



UNIVERSITY OF PÉCS
MEDICAL SCHOOL



Bests of athletic performance

Lecture 1



PTE740

<http://potecho.pte.hu>

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Requirements, recommended literature

- 25 % absence is allowed
- Examination: written test (simple choice, true false questions)

Lessons:

- 09/10/2024; 16/10/2024; 30/10/2024; 06/11/2024

Room: SIOT1015

Presentations: homepage of Sports Medicine Center (Educational materials)

- Recommended literature:

1. Cooper C.B, Storer T.W. Exercise testing and interpretation. A practical approach.

Cambridge University Press, Cambridge, 2004

2. Katch V.L., McArdle W.D., Katch F.I. Essentials of exercise physiology. Lippincott Williams & Wilkins, a Wolters Kluwer business, Philadelphia, USA, 2011

Result of the test (%)	Grade
100-85	5
84-75	4
74-65	3
64-50	2
0-49	1

slido



Why did you choose this course?

What do you expect from this course?

Participants can vote at **slido.com** with

2294056

(12 - 15 Oct) or anytime at this link.

[https://app.sli.do/event/1K7CeNy5WNGxP](https://app.sli.do/event/1K7CeNy5WNGxPrUShwasYy)

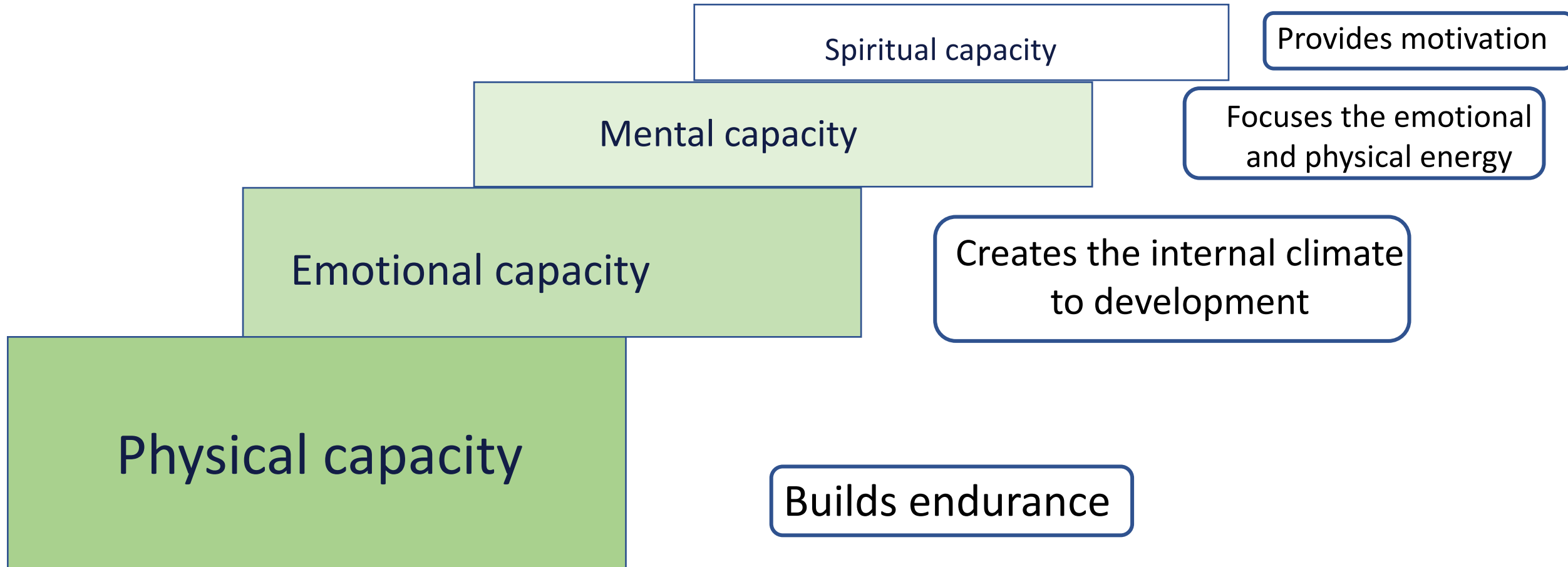
[rUShwasYy](https://app.sli.do/event/1K7CeNy5WNGxPrUShwasYy)



