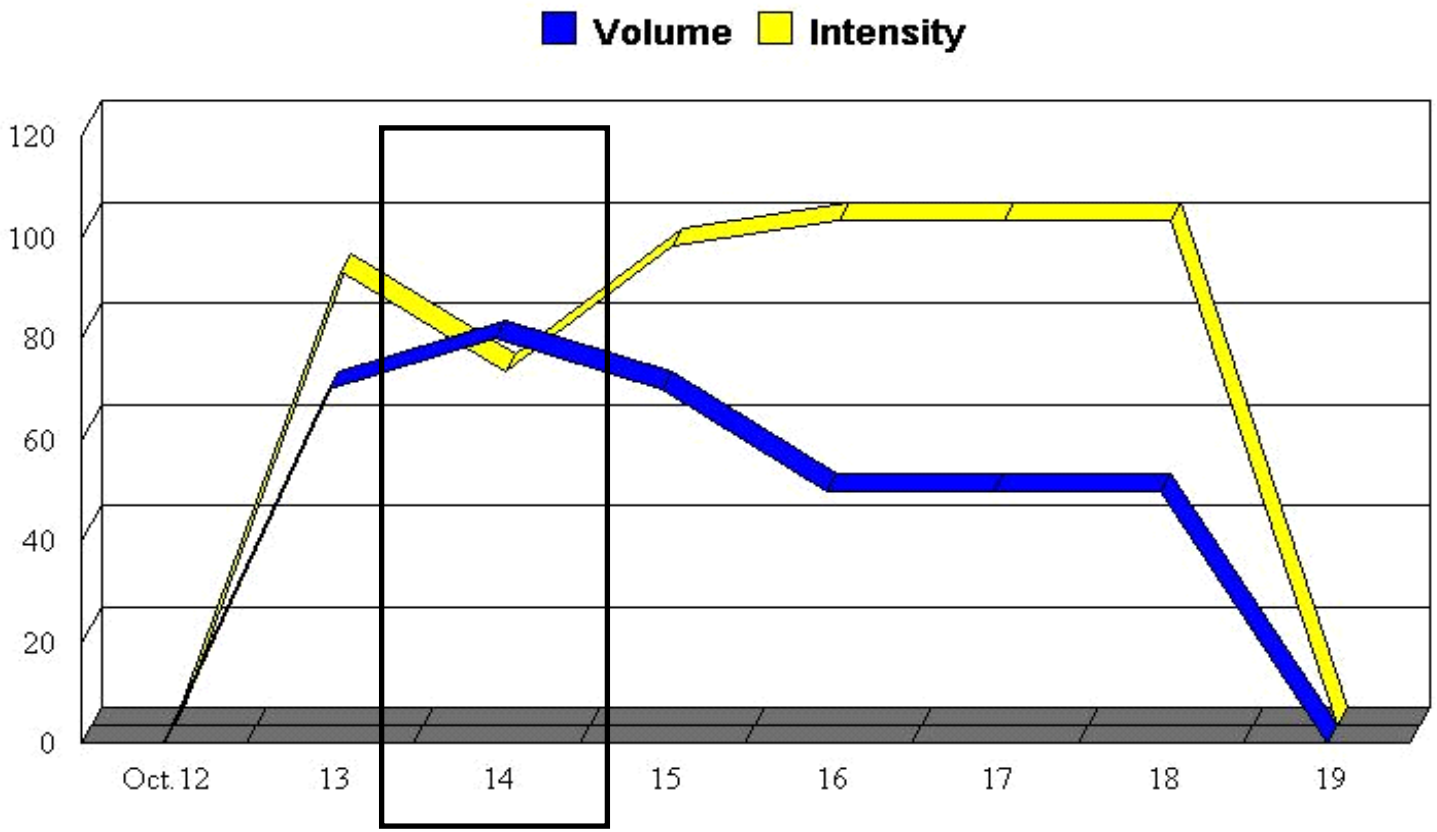
Bollettieri Tennis Academy

Annual Plan - Phase 1



Bollettieri Tennis Academy

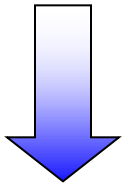
Micro Cycle 6 - Pre-Competition Cycle



Daily Cycle- 14th October 1999

Time	Rotation	Court
1:30-3:00pm	Drilling	14
3:00 -4:30pm	IPI	Dome
3:00 – 3:45pm	Mental Conditioning.	(M/T)*
4:30-6:00pm	Match-play	21

***Note**: *On Monday's each student will have 45 minutes of mental conditioning. On Thursday a mental conditioning staff member observes each student on the courts.*

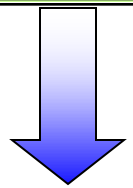


Rotation 1 – Drilling

Time: 1:30-3:00pm

Objective: Match Simulation Drills

1. W/Up: Mini Tennis	**10 min**
2. Defend B/line X-crt	**15 min**
3. Attack B/line D-T-L	**15 min**
4. Control Center & Close In	**15 min**
5. Change of Direction	**15 min**
6. Depth & Consistency	**10 min**
7. W/Dn: Stretch & Hydrate	**10 min**
	Total 90 min



Rotation 2 – IPI (Fitness)

Time: 3:00 – 4:30

Objective: Download before competition

1. Warm-up	**10 min**
2. Agility	**10 min**
3. Balance	**10 min**
4. Speed	**10 min**
5. Rest	**10 min**
6. Strength	**10 min**
7. Power	**10 min**
8. Pre-habilitation	**10 min**
9. Regeneration	**10 min**
	Total 90 min

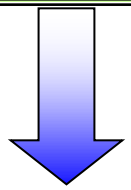
Rotation 3 – Mental Conditioning

Time: 3:00 – 4:00 pm

Objective: Increase mental toughness

.Testing Evaluation
.Goal Setting
.Quality Practice = Quality Performance
.Attitude / Concentration / Effort
.Developing Rituals
.Self Awareness

