Zdatnost

MUDr. Kryštof Slabý

Klinika rehabilitace a tělovýchovného lékařství UK 2.LF a FN Motol

Zdatnost a spol.

- Zdatnost
- Trénovanost
- Výkonnost
- Kondice

- Vytrvalost
- Síla

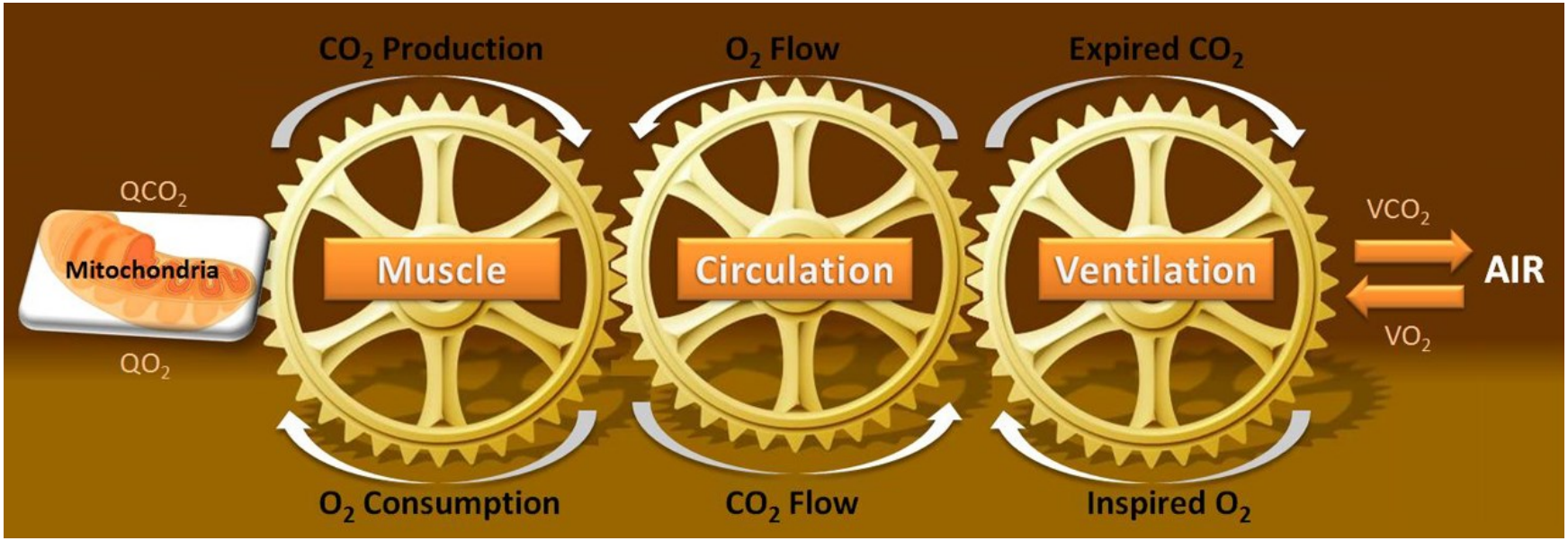
- Psychický stres
- Obratnost
- Koordinace
- Rovnováha
- „Posturální zátěž“
- „Statická zátěž páteře“

Typy zátěže

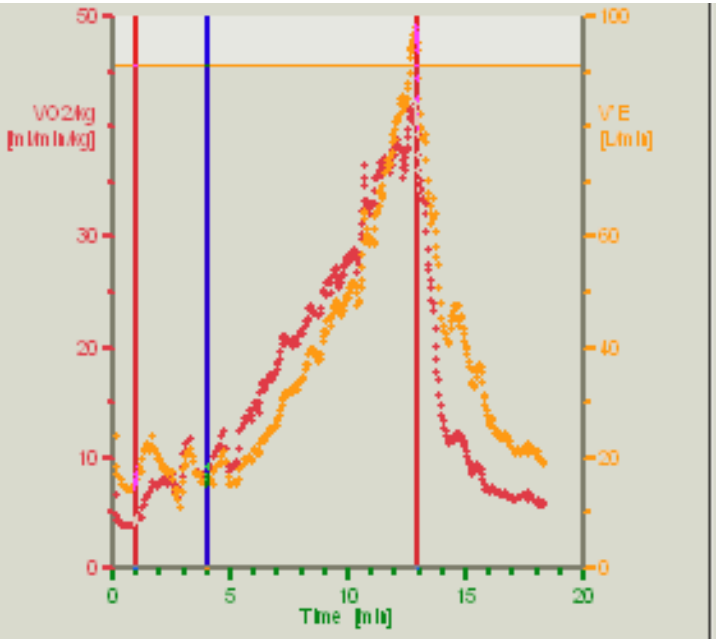
- Fyzická
  - Fyzikální (teplo, chlad)
  - Polohou (HUTT, stoj)
  - **Tělesná zátěž**
    - **Dynamická**
    - **Statická**
- Farmakologická
- Psychická
- „Metabolická“ (glukóza, laktóza, hlad)