Examining the sports performance of the best



General performance



Physical performance - Classification of physical abilities

Conditional physical abilities:

1. Resilience / Endurance
2. Force
3. Speed

Flexibility

Coordination physical abilities:

1. Ability to differentiate (coordination)
2. Coupling or synchronization capacity
3. Rhythm ability or rhythm
4. Balancing ability
5. Readaptation or change capacity
6. Guidance capacity
7. Reaction capacity

Special abilities

The most frequently measured components of physical performance



Components of physical performance (or health related physical fitness):

1. muscular endurance
2. cardiovascular endurance
3. muscular strength /force
4. body composition
5. flexibility
6. speed

Need for measurements:

- Aim / aims of the measurement
- Participants (age, gender, sport habits, health status)
- Available devices, infrastructure and professionals

Measurement of physical performance (Premier League Fitness Test)

<https://www.youtube.com/watch?v=4FtmxYFhnT4>



Collect and write the name of the test and the measured motor skills.

Purposes of physical performance measurements

1. Actual physical performance measurements:

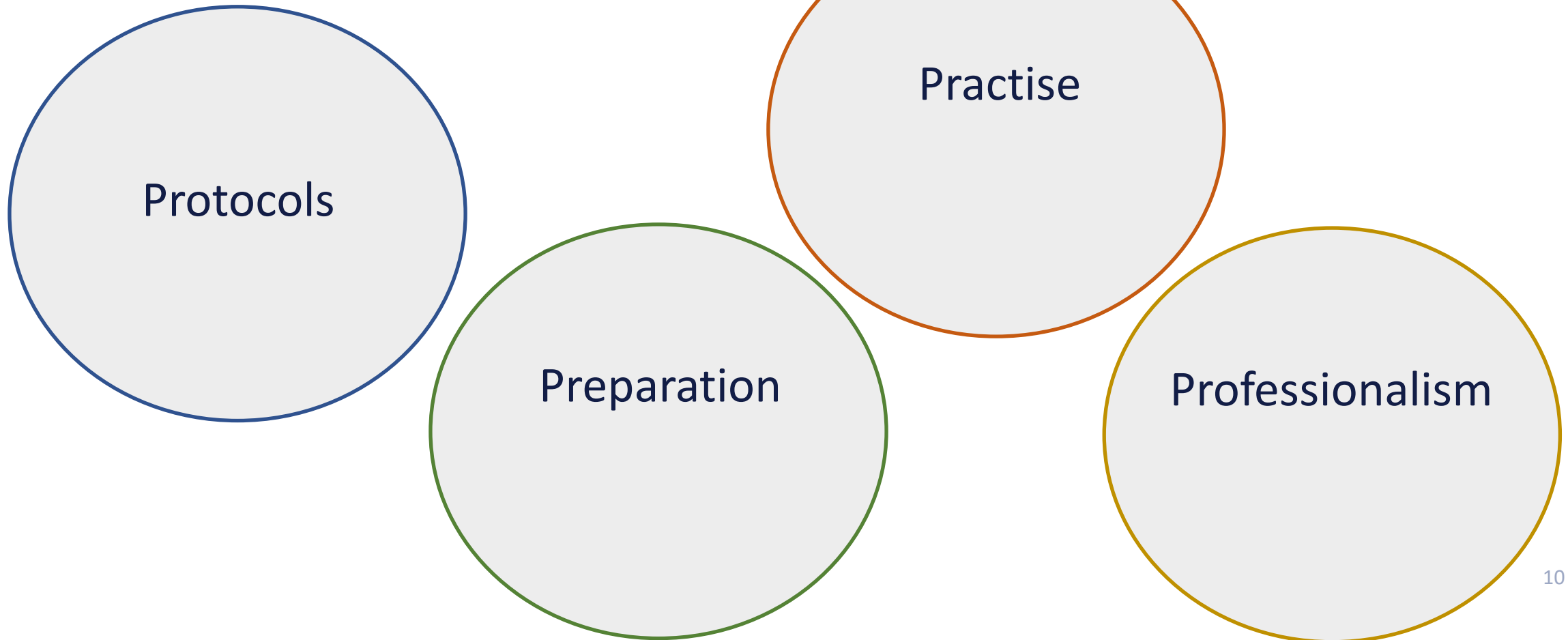
- Screening athletes with physical tests (professional athletes: after sport injury and rehabilitation, end of summer holiday, or patients before change in lifestyle etc.)
- Measurements for sport science researches