***Note**: These are some of the topics that are covered throughout the year.*

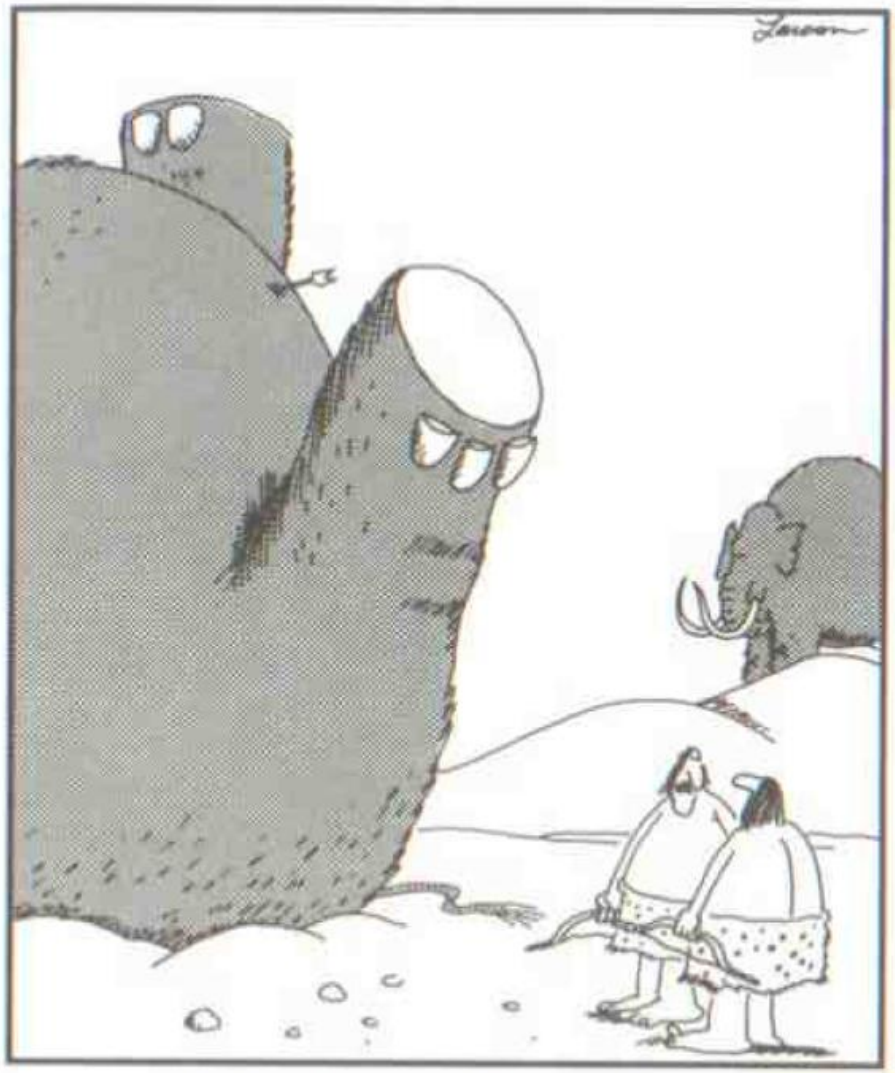


Rotation **4 – Match Play**

Time: 4:30 – 6:00

Objective: Practice Set

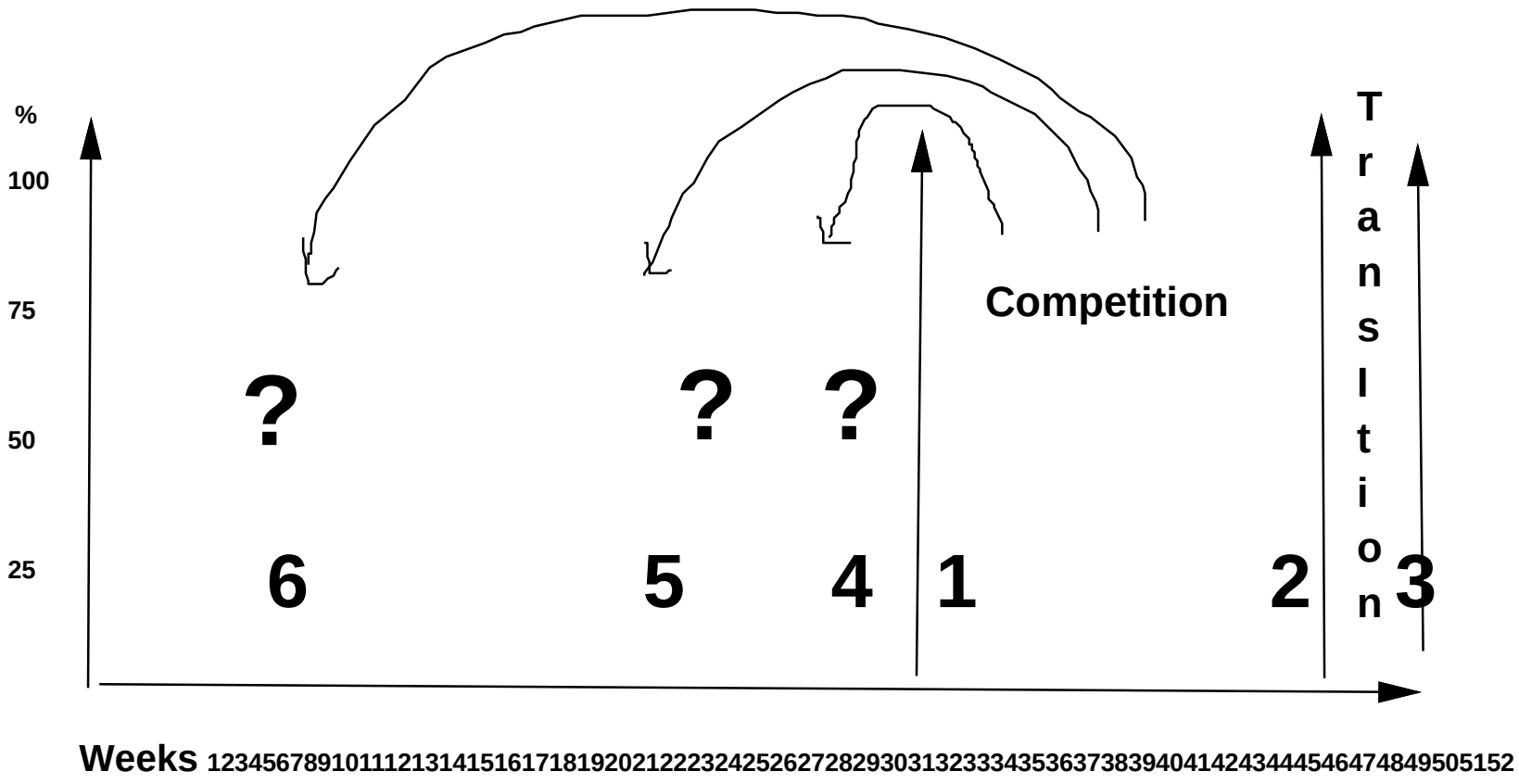
Planning



"We should write that spot down."