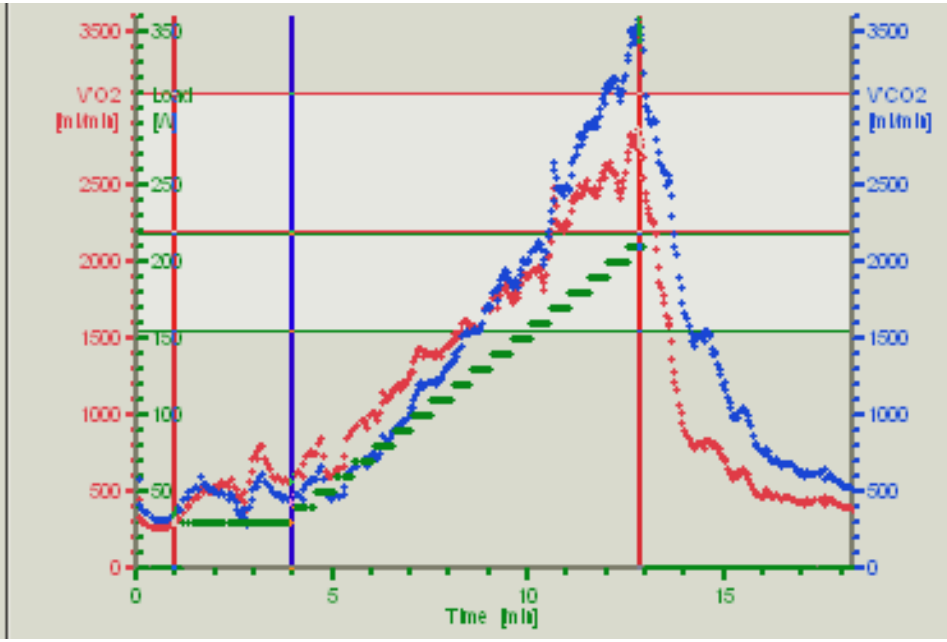
zátěžové testy / funkční diagnostika

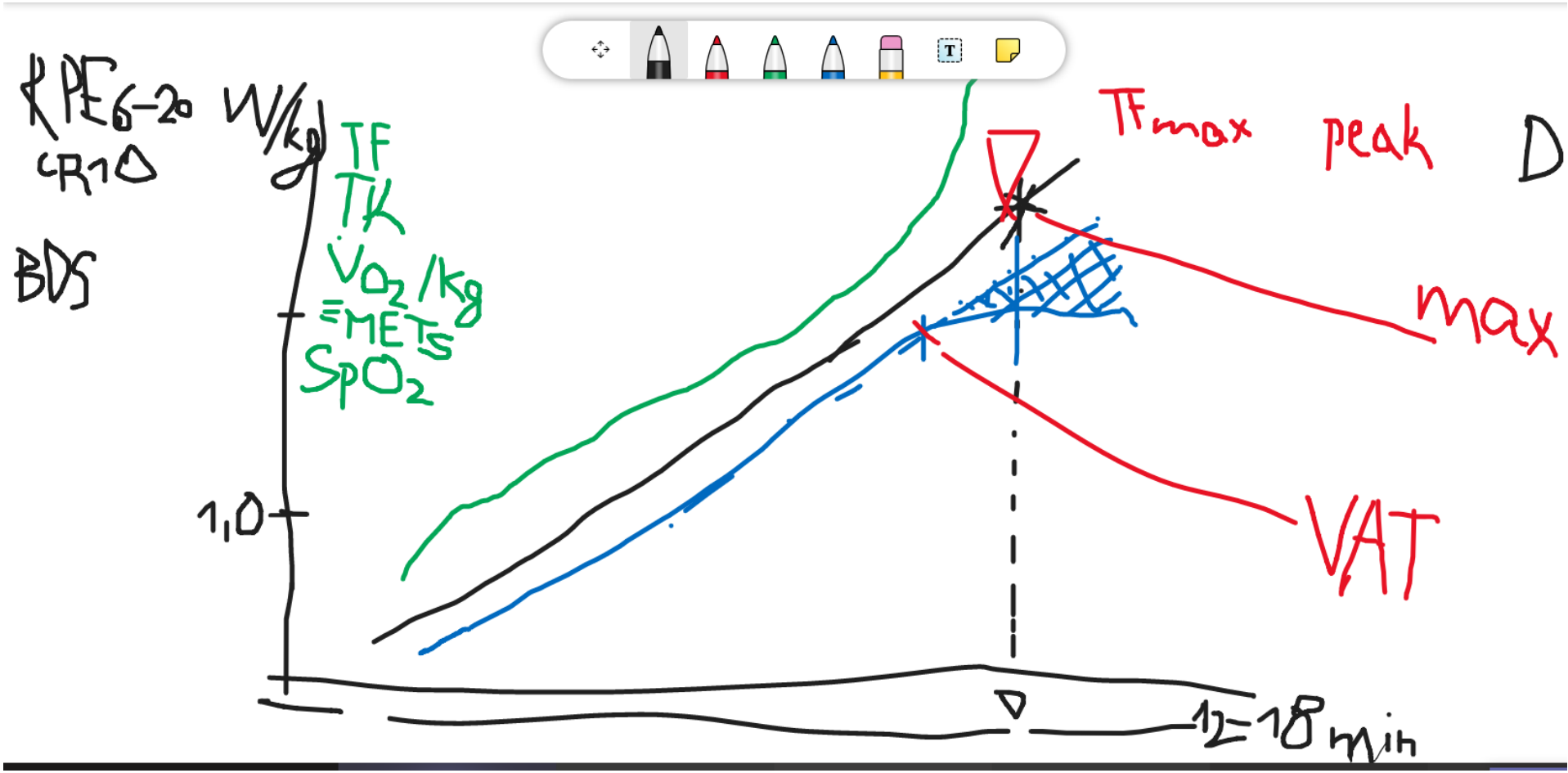
Kolečka pana Wassermana



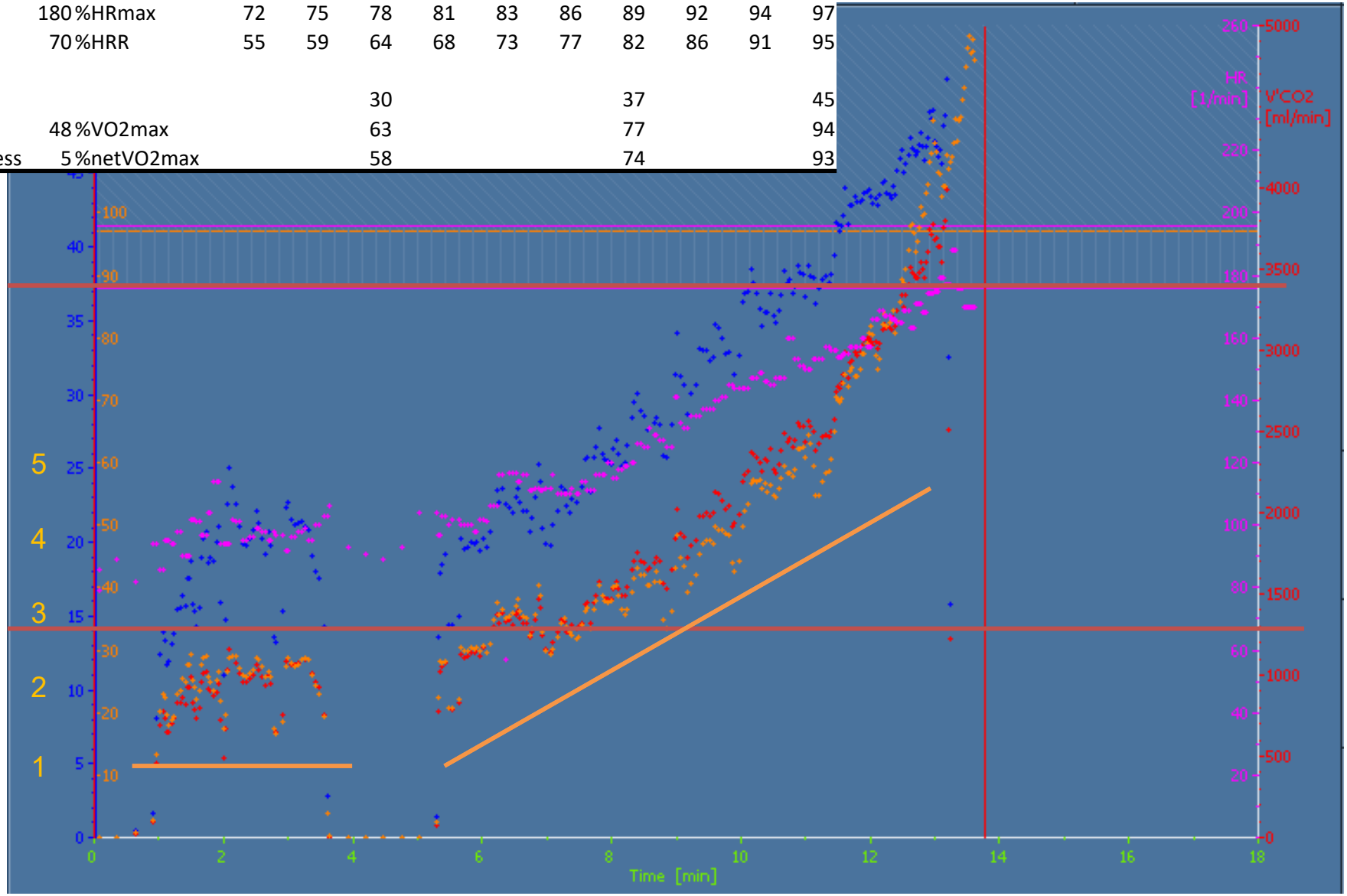
Wasserman K. Clin Sci 1981


VO2/kg
[ml/min/kg]
VE
[L/min]
Time [min]


VO2
[ml/min]
Load
[W]
VCO2
[ml/min]
Time [min]


KPE6-20
CR10
BDS
W/kg
TF
TK
VO2/kg
=METS
SpO2
1,0
TFmax
peak
D
max
VAT
D
12-18 min

HR		130	135	140	145	150	155	160	165	170	175
max	180 %HRmax	72	75	78	81	83	86	89	92	94	97
rest	70 %HRR	55	59	64	68	73	77	82	86	91	95
VO2				30				37			45
max	48 %VO2max			63				77			94
loadless	5 %netVO2max			58				74			93