2. Regular physical performance measurements:

- For creating an individual training plan
- For measuring the effectiveness of the training
- Measurements for sport science researches

Principles of physical performance measurement

The four P's:



The fastest athletes



Speed, agility

Speed: Speed is the ability to move quickly across the ground or move limbs rapidly to grab or throw.

Agility: “a rapid whole-body movement with change of velocity or direction in response to a stimulus” (Sheppard, 2005)

Forms, Types:

- Acyclic speed
- Cyclic speed
- Straight sprint
- Changes of direction

What is the difference between these two abilities?
<https://www.youtube.com/watch?v=hZqEj-Qyg6U>

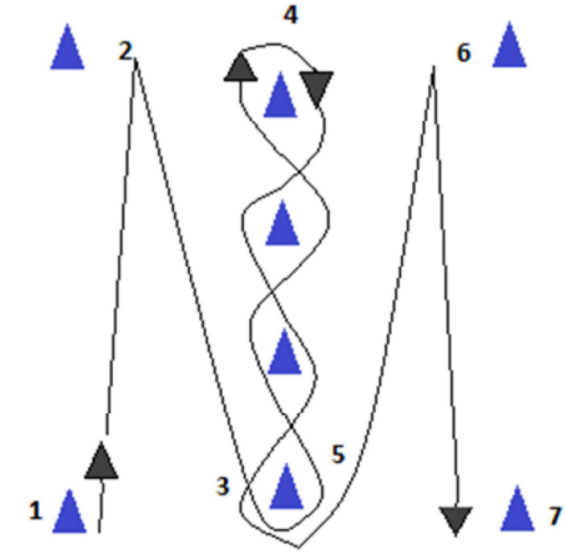
Measurements of speed and agility

- Field tests E.g.: Illinois Agility Test

<https://www.youtube.com/watch?v=u6emyuz76Uk>

- Laboratory measurement of speed

<https://www.youtube.com/watch?v=SdMo9hbt2nI>
(3:11)



Sports, where speed is important (speed sports)

Ranking	Sport	Rating (/10)
1.	Track and Field: Sprints	9.88
2.	Speed Skating	8.88
3.	Swimming (all strokes): Sprints	7.88
4.	Ice Hockey	7.75
5.	Track and Field: Middle Distance	7.75
6.	Cycling: Sprints	7.50
7.	Skiing: Alpine	7.38
8.	Basketball	7.25
9.	Soccer	7.25
10.	American Football	7.25

Fastest athletes I. – 100m sprint

Current men's world record: Usain St. Leo Bolt (9.58 s; 44.72km/h; Berlin 2009 World Athletics Championships)

https://www.youtube.com/watch?v=3nbjhpcZ9_g

Eight-time Olympic and eleven-time world champion.