Year 1 - Steps 1 - 3

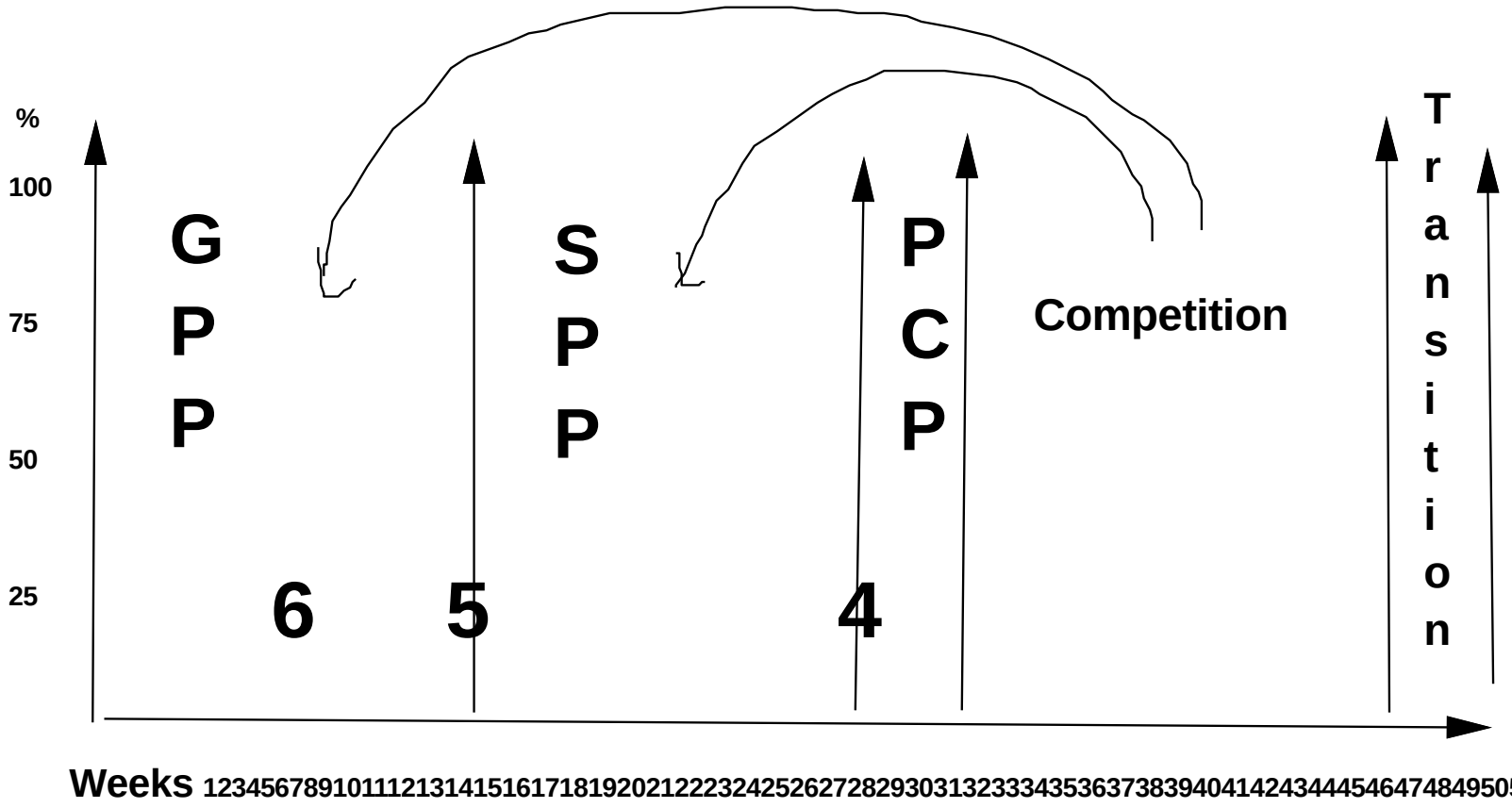
Competition and Transition Phases



Similar procedure is used for double or multiple

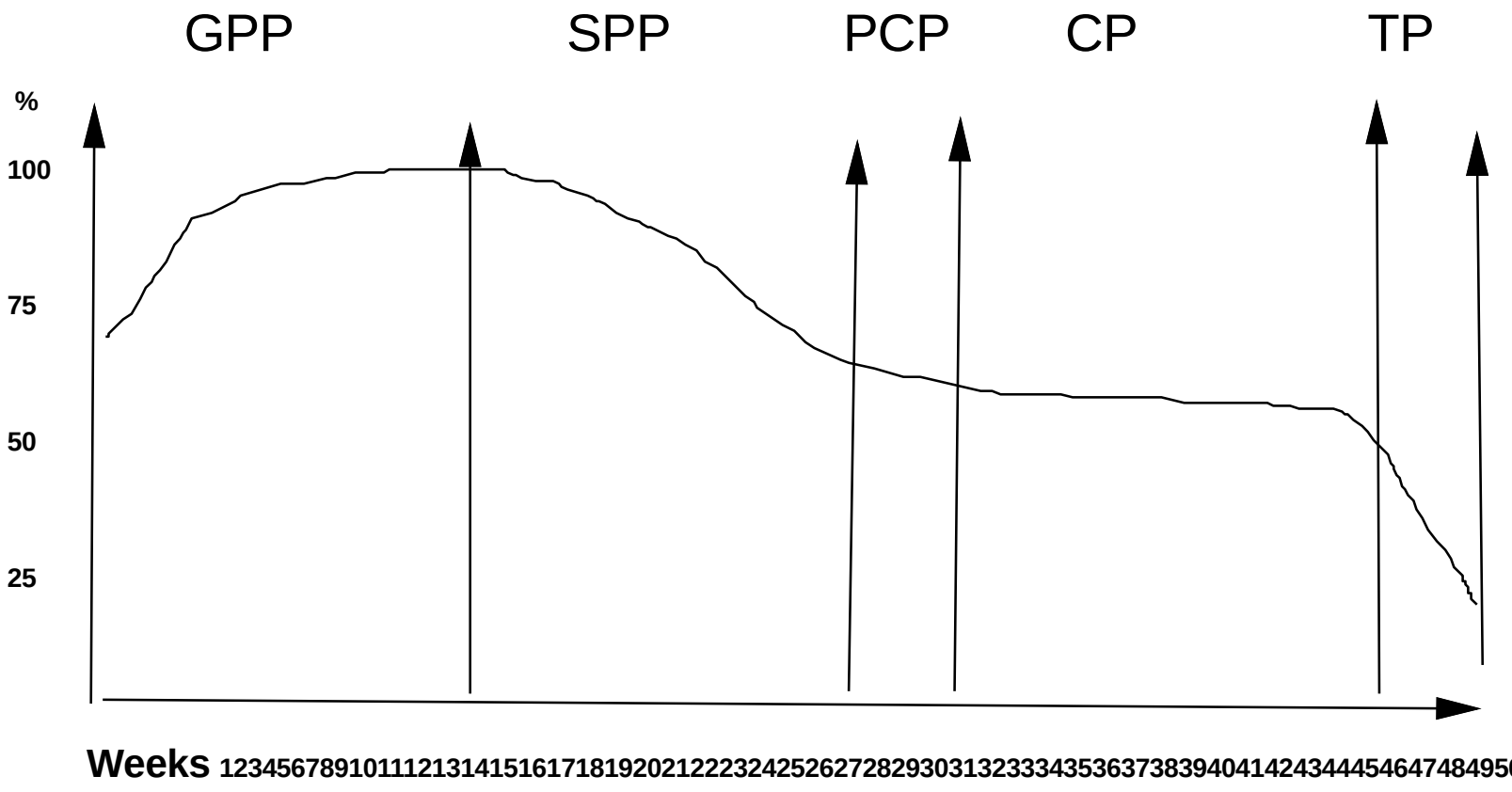
Year 1 - Steps 4 - 6

General, Specific and Pre-Competitive Phases



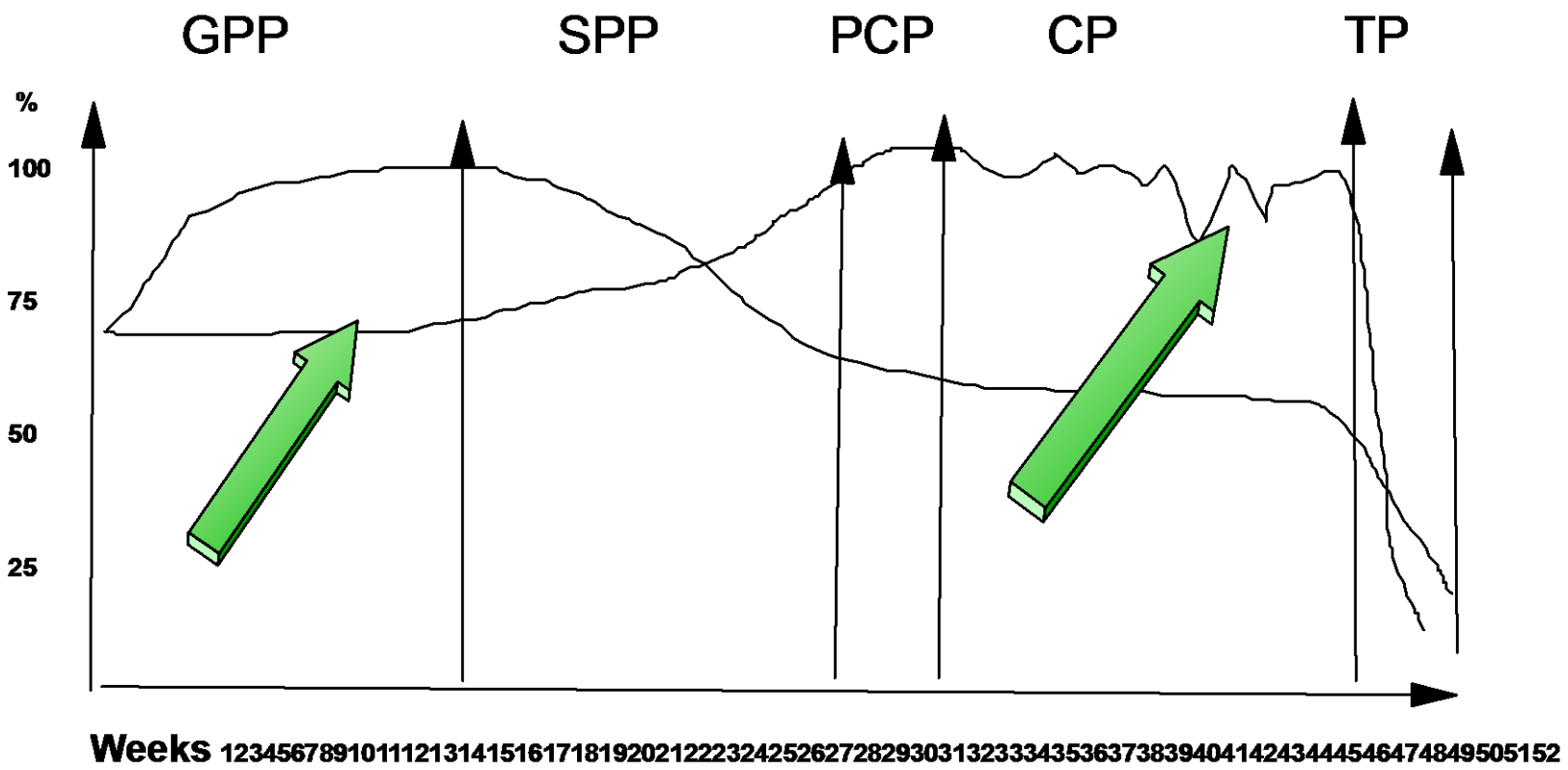
Year 1 - Step 7

Plot the Volume of Training



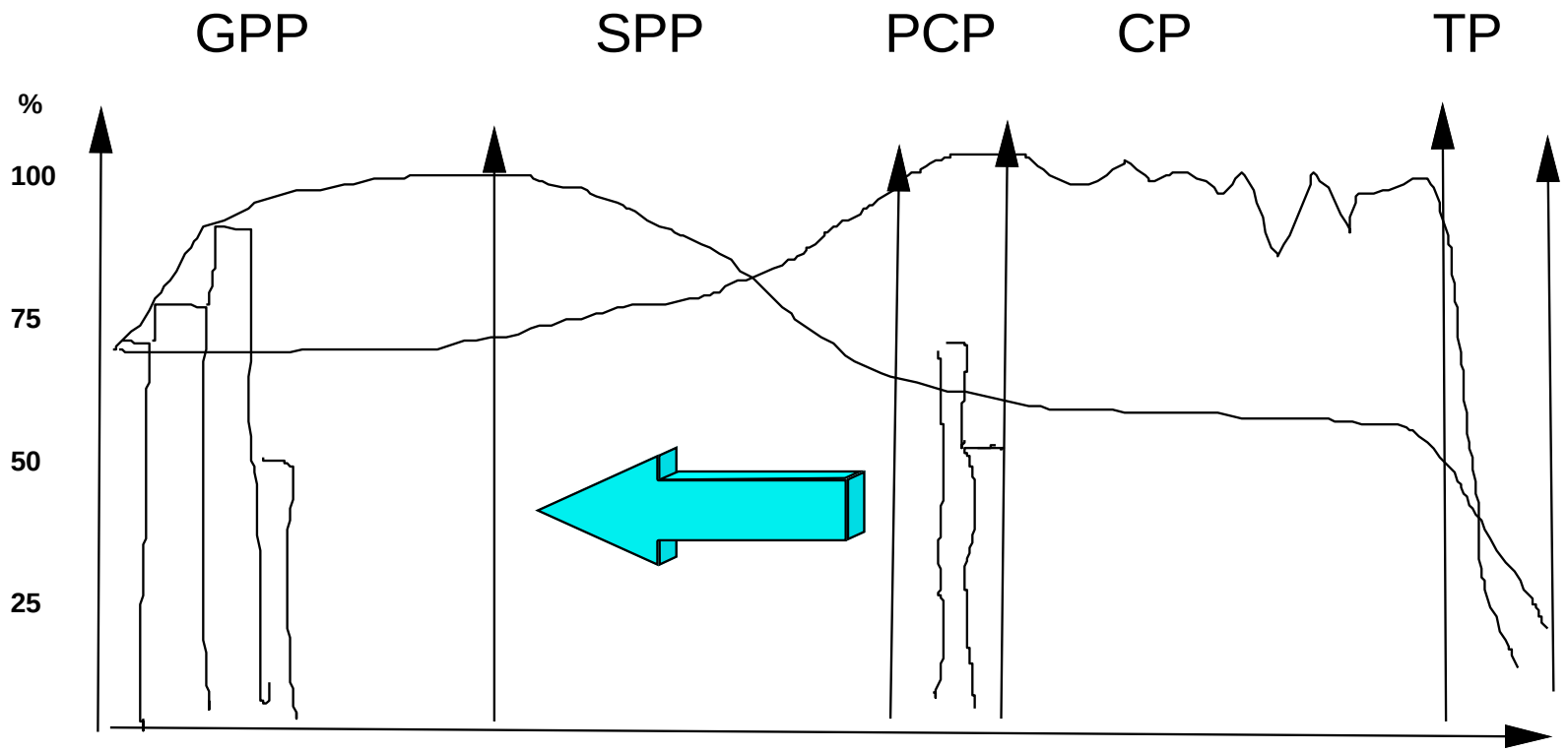