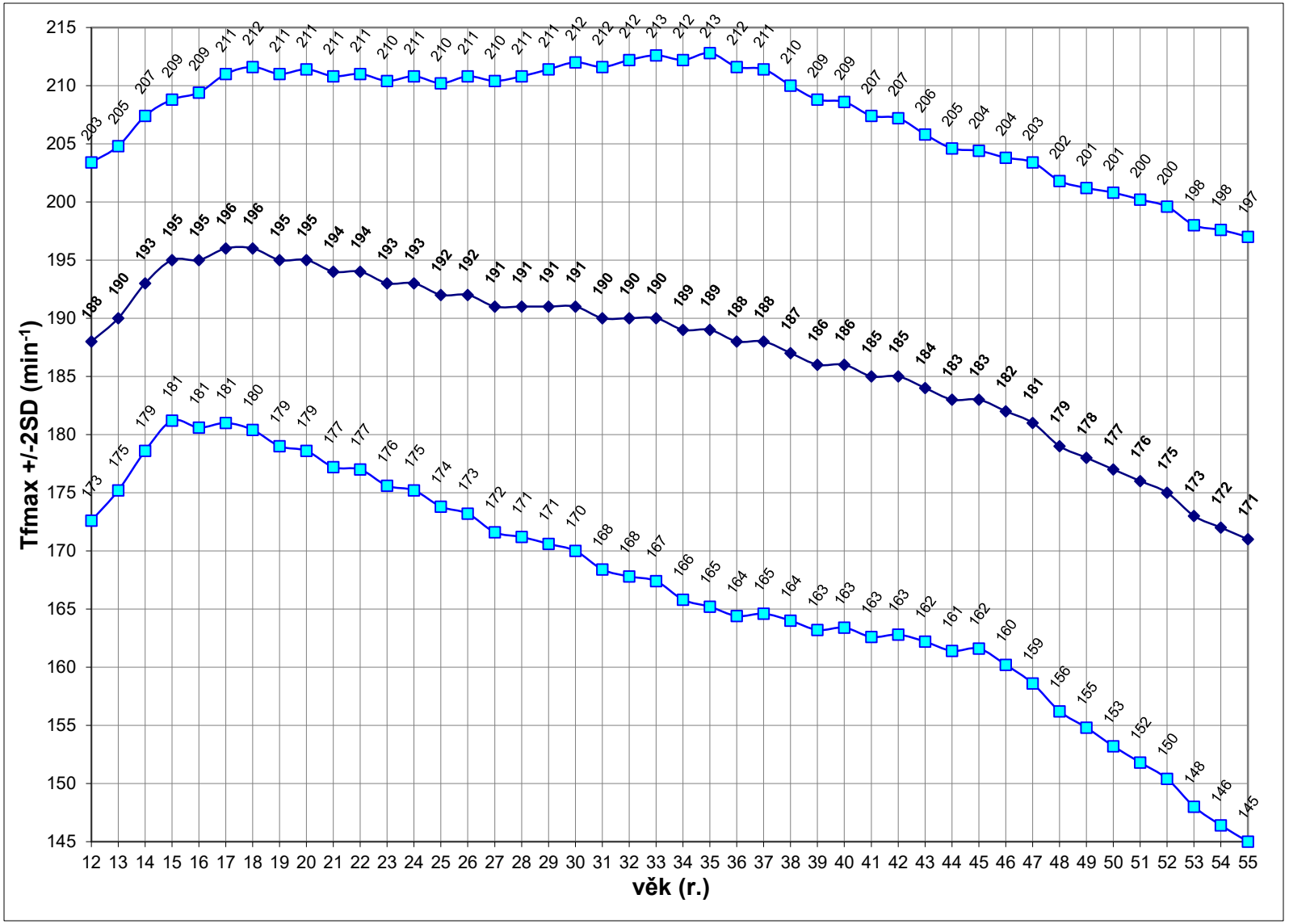
Maximální TF

Researcher	Population	Formula
Lester	W&M Trained	205 - 0.41x age
Brick	? Women	226 - age
Ricard	W&M Treadmill	209 - 0.587 x age
Jones	? Healthy W&M	210 - 0.65 x age
Hossack	Healthy Men	227 - 1.067 x age
Schiller	Hispanic Women	213.7 - 0.75 x age
Bruce	Healthy Men	210 - 0.662 x age
Bruce	High BP + CHD	210 - 0.662 x age
Cooper	Healthy Men	217 - 0.845 x age
Schiller	Caucasian Women	207 - 0.62 x age
Hossack	Healthy Women	206 - 0.597 x age
Lester	W&M Untrained	198 - 0.41x age
Whaley	Men	214 - 0.8 x age
Froelicher	Healthy Men	207 - 0.64 x age
Miller	Obese W&M	200 - 0.48 x age
Whaley	Women	209 - 0.7 x age
Robinson	Healthy Men	212 - 0.775 x age
Sheffield	Women	216 - 0.88 x age
Tanaka	W&M	208 - 0.7 x age
ACSM * Traditional	W&M	220 - age
Fernhall	Healthy W&M	205 - 0.64 x age
Tanaka	? Active W&M	207 - 0.7 x age
Tanaka	? Sedentary W&M	211 - 0.8 age

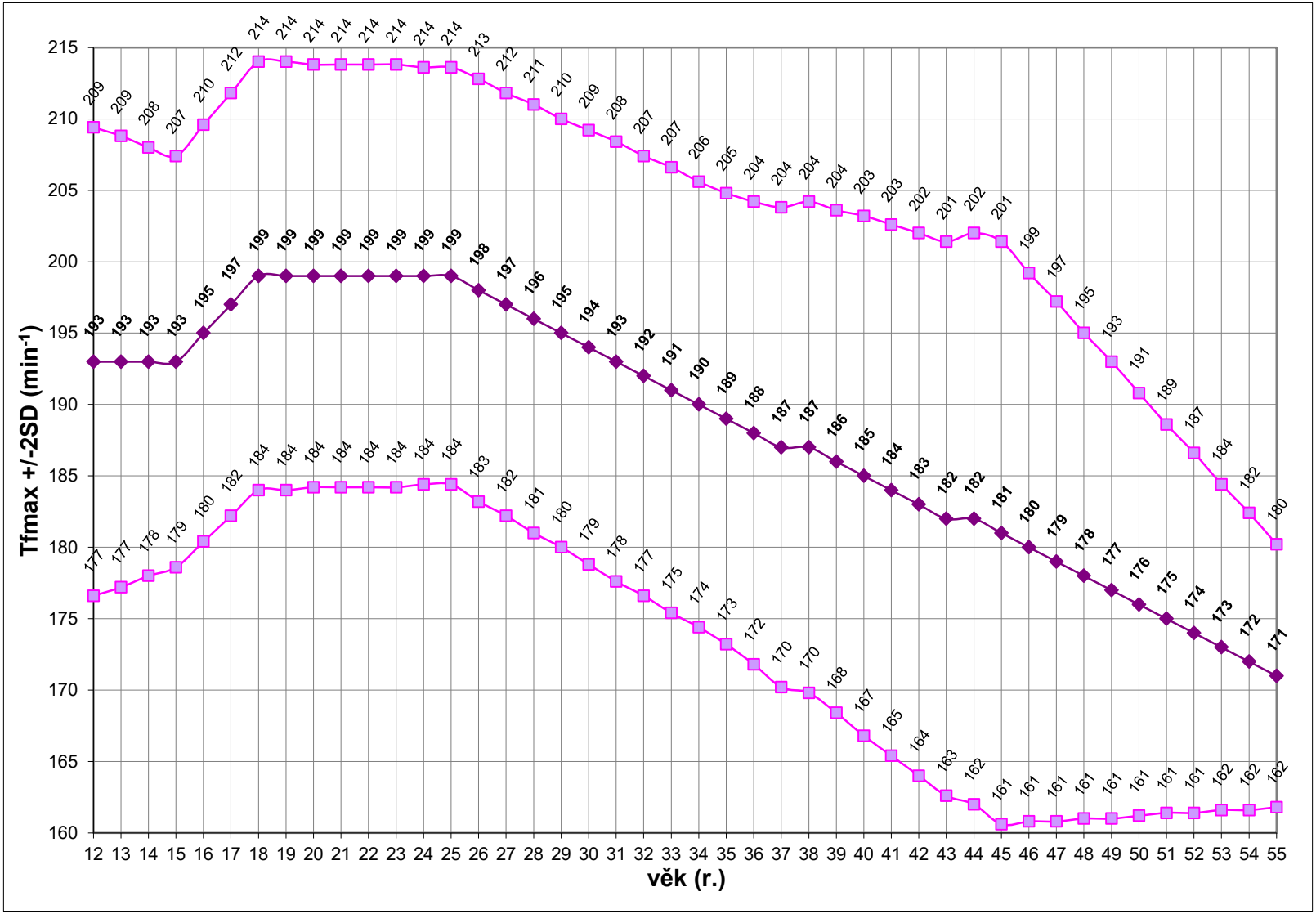
TFmax ≠ 220-věk

Inbar * Most accurate	Healthy W&M	205.8 - 0.685 x age
Tanaka	? Endurance Trained	206 - 0.7 x age
Londeree	? National Athletes	206.3 - 0.711 x age
Jones	Healthy Women	201 - 0.63 x age
Ellestad	Healthy Men	197 - 0.556 x age
Astrand	Healthy Men cycl.erg	211 - 0.922 x age
Graettinger	Healthy Men	199 - 0.63 x age
Jones	Healthy W&M cycl.er	202 - 0.72 x age
Rodeheffer	Healthy Men	214 - 1.02 x age
Ricard	W&M cycl.ergometer	200 - 0.687 x age
Morris	Healthy Men	200 - 0.72 x age
Hammond	Heart Disease	209 - age
Fernhall	Mental Retardation	189 - 0.56 x age
Bruce	CHD	204 - 1.07 x age
Bruce	Hypertension	204 - 1.07 x age
Morris	Heart Disease	196 - 0.9 x age

TFmax muži


Tfmax +/-2SD (min-1)
215
210
205
200
195
190
185
180
175
170
165
160
155
150
145
203 205 207 209 209 211 212 211 211 211 211 210 211 210 211 210 211 211 212 212 212 213 212 213 212 211 210 209 209 207 207 206 205 204 204 203 202 201 201 200 200 198 198 197
188 190 193 195 195 196 196 195 195 194 194 193 193 192 192 191 191 191 191 190 190 190 189 189 188 188 187 186 186 185 185 184 183 183 182 181 179 178 177 176 175 173 172 171
173 175 179 181 181 181 180 179 179 177 177 176 175 174 173 172 171 171 170 168 168 167 166 165 164 165 164 163 163 163 163 162 161 162 160 159 156 155 153 152 150 148 146 145
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 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 53 54 55
věk (r.)