Event	Time (seconds)	Venue	Date	Records
100 metres	9.58	Berlin, Germany	16 August 2009	WR
150 metres	14.35	Manchester, England	17 May 2009	WB ^[note 2]
200 metres	19.19	Berlin, Germany	20 August 2009	WR



References:

https://en.wikipedia.org/wiki/Usain_Bolt
<https://www.superfitt.hu/usain-bolt-sebessege-palyafutasa/>
<https://www.youtube.com/watch?v=OPH0SV4j1Es>

2025: Jamaica National Stadium: Kishane Thompson 9,75s

9.95	0.3		Jim Hines	 United States	Mexico City, Mexico	October 14, 1968	OR , A ^[2]	14 years, 8 months and 19 days
9.93	1.4		Calvin Smith		Colorado Springs, USA	July 3, 1983	A ^[2]	4 years, 1 month and 27 days
9.83	1.0		Ben Johnson	 Canada	Rome, Italy	August 30, 1987	[note 3]	0 days
9.93	1.0		Carl Lewis	 United States	Rome, Italy	August 30, 1987	[5][6][note 4]	11 months and 18 days
	1.1				Zürich, Switzerland	August 17, 1988	[2]	1 month and 7 days
9.79	1.1		Ben Johnson	 Canada	Seoul, South Korea	September 24, 1988	[note 3][2]	0 days
9.92	1.1		Carl Lewis	 United States	Seoul, South Korea	September 24, 1988	OR [note 3][2]	2 years, 8 months and 21 days
9.90	1.9		Leroy Burrell		New York, USA	June 14, 1991	[2]	2 months and 11 days
9.86	1.2 ^[a]		Carl Lewis		Tokyo, Japan	August 25, 1991	[2]	2 years, 10 months and 11 days
9.85	1.2	9.848	Leroy Burrell		Lausanne, Switzerland	July 6, 1994	[2]	2 years and 21 days
9.84	0.7	9.835	Donovan Bailey	 Canada	Atlanta, USA	July 27, 1996	OR [2][7]	2 years, 10 months and 20 days
9.79	0.1		Maurice Greene	 United States	Athens, Greece	June 16, 1999	[2]	3 years, 2 months and 29 days
9.78	2.0		Tim Montgomery		Paris, France	September 14, 2002	[8][note 5]	2 years and 9 months
9.77	1.6	9.768	Asafa Powell	 Jamaica	Athens, Greece	June 14, 2005	[2]	10 months and 28 days
	1.7	9.766	Justin Gatlin	 United States	Doha, Qatar	May 12, 2006	[5][9][note 6]	30 days
	1.5	9.763	Asafa Powell	 Jamaica	Gateshead, United Kingdom	June 11, 2006	[2]	2 months and 7 days
	1.0	9.762			Zürich, Switzerland	August 18, 2006	[2]	1 year and 22 days
9.74	1.7	9.735	Rieti, Italy		September 9, 2007	[1][10]	8 months and 22 days	
9.72	1.7		New York, USA		May 31, 2008	[2]	2 months and 16 days	
9.69	0.0	9.683	Usain Bolt		Beijing, China	August 16, 2008	OR ^[2]	1 year
9.58	0.9	9.572			Berlin, Germany	August 16, 2009	CR ^{[1][11][12]}	13 years

11
sprinters,
who
broke
world
record

Fastest athletes II. – 100m sprint

Current women's world record: Florence Griffith-Joyner
(10.49 s; Indianapolis 1988)

<https://www.youtube.com/watch?v=Mrt9yZL8dbI>



Rank	Mark	WIND	Competitor	DOB		Pos	Venue	Date	Results Score
1	10.49	0.0	Florence GRIFFITH JOYNER	21 DEC 1959	USA	1qf1	Indianapolis, IN (USA)	16 JUL 1988	1314
2	10.54	+0.9	Elaine THOMPSON-HERAH	28 JUN 1992	JAM	1	Hayward Field, Eugene, OR (USA)	21 AUG 2021	1302
3	10.60	+1.7	Shelly-Ann FRASER-PRYCE	27 DEC 1986	JAM	1	Stade Olympique de la Pontaise, Lausanne (SUI)	26 AUG 2021	1289
4	10.64	+1.2	Carmelita JETER	24 NOV 1979	USA	1	Shanghai (CHN)	20 SEP 2009	1280
5	10.65	+1.1	Marion JONES	12 OCT 1975	USA	1	SGJ, Johannesburg (RSA)	12 SEP 1998	1277
5	10.65	+1.0	Shericka JACKSON	16 JUL 1994	JAM	1	National Stadium, Kingston (JAM)	07 JUL 2023	1277
5	10.65	-0.2	Sha'Carri RICHARDSON	25 MAR 2000	USA	1	Nemzeti Atlétikai Központ, Budapest (HUN)	21 AUG 2023	1278
5	10.65	+0.4	Melissa JEFFERSON-WOODEN	21 FEB 2001	USA	1	Hayward Field, Eugene, OR (USA)	01 AUG 2025	1277

