UNIVERSITY OF PÉCS
MEDICAL SCHOOL

SPORTMED
PTE ÁOK SPORTMEDICINA TANSZÉK

Bests of athletic performance

Lecture 1

POTEcho

PTE555

http://potecho.pte.hu

Eva Tékus, PhD

fall semester 2024, Pécs

Requirements, recommended literature

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

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

  Lessons:

  - 10/10/2024; 17/10/2024; 24/10/2024; 07/11/2024

  Room: SIOT0037

  Presentations: homepage of Sports Medicine Center (Educational materials)

- Recommended literature:

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

slido

Why did you choose this course?

What do you expect from this course?

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

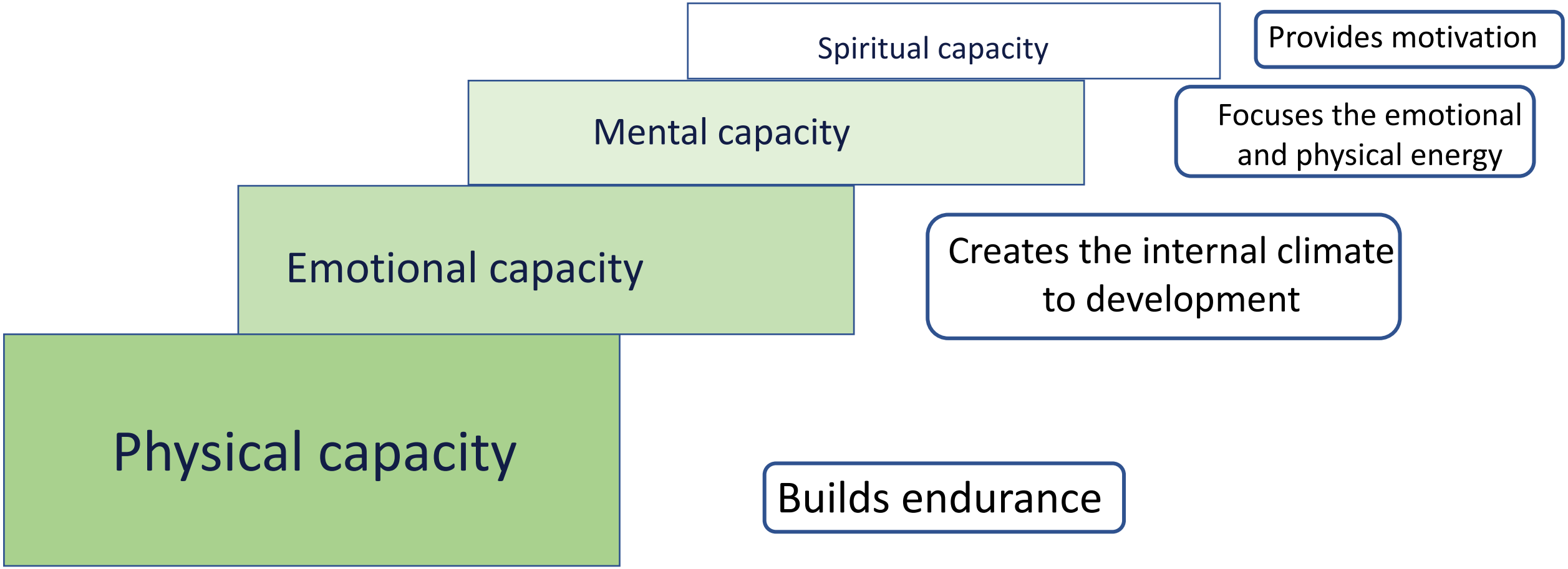
 # 2294056

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

https://app.sli.do/event/1K7CeNy5WNGxPrUShwasYy

Examining the sports performance of the best

General performance



References: Based on High performance pyramide (Harvard Business Review)

Physical performance - Classification of physical abilities

Conditional physical abilities:

1.Resiliance / Endurance

2. Force

3. Speed

Flexibility

Coordinational 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

References: http://tamop-sport.ttk.pte.hu/files/tananyagfejlesztes/motorikus-kepessegek-merese.pdf
https://www.lifepersona.com/what-are-conditional-physical-capabilities-classification
https://www.lifepersona.com/what-are-coordinating-physical-capabilities

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:

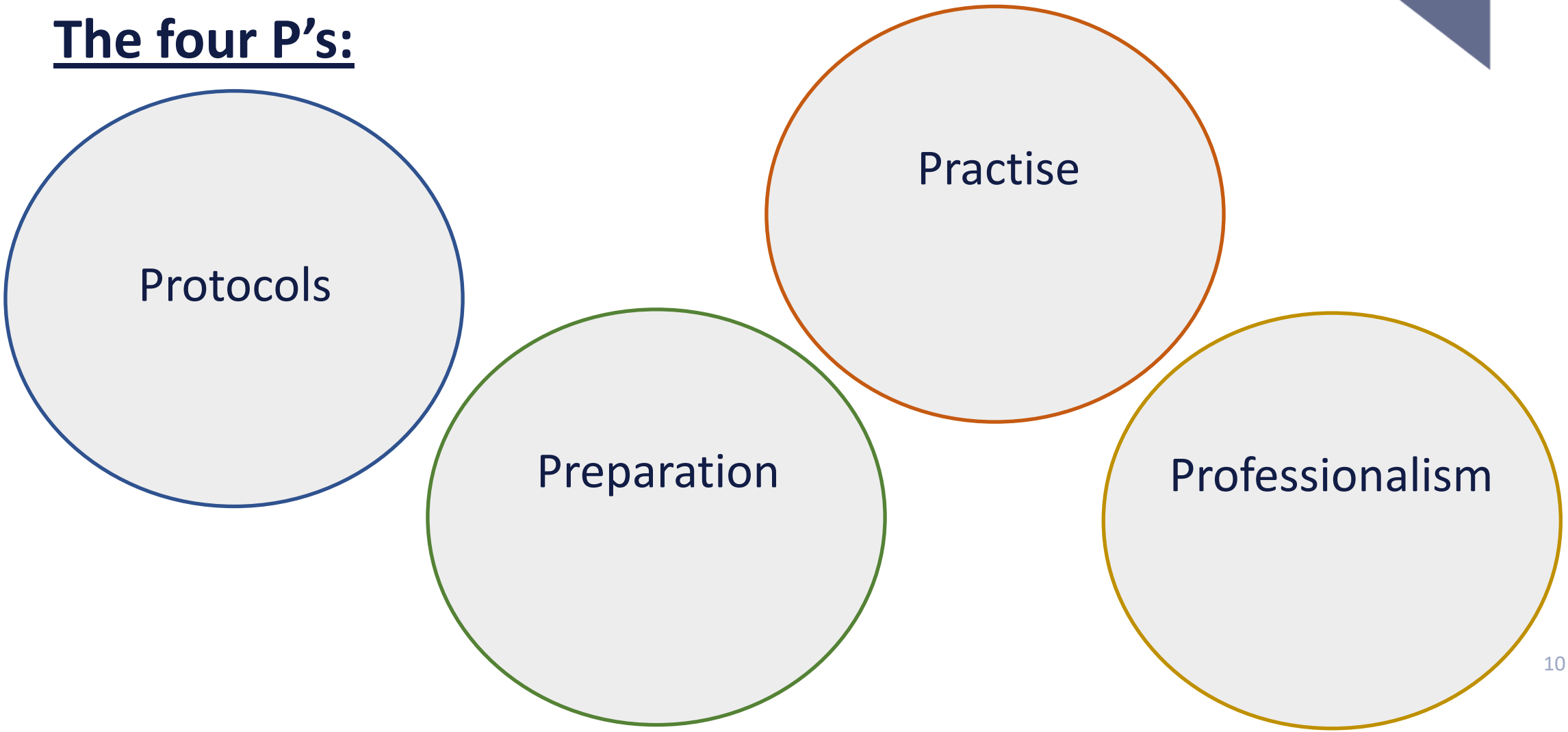
- Screening athletes with physical tests (professional athletes: after sport injury and rehabilitation, end of summer holiday, or patients before change in lifestyle etc.)
- Measurements for sport science researches

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

References: http://tamop-sport.ttk.pte.hu/files/tananyagfejlesztes/motorikus-kepessegek-merese.pdf
Sheppard JM, Young WB. (2005). Agility literature review: classifications, training and testing. J Sports Sci. 2006 Sep;24(9):919-32.