Year 1 - Step 8

Plot the Intensity of Training



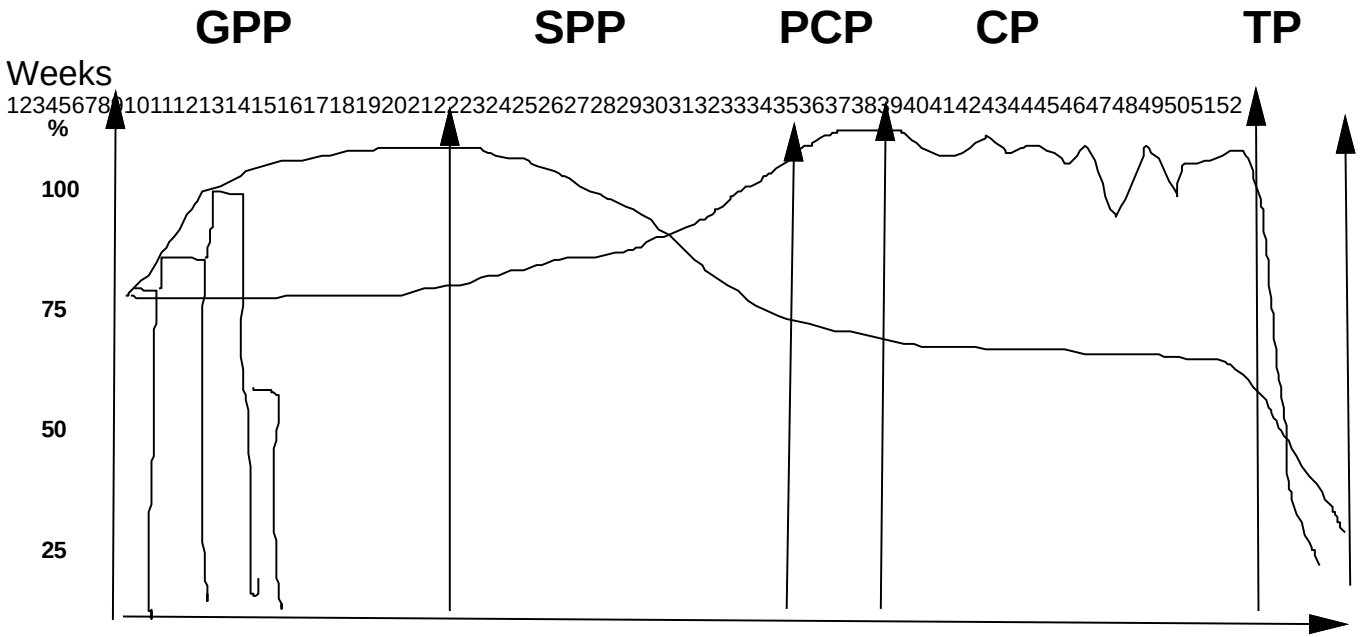
Year 1 - Step 9

Macro and Micro Cycle Planning



Year 1 - Step 10

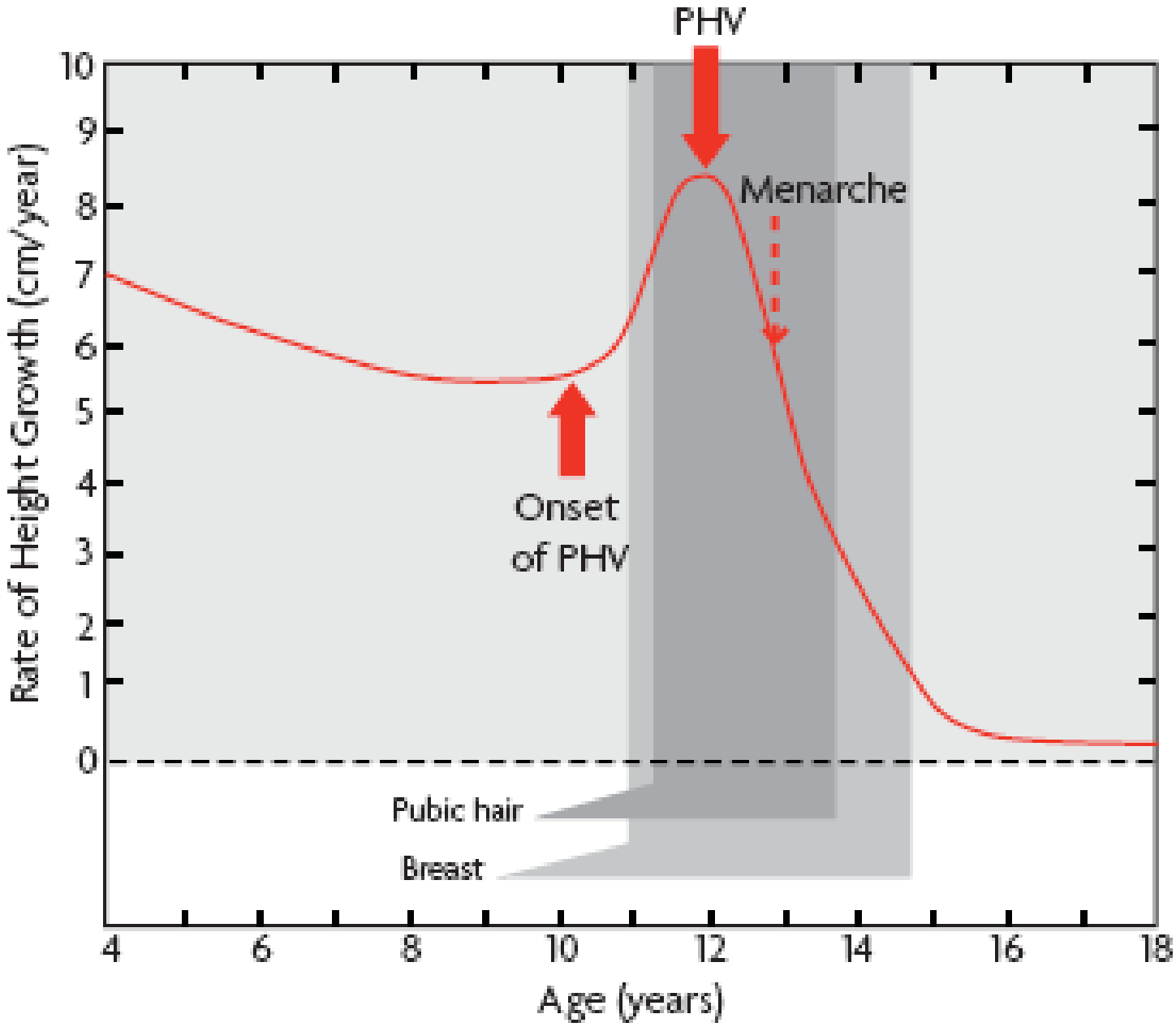
Quantitification



Stamina	**50**	**30**	**10**	**10**
Strength	**20**	**20**	**10**	**10**
Speed	**5**	**10**	**15**	**15**
Skill	**20**	**35**	**60**	**60**
Suppleness	**5**	**5**	**5**	**5**