References: https://en.wikipedia.org/wiki/Women%27s_100_metres_world_record_progression
<https://worldathletics.org/records/all-time-toplists/sprints/100-metres/outdoor/women/senior>

Fastest athelets IV.

https://www.youtube.com/watch?v=SaO1_d3WmRg



Group work

Group 1: Which external factors affect the speed of athletes (e.g. 100 m sprint) on track?

Group 2: Which internal factors affect the speed of athletes (e.g. 100 m sprint) on track?

Which external factors do you need to be the fastest athletes?

Environmental factors:

- Wind direction and speed: significantly influence the result (a tailwind of 2 m/s results in a time improvement of 0.01 s)
- Temperature: In the case of single sprint performance, a higher temperature is preferable. 2nd biggest influencer of time (with an increase of 0.01 s / 10 °C per step at 100 m)
- Humidity: significantly affects air resistance (little effect on time, less than 0.01 s)
- Air pressure: It has a small influence (less than 0.01 s)
- Altitude: 1000 m climb improves time by 0.03 s
- Time of day (circadian rhythm)
- Clothes, shoes
- Track, soil quality, etc.

Which skills, abilities do you need to be the fastest athletes?



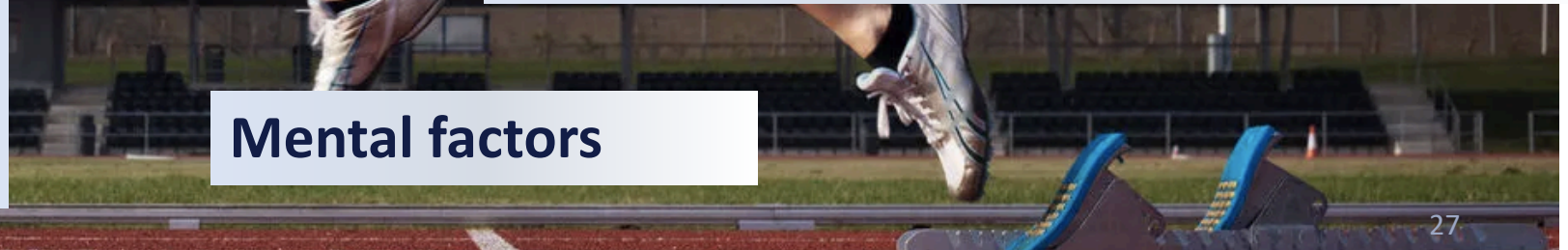
Motor skills:

- High reaction speed and responsiveness
- High explosive power
- High movement speed
- Optimal body composition
- Good balance ability
- Sense of rhythm

Physiological and molecular suitability:

- Optimal work of the nervous and muscular system (for example impulse conduction, nerve-muscle connection, muscle contraction)
- Optimal muscle fiber ratios
- Predisposition to muscle hypertrophy
- Higher production in steroid hormones / growth hormone
- Adequate charging of energy stores (ATP, CrP)

Mental factors



Bests of athletic performance

Why is it impossible to run 100m in 9s?
Can human speed improve?

<https://www.youtube.com/watch?v=SdMo9hbt2nI>

Most exciting moments of the fastest athletes

<https://www.youtube.com/watch?v=SdMo9hbt2nI>



The strongest athletes



Strength, force

Ability to carry out work against a resistance (internal, external). Strength is the maximal force you can apply against a load.

Look like strong:

<https://www.youtube.com/watch?v=lrGeFP9ps3Q>

Forms:

- Maximal strength
- Relative strength
- Explosive strength
- Force endurance
- etc.