TFmax ženy


Tfmax +/-2SD (min-1)
215
210
205
200
195
190
185
180
175
170
165
160
12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 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 53 54 55
věk (r.)

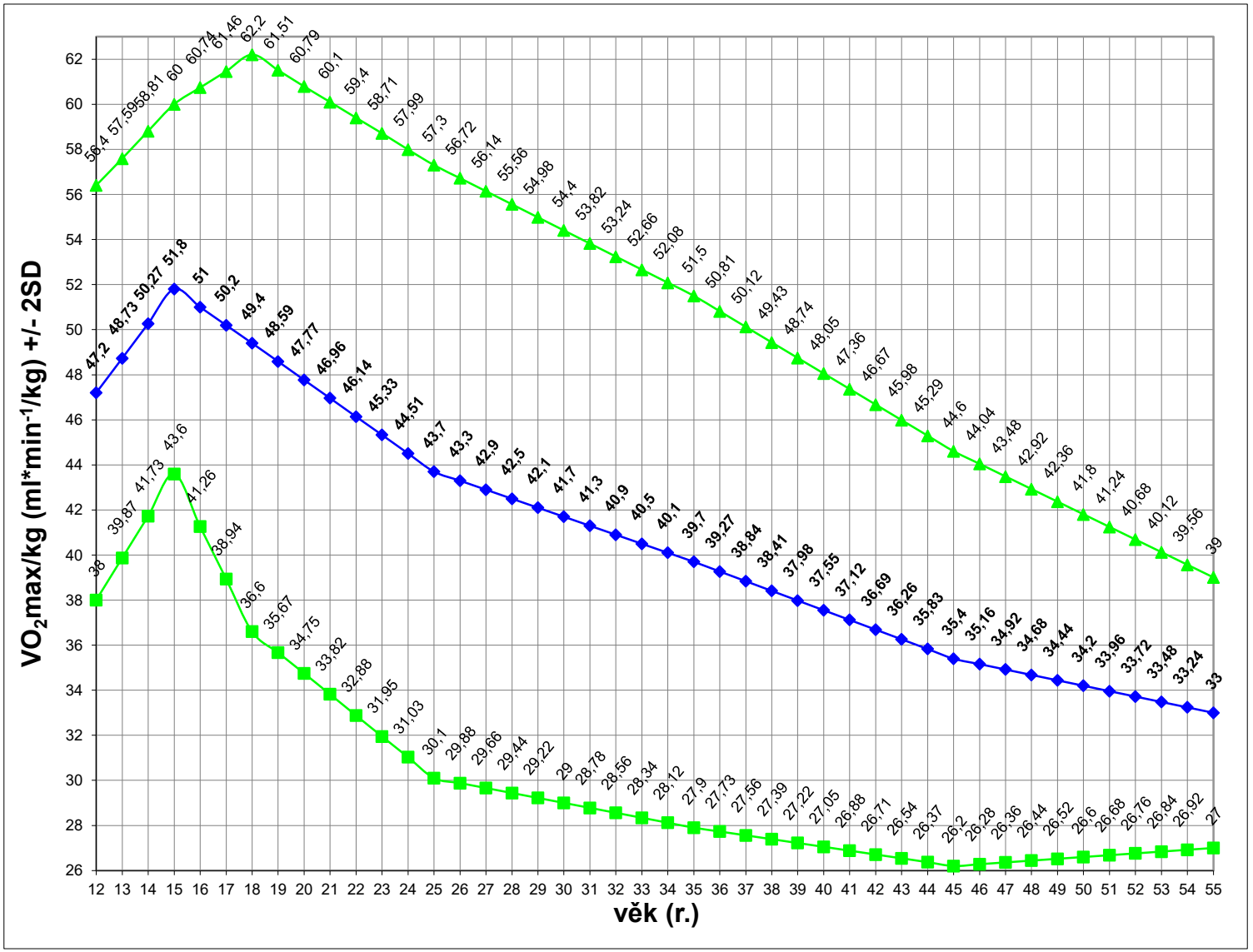
Spotřeba kyslíku / METs

- 1 MET = energ. výdej v klidu (ne ve spánku)
- 1 MET = 3,5 ml/min/kg
- Klidový EE u dětí 4,5-5,0 ml/min/kg
- Adjusted MET – příliš se nepoužívá

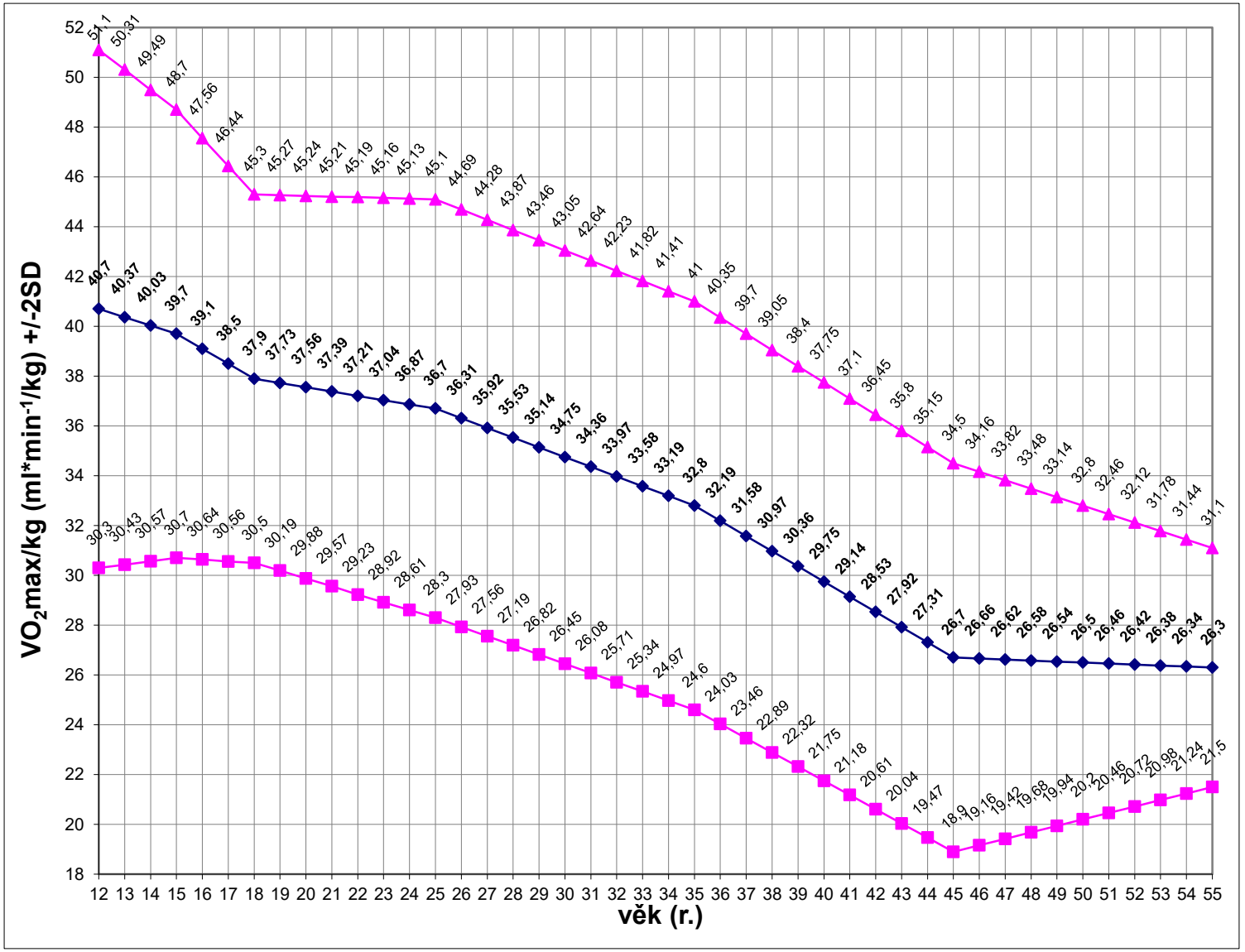
Barbara Ainsworth et al.: Compendium of Physical Activities