Reactive Periodization

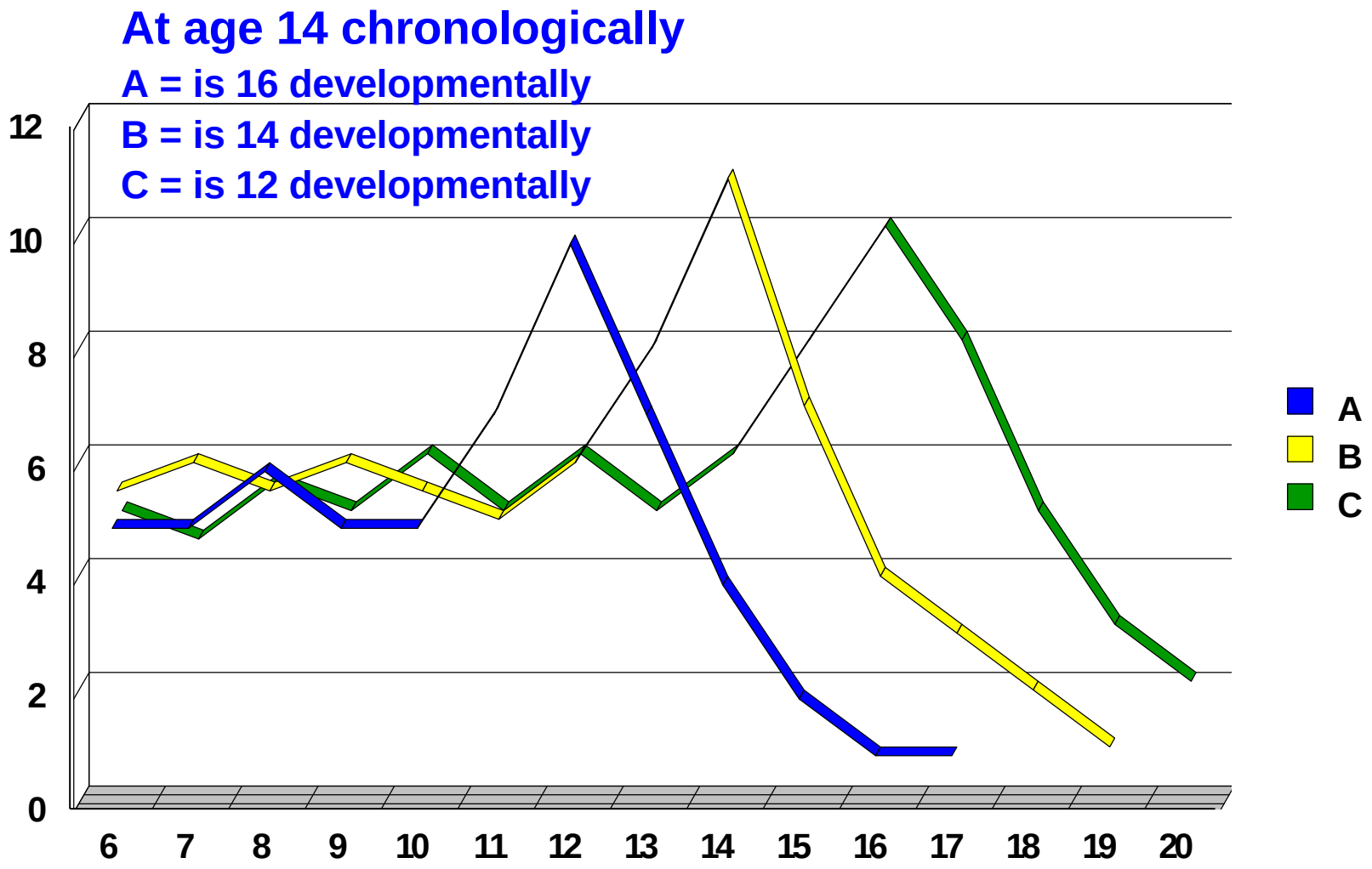
- **Biological markers**
- **Monitoring the onset of the growth spurt, PHV and deceleration of growth is a must to design/ adjust the plan**
- **Reacting to the velocity of growth**
- **Adjusting training, competition and recovery program designs and activities**
- **"Adolescent maintenance"**
- **Viru = "If there is a conflict between the long-term plan and competition demands, the first must take priority!"**