Strength measurements

- Field tests E.g.: 1RM test – one repetition maximum test

<https://www.youtube.com/watch?v=kORJnq0nP5g>

- Laboratory measurements E.g.: Hand grip strength

<https://www.youtube.com/watch?v=hBPfDbUW7lw>



Sports, where strength is important (strength sports)

Ranking	Sport	Rating (/10)
1.	Weight-Lifting	9.25
2.	American football	8.63
3.	Wrestling	8.38
4.	Boxing	8.13
5.	Track and Field: Weights	7.88
6.	Rowing	7.75
7.	Speed Skating	7.25
8.	Ice Hockey	7.13
9.	Rodeo: Steer Wrestling	7.00
10.	Rugby	7.00
11.	Track and Field: Pole Vault	6.88

The strongest athletes I. – Olympic weightlifting (men)

Races: snatch, clean and jerk, total
IWF Men's weight classes changed in 2018, new categories.

WR of the 55 kg category: Om Yun-chol (Clean and jerk: 166 kg; Total: 294kg, World Championship 2019)



Event	Record	Athlete	Nation	Date	Meet	Place
55 kg						
Snatch	135 kg	<i>World Standard</i>				
Clean & Jerk	166 kg	Om Yun-chol	 North Korea	18 September 2019	World Championships	 Pattaya, Thailand
Total	294 kg	Om Yun-chol	 North Korea	18 September 2019	World Championships	 Pattaya, Thailand

<https://www.youtube.com/watch?v=oEL6o49lazQ>

The strongest athletes II. – Olympic weightlifting (women)

49kg weight group world record holder: Ri Song-gum (Snatch: 125 kg; 221 kg; Asian Championships 2024)

Races: snatch, clean and jerk, total

IWF Women's weight classes changed in 2018, new categories.

WR of the 49 kg category: Ri Song-gum (Snatch: 125 kg; Total: 221 kg; in Asian Championships 2024)



49 kg							
Snatch	97 kg	Hou Zhihui	China	1 April 2024	World Cup	Phuket, Thailand	[6]
Clean & Jerk	125 kg	Ri Song-gum	North Korea	4 February 2024	Asian Championships	Tashkent, Uzbekistan	[37]
Total	221 kg			1 April 2024	World Cup	Phuket, Thailand	[6]

<https://www.youtube.com/shorts/yCihp5zTt7w>

Strongest athletes III. – non-olympic sports (2025 World's Strongest Man)

Winner of this year: Rayno Nel (South Africa)

#	Athlete	Nation	Points
1	Rayno Nel	 South Africa	47
2	Tom Stoltman	 United Kingdom	46.5
3	Mitchell Hooper	 Canada	43.5

<https://www.youtube.com/watch?v=nl1lvTlsz2U>

<https://www.youtube.com/watch?v=Zsfe4zOOhzo>

Which factors influence the strength of the strongest athletes?

- Cross-section of muscle, length
- Muscle fibre type and ratio
- Muscle adhesion
- Gender
- Age
- Lean body mass

Higher cross-section resulted higher force

Higher FG and FOG ratio improve the short-term force exertion.