- https://sites.google.com/site/compendiumofphysicalactivities/

VO2max/kg muži

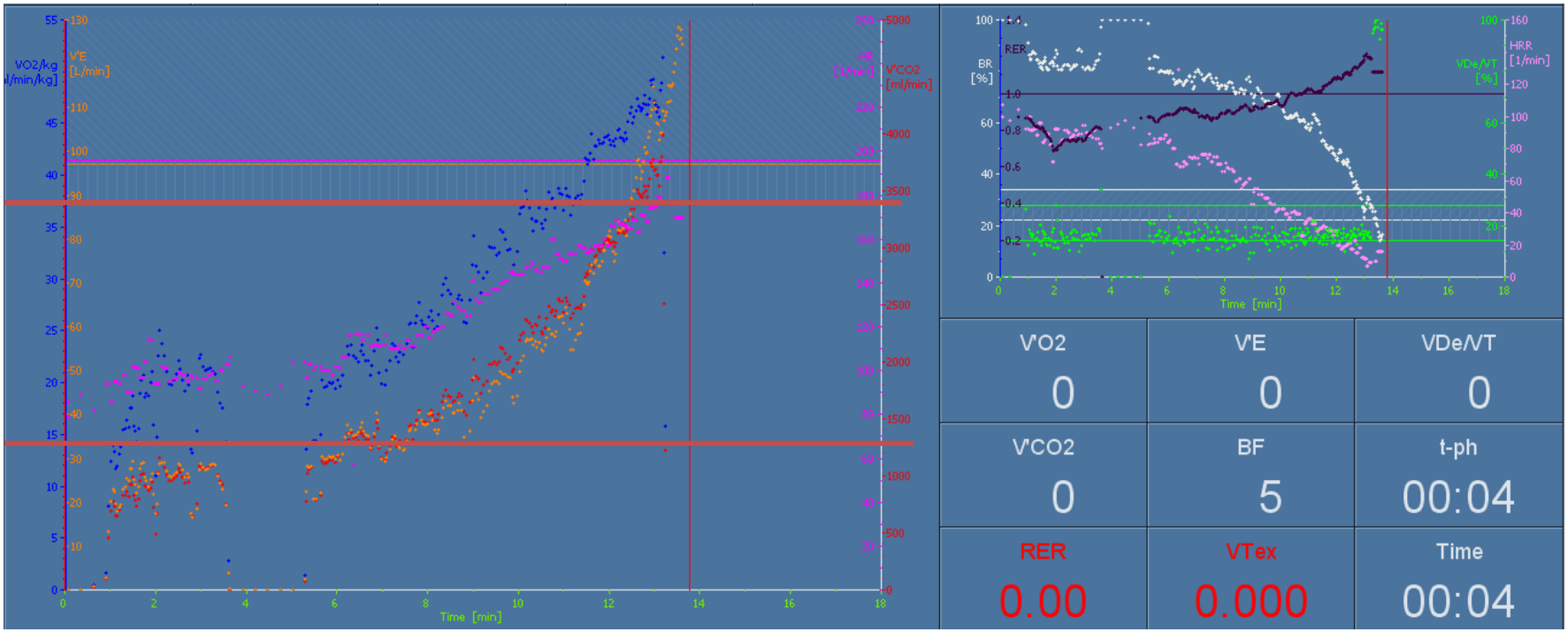


VO2max/kg ženy



Stresový práh

Dynamická práce při spiroergometrii



Energetika

~ čas: ATP → CrP → metabolismus

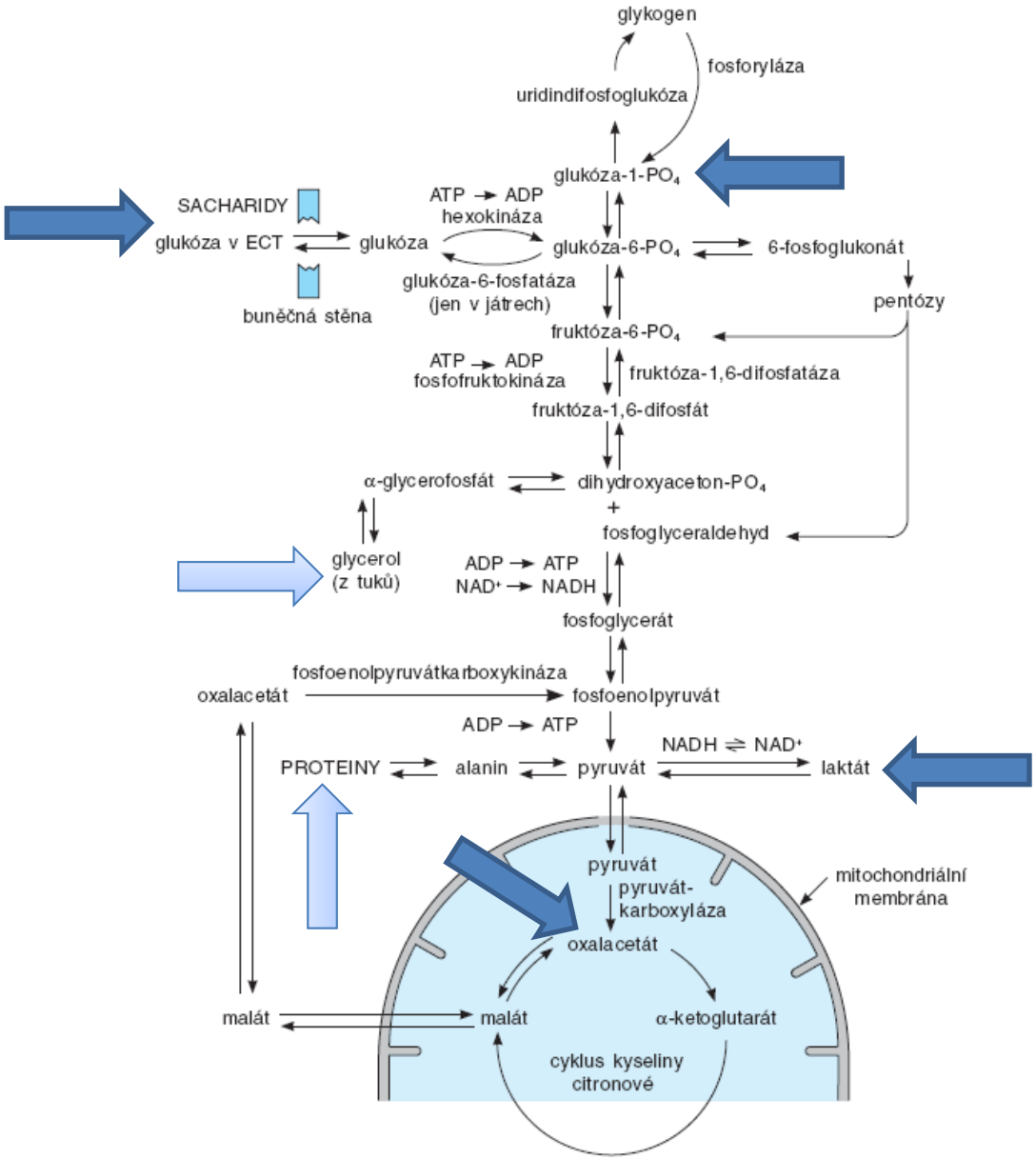
glc + 2ATP → La^- + 4ATP

glc + 2ATP + $6O_2$ → $6CO_2$ + $6H_2O$ + 40ATP

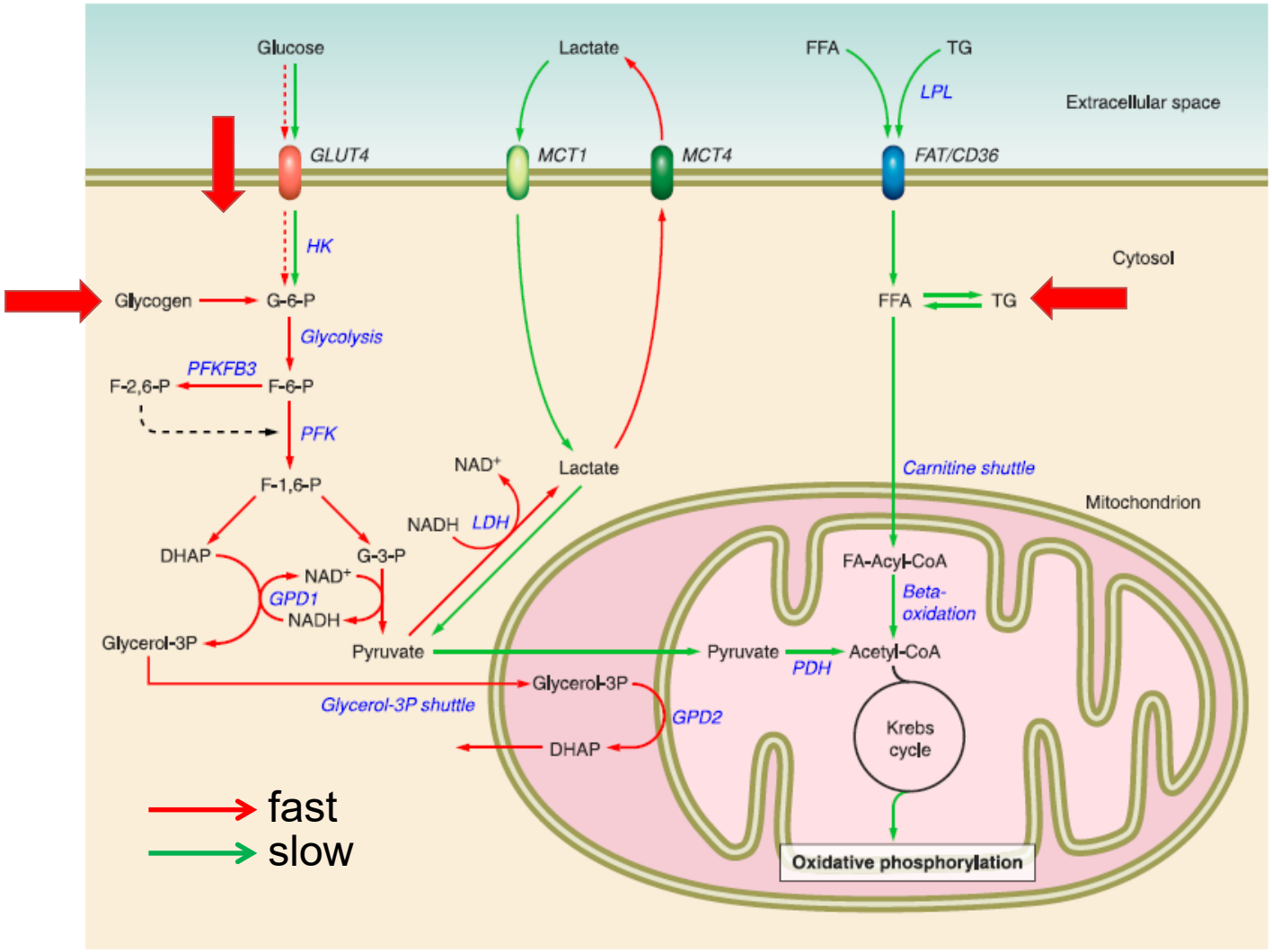
FFA + O_2 → CO_2 + H_2O + >100ATP

~ intensita: FFA → aer. glykolysa → anaer. glykolysa

~ čas: O_2 netřeba → myoglobin → periferní extrakce O_2