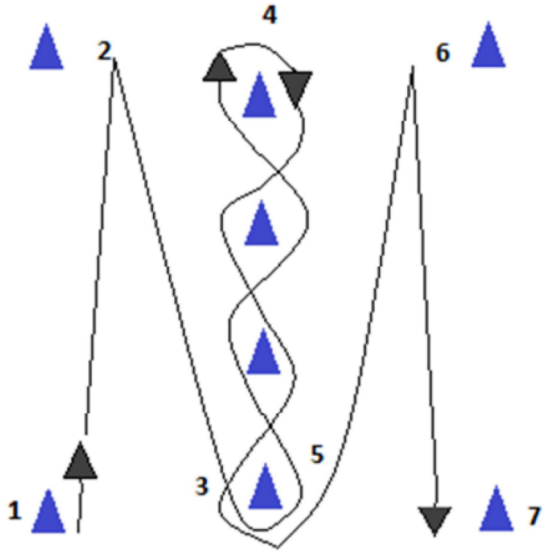
Measurements of speed and agility

- 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)



References: http://tamop-sport.ttk.pte.hu/files/tananyagfejlesztes/motorikus-kepessegek-merese.pdf
Sheppard JM, Young WB. (2005). Agility literature review: classifications, training and testing. J Sports Sci. 2006 Sep;24(9):919-32.

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

References: https://www.topendsports.com/fitness/sports-speed.htm

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

2024, Jamaica National Stadium: Kishane Thompson 9.77s

References:
https://en.wikipedia.org/wiki/Usain_Bolt
https://www.superfitt.hu/usain-bolt-sebessege-palyafutasa/
https://www.youtube.com/watch?v=0PH0SV4j1Es

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		Usain Bolt		New York, USA	May 31, 2008	[2]	2 months and 16 days
9.69	0.0	9.683			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

Reference: https://en.wikipedia.org/wiki/Men%27s_100_metres_world_record_progression, http://homedesigningersing.com/

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	Nat	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

References: https://en.wikipedia.org/wiki/Women%27s_100_metres_world_record_progression
https://www.eurosport.hu/atletika/ki-lehet-radirozni-a-tortenelemkonyvekbol-egy-legendas-vilagcsucsot-csak-mert-gyanusak-voltak-a-koru_sto8925538/story.shtml
https://www.eurosport.hu/atletika/ki-lehet-radirozni-a-tortenelemkonyvekbol-egy-legendas-vilagcsucsot-csak-mert-gyanusak-voltak-a-koru_sto8925538/story.shtml

Fastest athletes III.

American football:

- Bo Jackson: 100m 10.39s (Christian Coleman: 10.39 s – WR at that time)

Basketball:

- Russell Westbrook: whole court run (94 feet=28.65m) 3.36s with ball
  Maximal velocity: 34.8 km/h

Baseball:

- Rickey Henderson: 1406 steals
  Maximal velocity: 35.08 km/h

Soccer:

- Gareth Bale: Maximal velocity: : 36.85 km/h
  Avegare running distance: 10-12 km

Reference: https://www.youtube.com/watch?v=uWFv1vuPtwo

Fastest athletes III.

Name	Sport	Maximal velocity (km/h)
Bo Jackson	Baseball, American football	
Russel Westbrook	Basketball	
Rickey Henderson	Baseball	
Gareth Bale	Soccer	

Fill in the table.

Reference: https://www.youtube.com/watch?v=uWFv1vuPtwo

Fastest athletes III.

Name	Sport	Maximal velocity (km/h)
Bo Jackson	Baseball, American football	34.64
Russel Westbrook	Basketball	34.80
Rickey Henderson	Baseball	35.08
Gareth Bale	Soccer	36.85

Reference: https://www.youtube.com/watch?v=uWFv1vuPtwo

Fastest athelets IV.

https://www.youtube.com/watch?v=uWFv1vuPtwo

Reference: https://canada.humankinetics.com/blogs/physical-education-and-health/health-related-fitness-skill-related-fitness-manipulative-skills

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?

Milyen külső tényezők segíthetik a leggyorsabbak teljesítményét?

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.

Forrás:http://tamop-sport.ttk.pte.hu/files/tananyagfejlesztes/motorikus-kepessegek-merese.pdf, Girard et al., Scand J Med Sci Sports 2015: 25 (Suppl. 1): 79–89; Mureika et al., Canadian Journal of Physics 2005 84(4)

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

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)

Motor skills:

-High reaction speed and responsiveness

-High explosive power

-High movement speed

-Optimal body composition

-Good balance ability

-Sense of rhythm

Mental factors

Reference: Hébert-Losieret al., (2017). Sports medicine (Auckland, N.Z.), 47(2), 319–342.