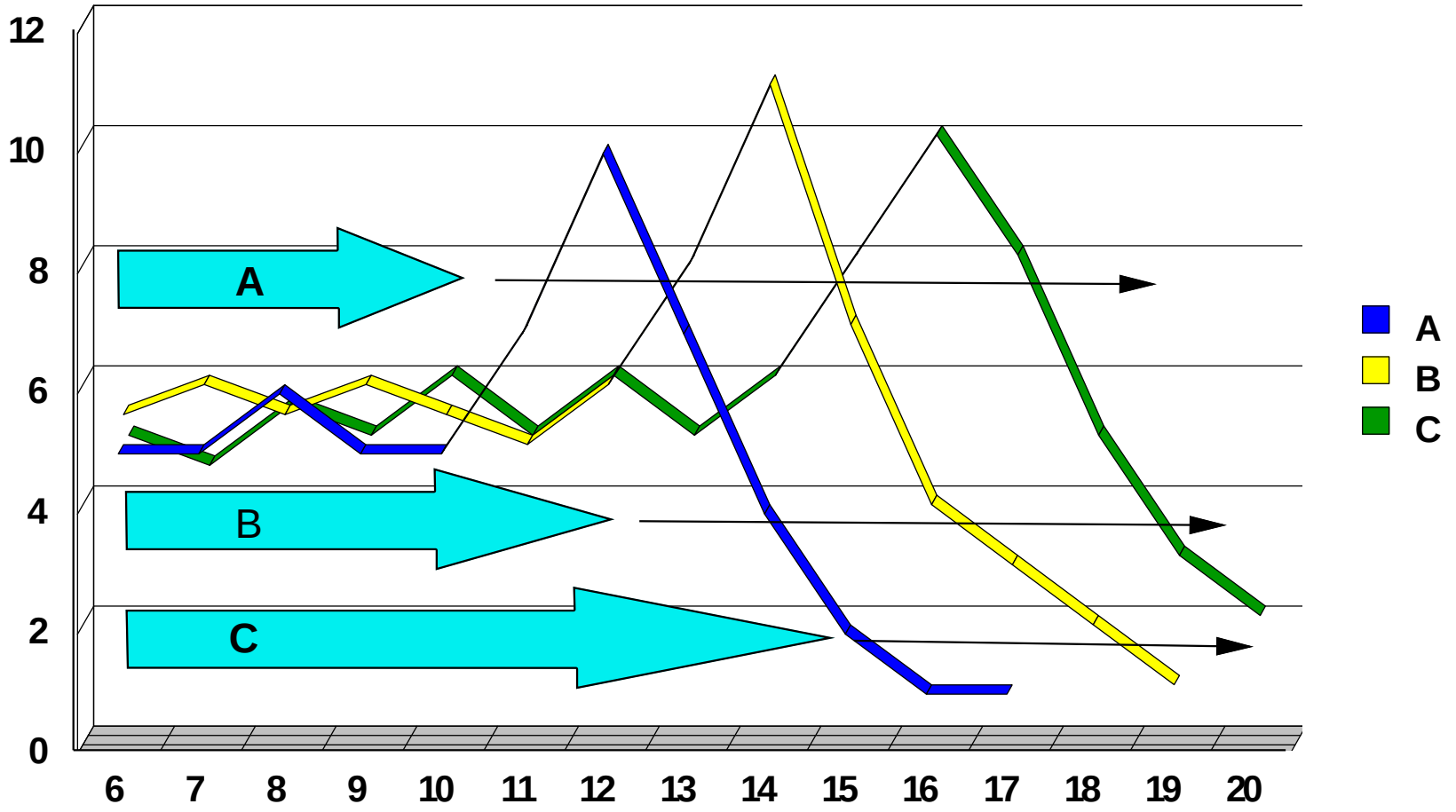
Maturity Events in Females

Early, Average and Late Maturer

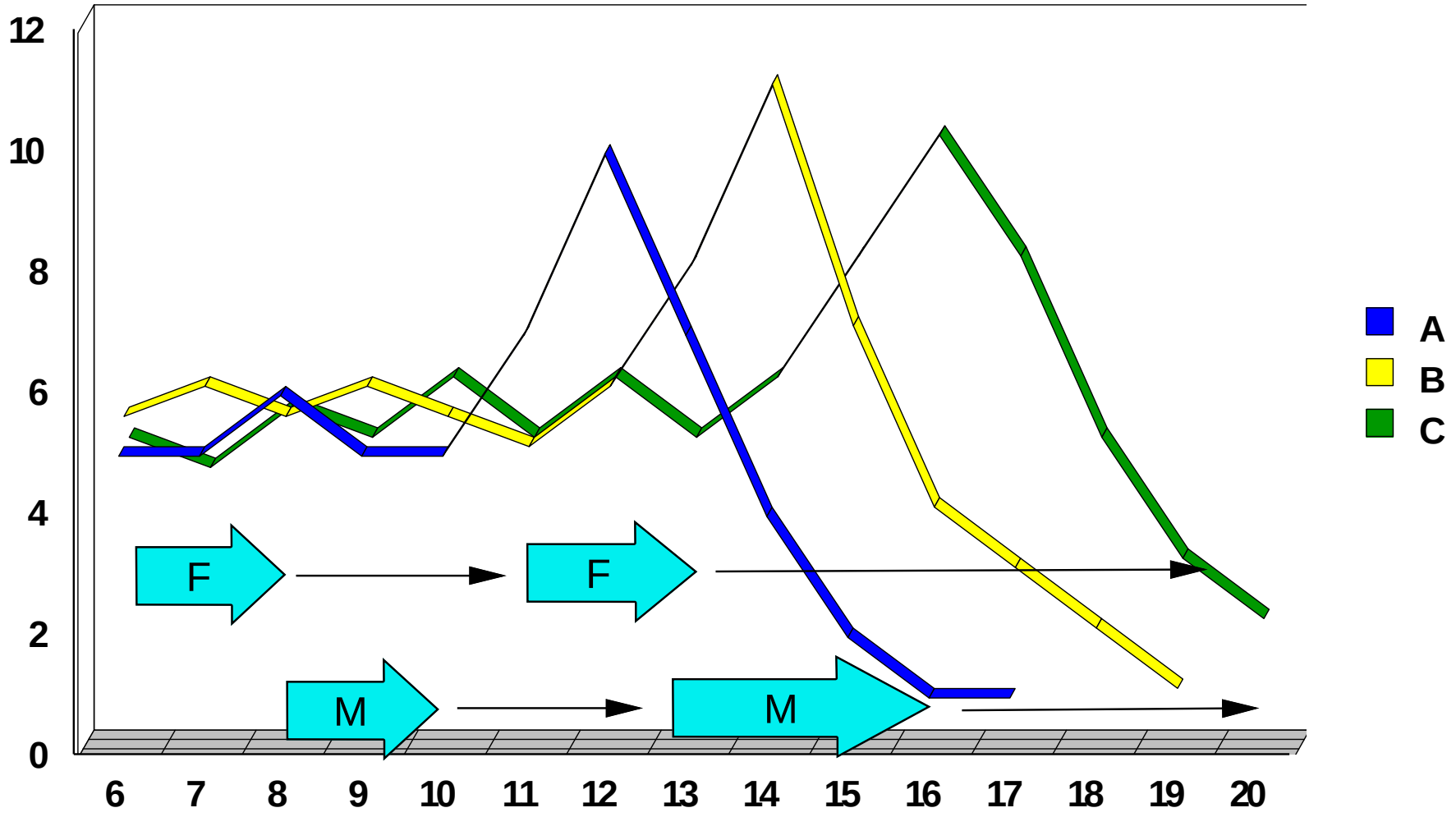
All 3 Athletes are 14 years of age Chronologically