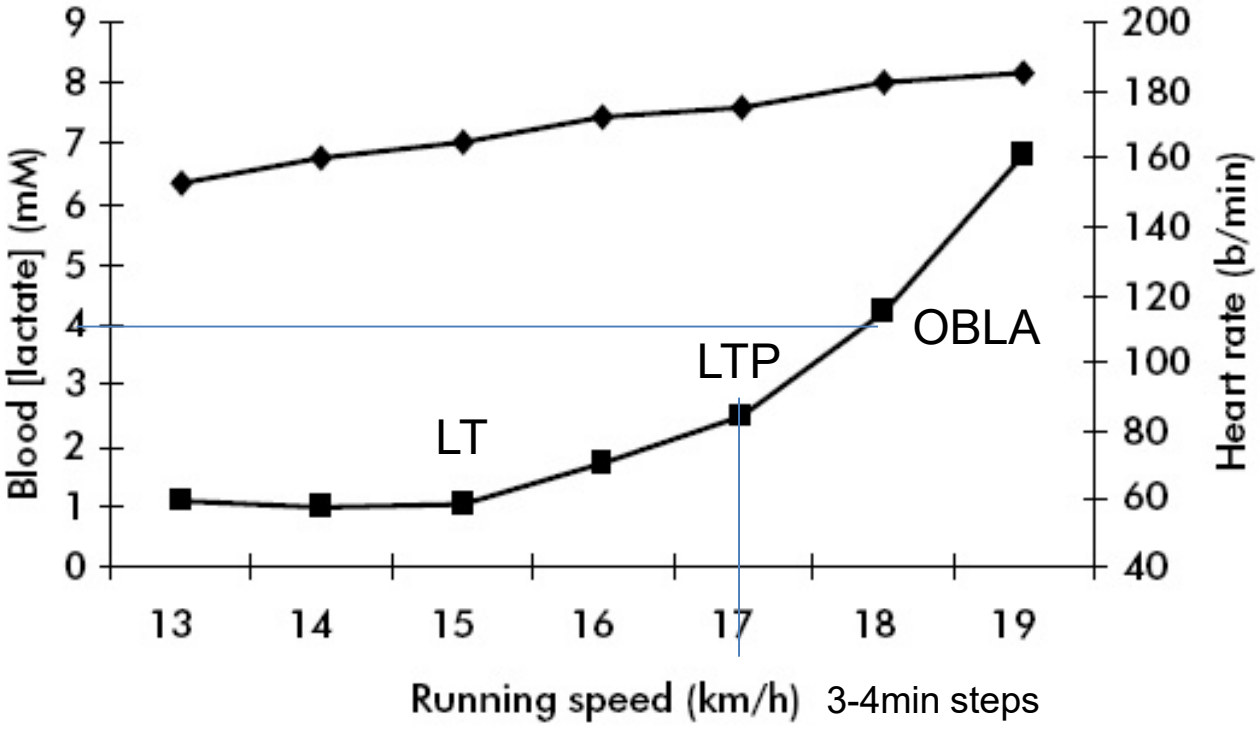


GANONG, William F. Přehled lékařské fyziologie. 20. vyd Praha : Galén, 2005. 890 s.



Schiaffino S, Reggiani C. Fiber Types In Mammalian Skeletal Muscles. Physiol Rev 91: 1447–1531, 2011

One incremental stepwise test



LT (AT) – 1st breakpoint or $[La^-] \geq 2$ mmol/l

LTP – 2nd breakpoint ($[La^-] \sim 3$ mmol/l), estimate of MLSS workload

OBLA – $[La^-] \geq 4$ mmol/l after 3-4min exercise → further increase

Sport and exercise physiology testing guidelines. Winter EM et al. (eds.)