Reference: https://www.youtube.com/watch?v=SdMo9hbt2nI, https://www.sportsnhobbies.org/what-are-the-different-events-in-track-and-field.htm

Most exciting moments of the fastest athletes

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

Reference: https://www.youtube.com/watch?v=SdMo9hbt2nI, https://www.sportsnhobbies.org/what-are-the-different-events-in-track-and-field.htm

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 strongs:
https://www.youtube.com/watch?v=IrGeFP9ps3Q

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

References: http://tamop-sport.ttk.pte.hu/files/tananyagfejlesztes/motorikus-kepessegek-merese.pdf
Sheppard JM, Young WB. (2005). Agility literature review: classifications, training and testing. J Sports Sci. 2006 Sep;24(9):919-32.

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=hBPfDbUW7Iw

References: http://tamop-sport.ttk.pte.hu/files/tananyagfejlesztes/motorikus-kepessegek-merese.pdf
https://www.hprc-online.org/physical-fitness/training-performance/what-one-rep-max

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

References: https://www.topendsports.com/fitness/sports/strength-espn.htm

The strongest athelets I. – Olympic weightlifting (men)

Races: snatch, clean and jerk, total

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

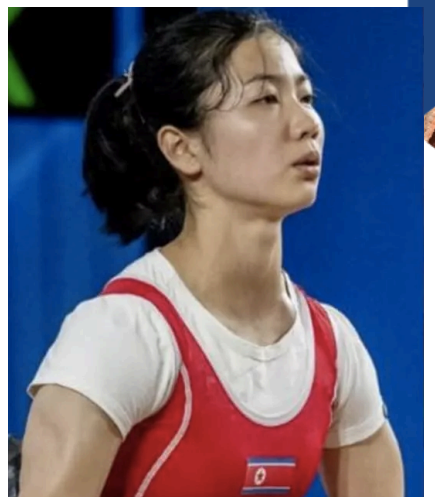
WR of the 55 kg category: Om Yun-chol (Clean and jerk: 166 kg; Total: 294kg, World Championship 2019)

Event	Record	Athlete	Nation	Date	Meet	Place
55 kg						
Snatch	135 kg	*World Standard*				
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
61 kg						

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

References: https://hu.wikipedia.org/wiki/Usain_Bolt
https://www.youtube.com/watch?v=oEL6o49lazQ

The strongest athelets II. – Olympic weightlifting (women)



Races: snatch, clean and jerk, total
IWF Women's weight classes changed in 2018, new categories.
WR of the 55 kg category: Kang Hyon-gyong (Snatch: 104 kg; clean and jerk: 131kg, Total: 234 kg; Asian Championship 2024, Wold Cup 2024)

https://www.youtube.com/shorts/6NtCh4dPIVw
https://www.youtube.com/shorts/1VXoiEiOuBs

Kang Hyon-gyong	103	30 September 2023	Asian Games	Hangzhou	[8]
	104	4 February 2024	Asian Championships	Tashkent	[9]
Kang Hyon-gyong	130	30 September 2023	Asian Games	Hangzhou	[8]
	131	2 April 2024	World Cup	Phuket	[2]

References: https://en.wikipedia.org/wiki/World_record_progression_women%27s_weightlifting

Strongest athletes III. – non-olympic sports (2024 World's Strongest Man)

Done in Strongman championship:

Deadlift – 430 kg (950 lb)
Squat – 391 kg (862 lb)
18-Inch Deadlift – 478 kg (1,054 lb)
Axle Press – 190 kg (420 lb)
Keg Toss – 7.50 m (24.6 ft) (2021 World's Strongest Man)
Flinstone Barbell – 240 kg (530 lb) (2022 World's Strongest Man)

#	Name	Nationality	Pts
1	Tom Stoltman	United Kingdom	53.5
2	Martins Licis	United States	43
3	Oleksii Novikov	Ukraine	43

https://www.youtube.com/watch?v=nl1lvTIsz2U

References: https://en.wikipedia.org/wiki/2022_World%27s_Strongest_Man
https://www.youtube.com/watch?v=nl1lvTIsz2U

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 stroonger than average women.