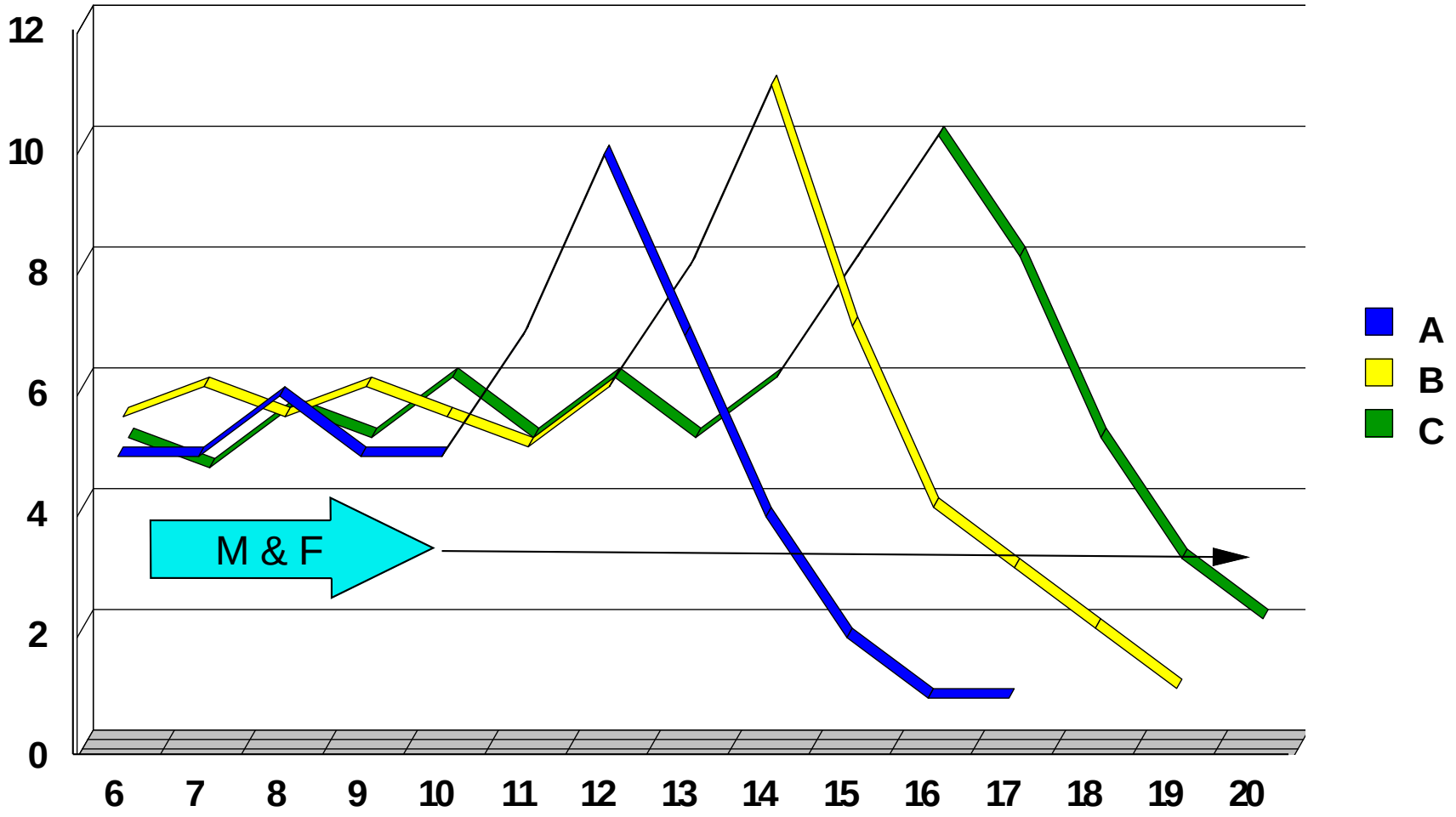
Skill Trainability



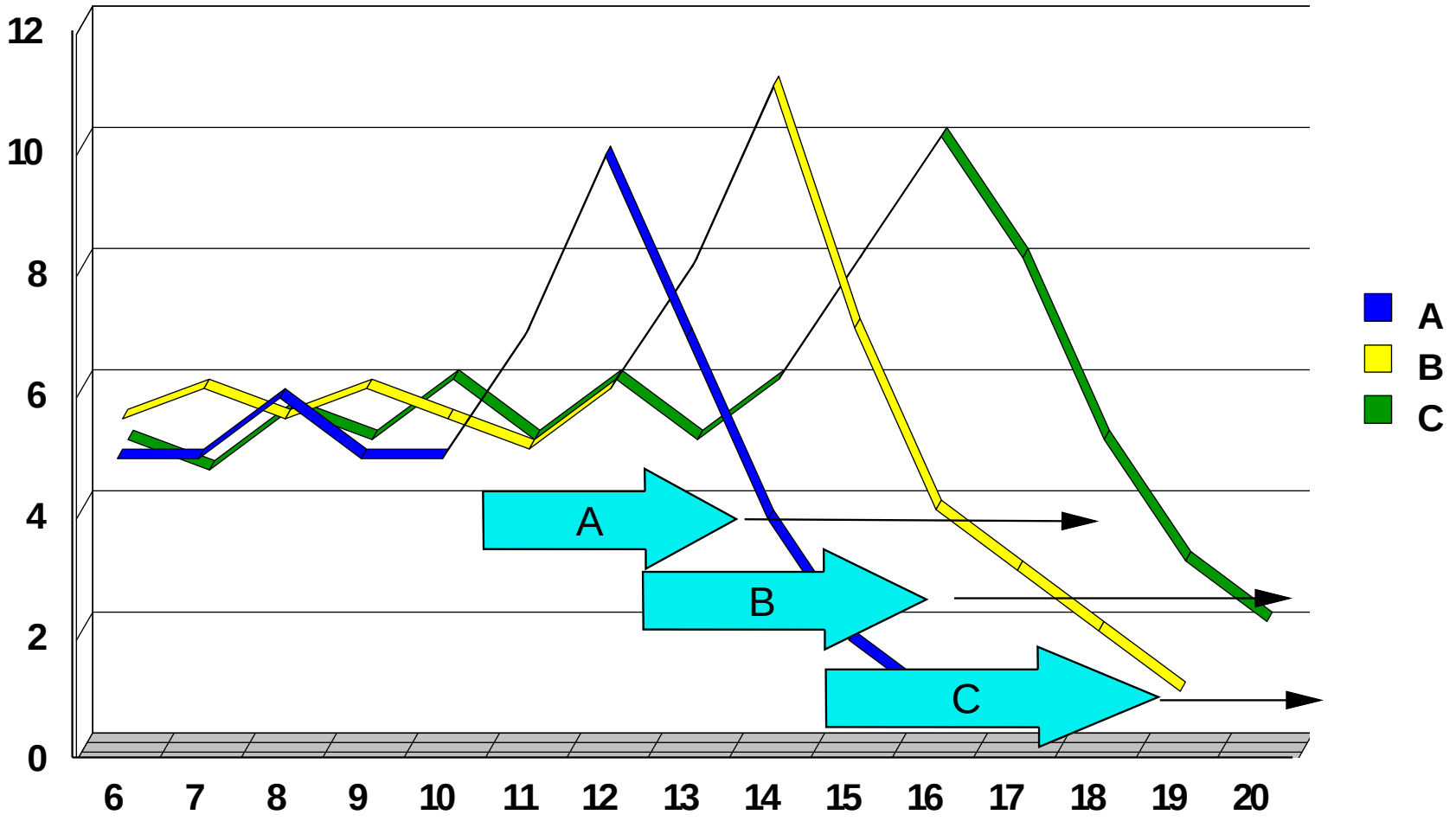
Speed Trainability



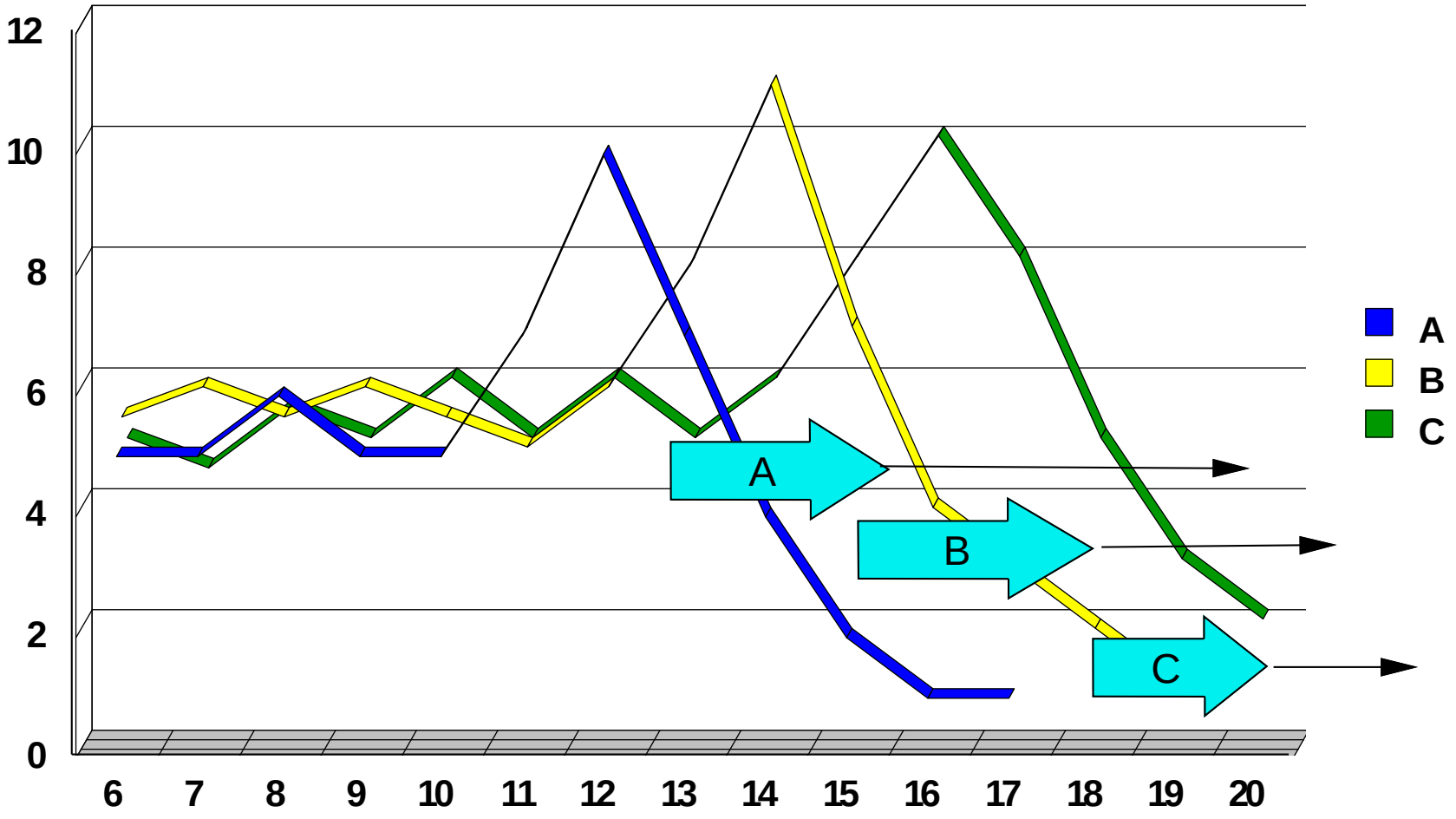
Suppleness Trainability



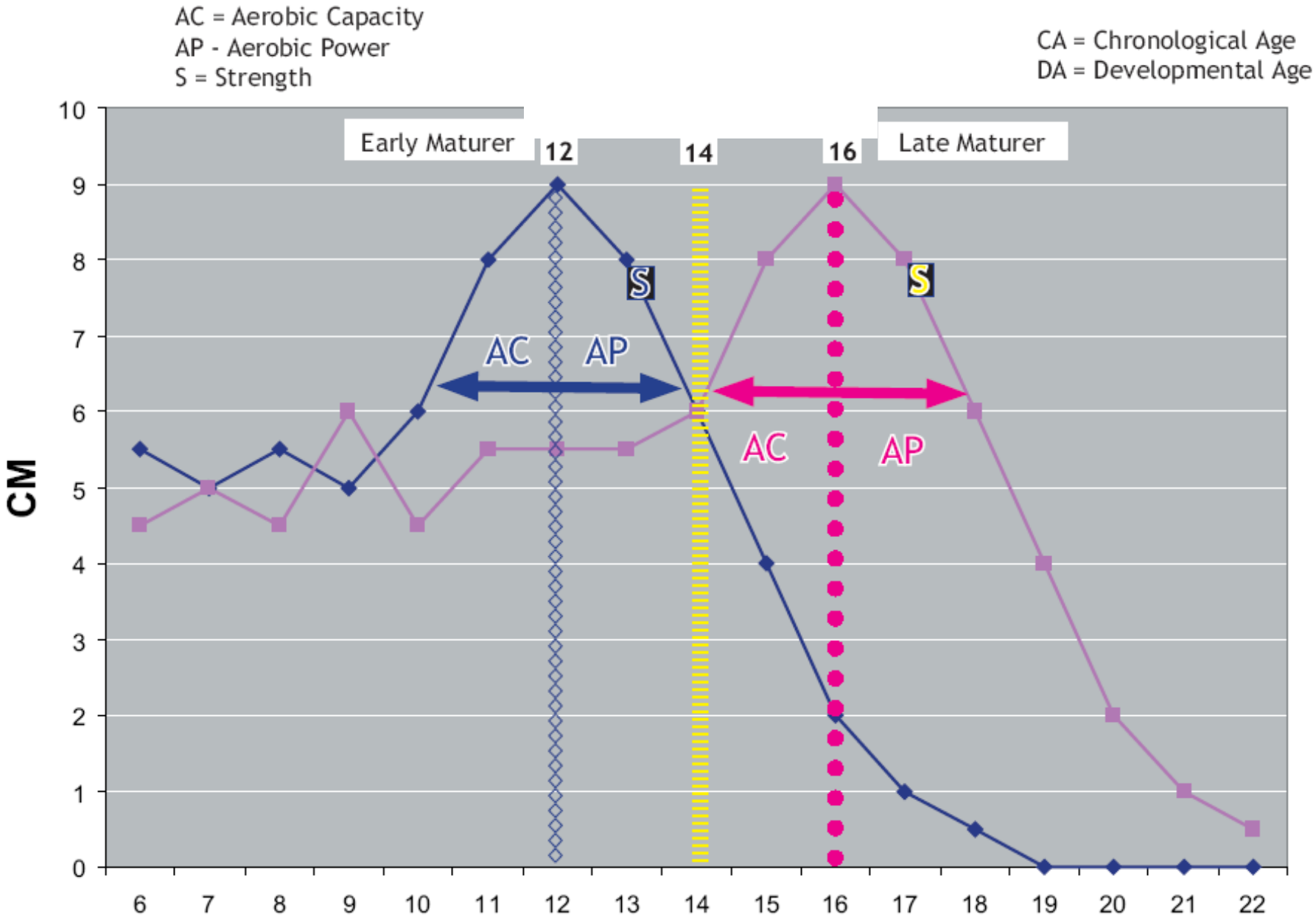
Endurance Trainability



Strength Trainability



Training Priorities Based on PHV



Development Age of a 14 year old

Reactive Periodization

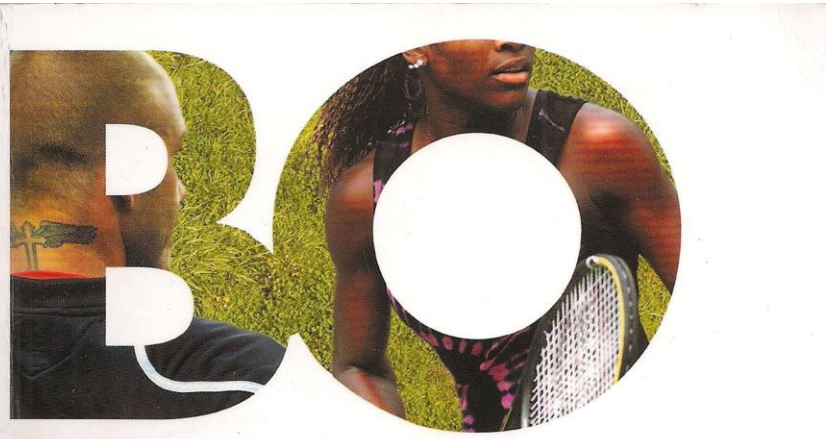
- **Biological markers**
- **Monitoring the onset of the growth spurt, PHV and deceleration of growth is a must to design/ adjust the plan**
- **Reacting to the velocity of growth**
- **Adjusting training, competition and recovery program designs and activities**
- **“Adolescent maintenance”**
- **Viru = “If there is a conflict between the long-term plan and competition demands, the first must take priority!”**

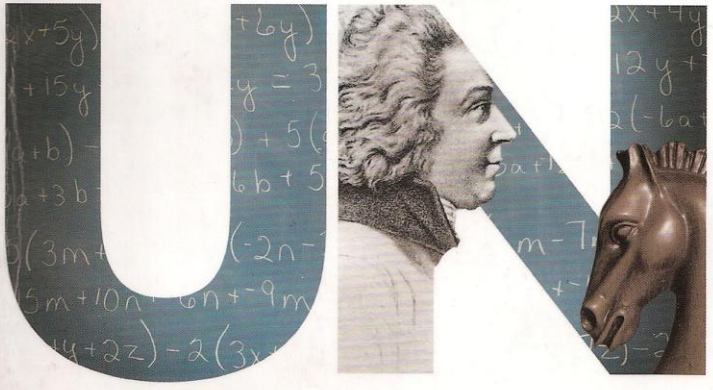
Talent is Overrated

What *Really* Separates World-Class Performers from Everybody Else

GEOFF COLVIN

Senior Editor at Large, FORTUNE





'A GRIPPING EXAMINATION OF THE HIDDEN FORCES THAT COME TOGETHER IN THE MAKING OF A CHAMPION.'
MIKE ATHERTON

'A FASCINATING SUBJECT AND SYED IS A DAZZLING WRITER.'
OWEN SLOT, *THE TIMES*

MATTHEW SYED

HOW CHAMPIONS ARE MADE

"I am willing to guarantee that you will not read a more important and useful book in 2009, or any other year."

—TOM PETERS, coauthor of *In Search of Excellence*