Maximal lactate steady state

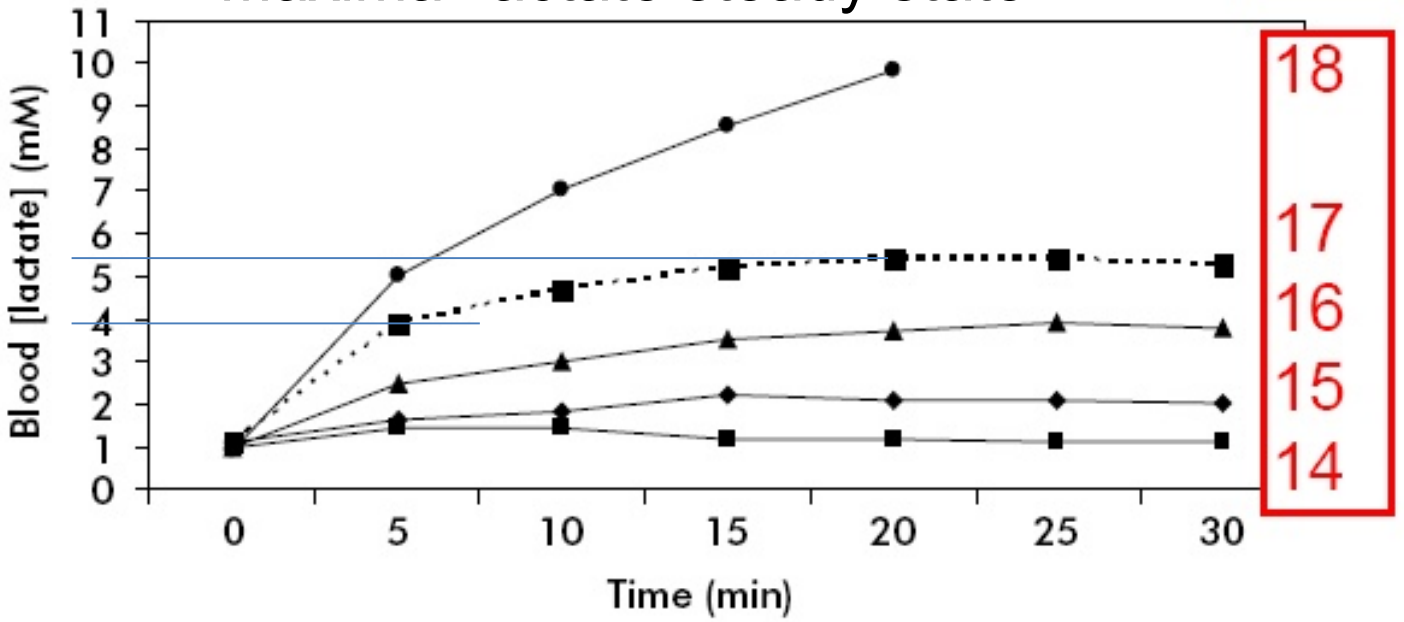


Figure 12.2 Determination of the running speed at the MLSS in an endurance athlete (the same as in Figure 12.1). This athlete completed five treadmill runs of up to 30 min duration at different running speeds (14, 15, 16, 17 and 18 km·h^{-1}) on different days. At 14 and 15 km·h^{-1}, blood [lactate] did not increase appreciably above that measured at rest; at 16 and 17 km·h^{-1}, blood [lactate] reached a delayed but elevated steady-state; and at 18 km·h^{-1}, blood [lactate] did not attain a steady state but increased inexorably until the athlete became exhausted. The running speed at the MLSS is therefore 17 km·h^{-1}

MLSS

Sport and exercise physiology testing guidelines. Winter EM et al. (eds.)

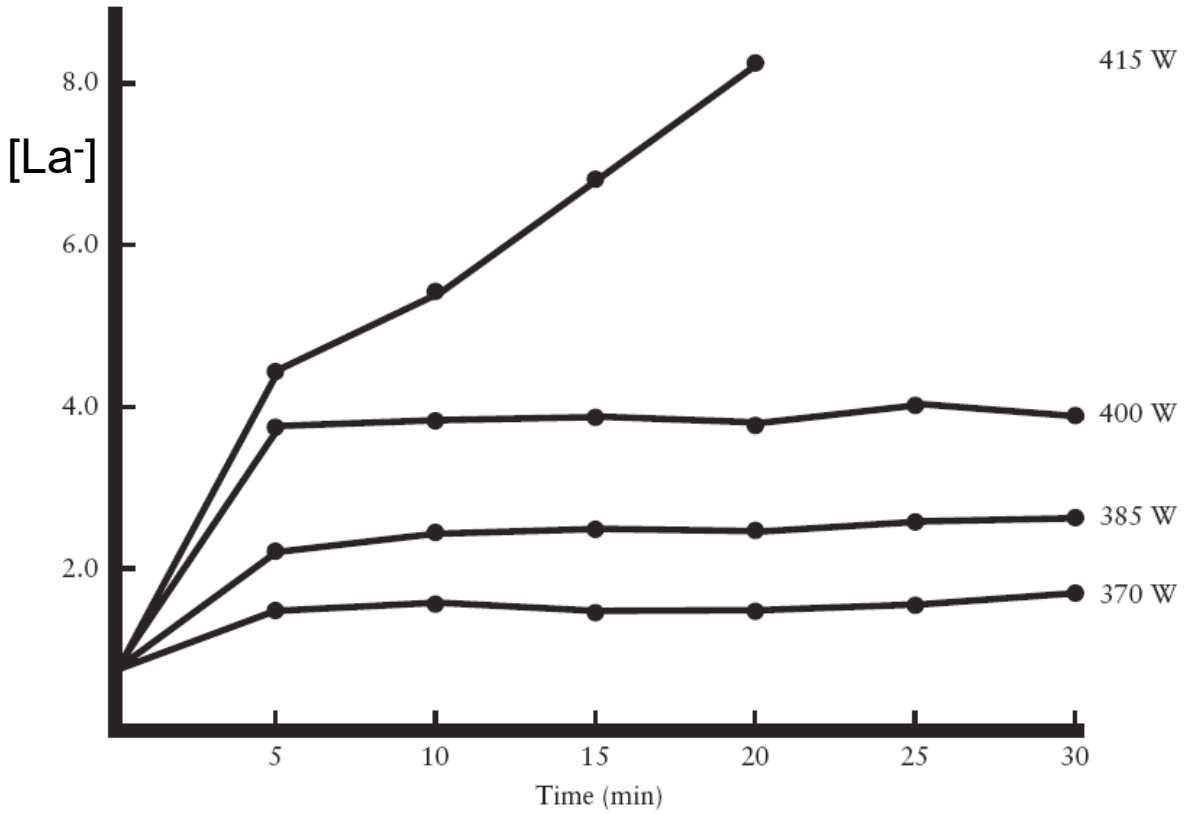


Figure 8.4 Data from repeated 30-min tests on the same cyclist as in Figure 8.3 showing the power output at which lactate begins to accumulate in the blood. The athlete is unable to continue at the required power output of 415 W and the test ends at 20 min. (With permission from Dr P. Keen, British Cycling Federation)

Exercise physiology. Hale T 2003

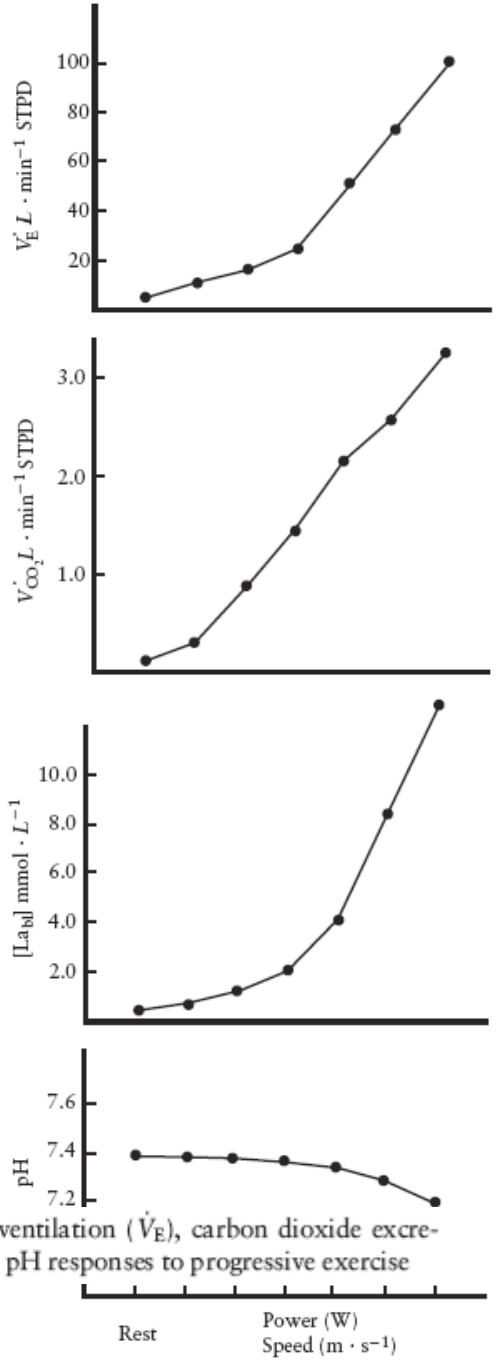
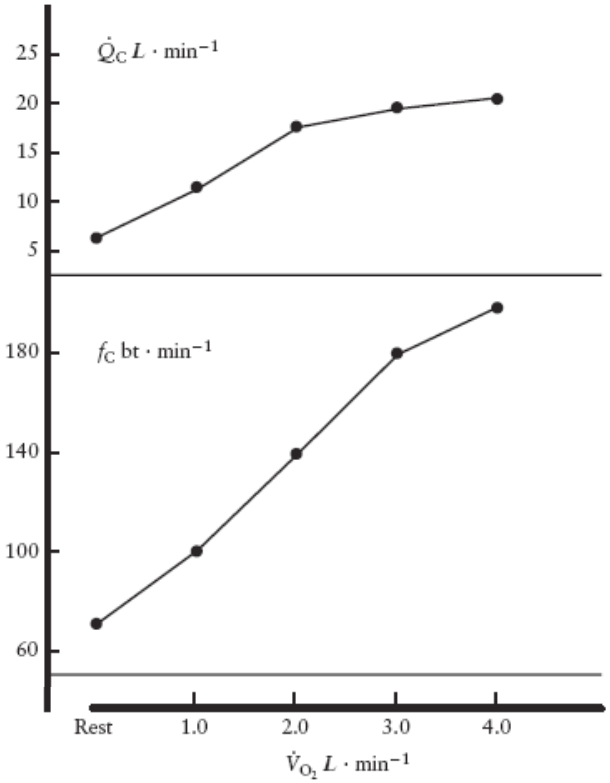
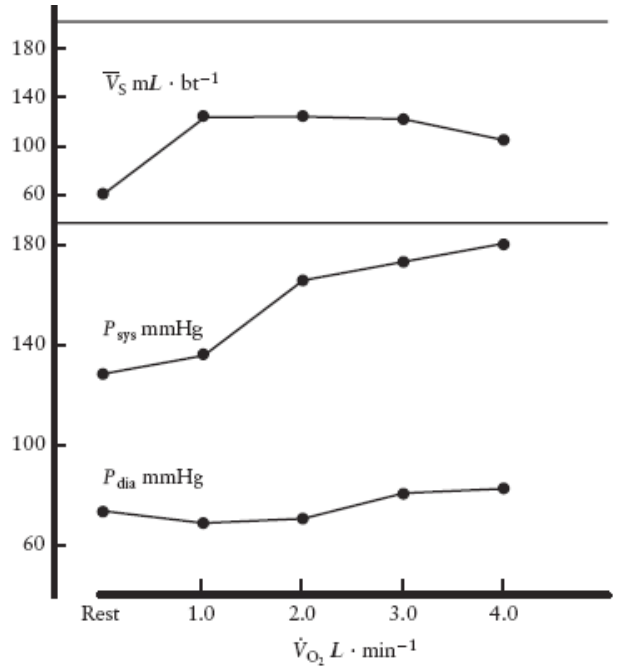