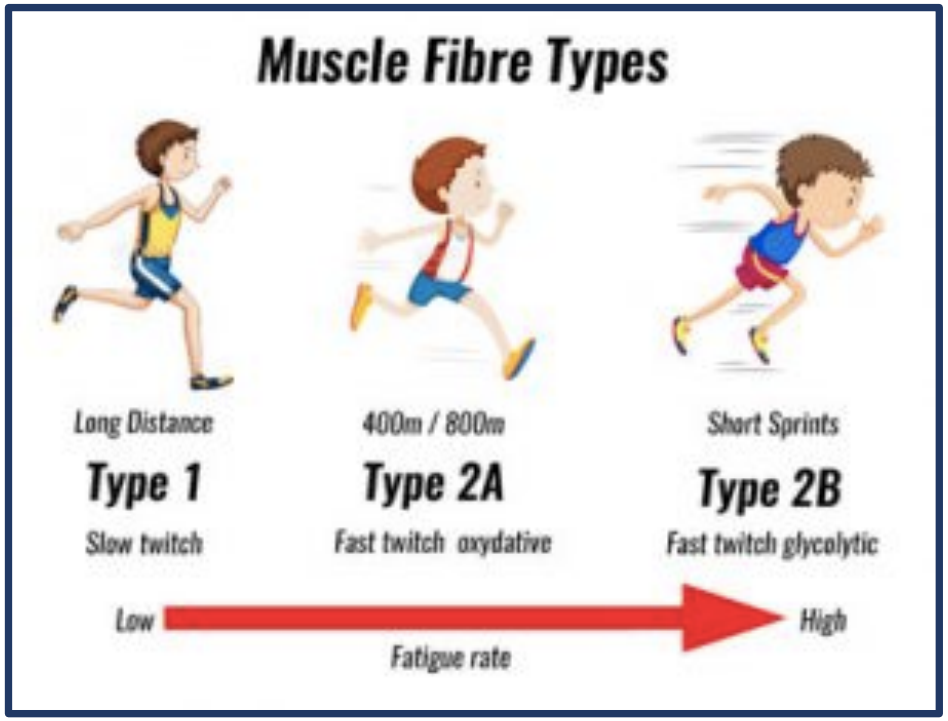
Higher testosterone level can cause higher muscle mass among men.

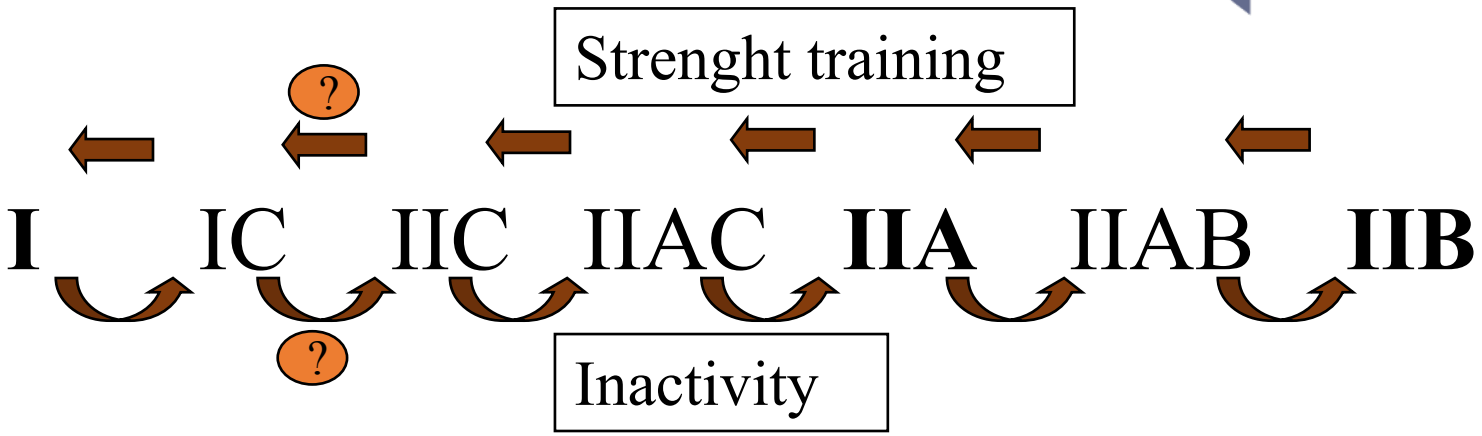
Peak strenght is typical for women between 16-25 yrs and for men between the ages of 18-30. Strenght decreases with age.

$$F = m * a$$

References: https://slideplayer.com/slide/16562334/
Kerksick et al. (2014). Journal of strength and conditioning research, 28(5), 1246–1254.

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





References: Staron et al., (1994) Journal of applied physiology (Bethesda, Md. : 1985), 76(3), 1247–1255. https://doi.org/10.1152/jappl.1994.76.3.1247http://atpplusct.com/muscle-fiber-type-review/

Funny sport cases

https://www.youtube.com/watch?v=T7GtFZWQFA0

Reference: Reeves et al, 2018, A scoping review of the potential sociological predictors of talent in junior-elite football: 2000–2016. Soccer and Society

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Thank you for your attention!

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Kahoot!

https://create.kahoot.it/course/5045eba1-50bd-4e23-8679-de958fe90b44