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GREATNESS ISN'T BORN. IT'S GROWN. HERE'S HOW.

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Supercharge Your Mental Circuits to Beat Stress, Sharpen Your Thinking, Lift Your Mood, Boost Your Memory, and Much More

JOHN J. RATEY, MD

COAUTHOR OF *DRIVEN TO DISTRACTION*

with ERIC HAGERMAN

The Scientific Plan *to Make You Smarter, Healthier, More Productive*

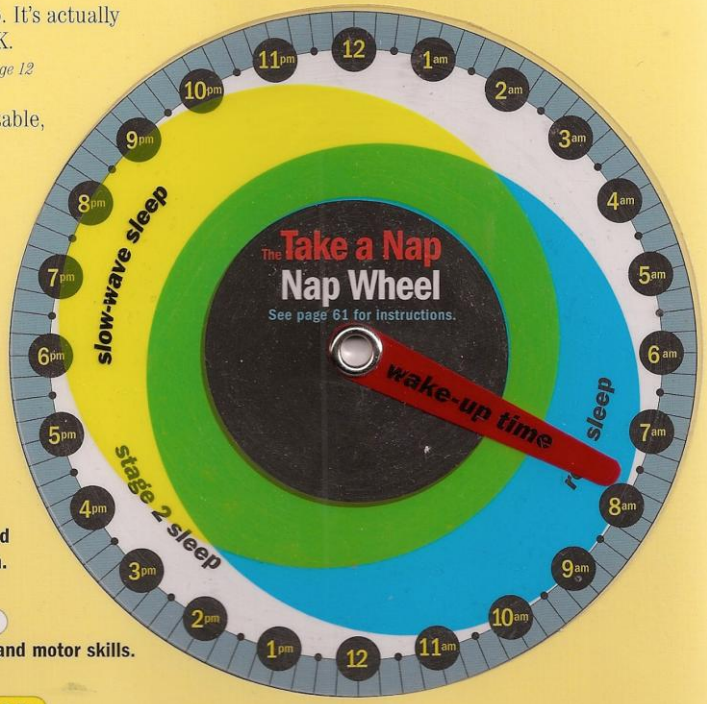
Take a Nap!

Change your life.

1 It's O.K. to nap. It's actually better than O.K. It's lifesaving. *See page 12*

2 Find a comfortable, safe spot. Set your alarm clock. (Your cell phone has one.) *See page 87*

3 Use the Nap Wheel to get exactly the nap you need: energy, fresh ideas, a better mood. *See page 61*

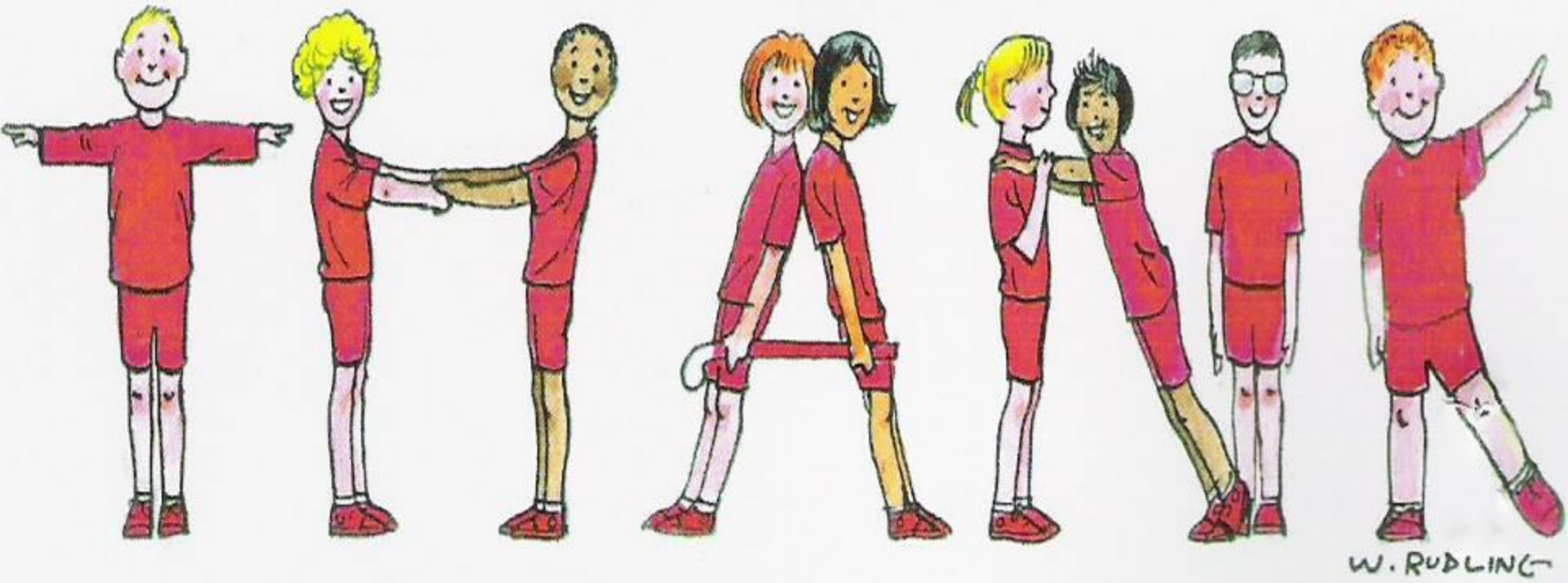


A nap with more rem sleep inspires creativity and heightens perception.

A nap with more stage 2 sleep increases alertness and motor skills.

A nap with more slow-wave sleep improves memory and clears your mind.

Sara C. Mednick, Ph.D. with Mark Ehrman


W. RUDLING


GUINNESS
DRAUGHT
GUINNESS
DRAUGHT

Key References

Review Article

Rushall, B. The Growth of Physical Characteristics in Male and Female Children.

In: Sports Coach, Australia. Vol.20. No 64, Summer, 1998. pp. 25 – 27.

"Most authors agree that the sensitive skill learning period is between 9 and 12 years."

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