Figure 9.1 Schematic representations of minute ventilation ($\dot{V}_E$), carbon dioxide excretion ($\dot{V}_{CO_2}$), blood lactate concentration ([La$_{bl}$]), and pH responses to progressive exercise

Exercise physiology. Hale T 2003





Graph showing the relationship between oxygen uptake ($\dot{V}_C$ heart rate (f_C), mean stroke volume ($\overline{V}_S$), and systolic and and P_{dia})

Exercise physiology. Hale T 2003

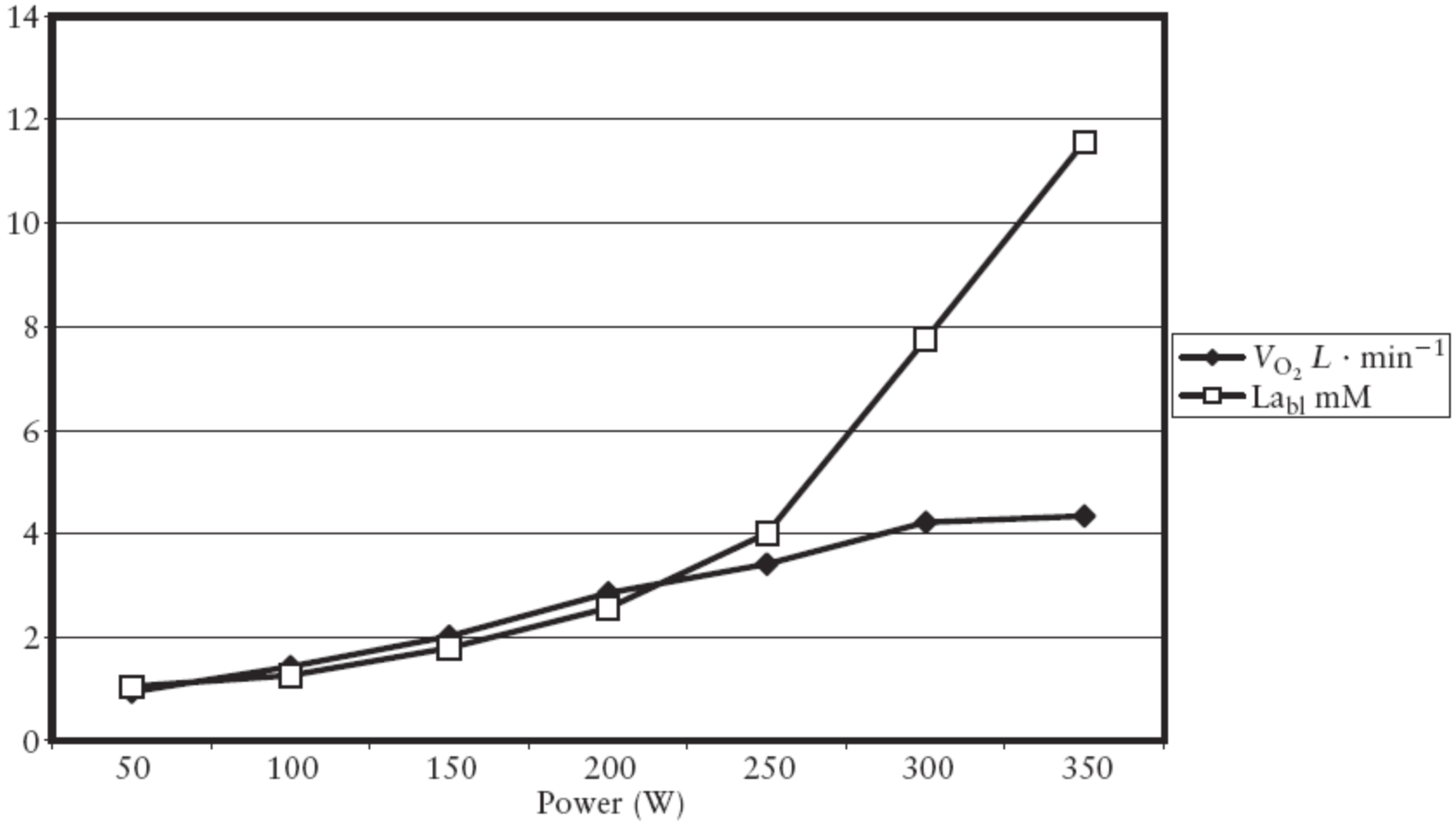


Figure 8.2 Blood lactate concentrations and oxygen uptake values during a maximal oxygen uptake test

Exercise physiology. Hale T 2003

Postexercise lactate

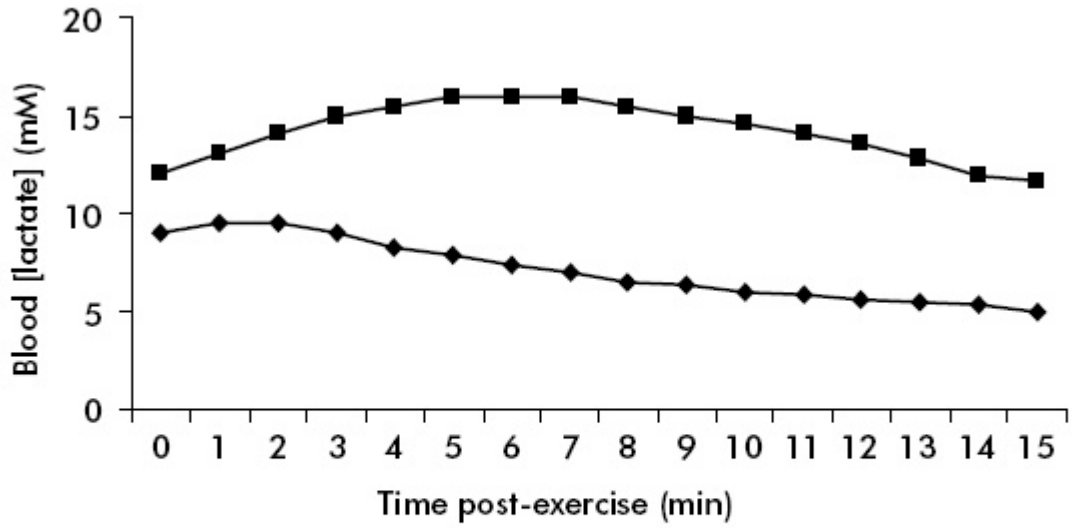


Figure 12.3 Schematic illustration of the response of blood [lactate] in the first 15 min of recovery from exhaustive high-intensity exercise in an endurance-trained athlete (closed diamonds) and a sprint-trained athlete (closed squares). Note that the peak blood [lactate] is higher and occurs later in recovery in the sprint-trained athlete

Sport and exercise physiology testing guidelines. Winter EM et al. (eds.)