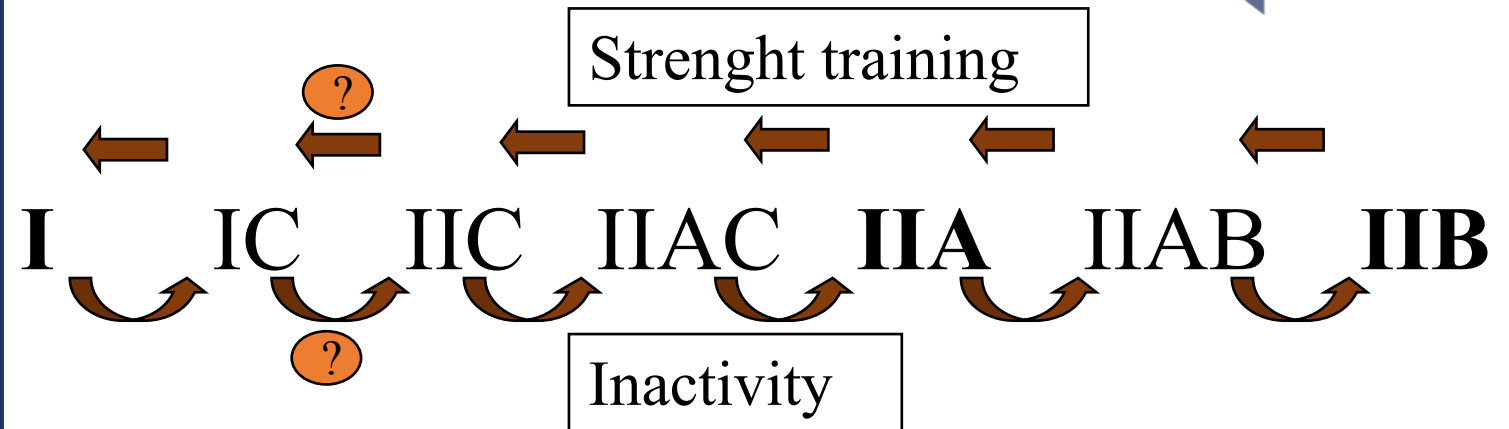
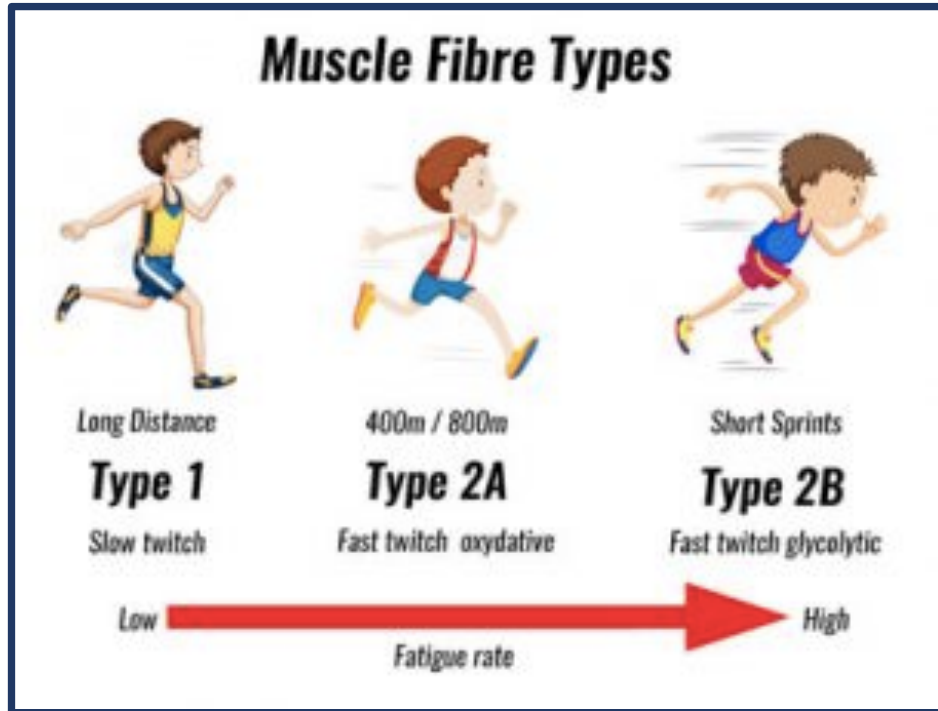
Average men is stronger than average women.

Higher testosterone level can cause higher muscle mass among men.

Peak strength is typical for women between 16-25 yrs and for men between the ages of 18-30. Strength decreases with age.

$$F = m * a$$

Which factors affect the strength of the strongest athletes? (Muscle fiber types)



Funny sport cases

<https://www.youtube.com/watch?v=gISO0o0YGsQ>



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Thank you for your attention!

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Kahoot!

<https://create.kahoot.it/details/650d40d6-8b7d-4543-9bf2-5d0b6b4a919d?drawer=>

