

A Scientific Approach to Running Faster

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Lisboa - 6 e 7 de Dezembro



The 5 Ingredients of Success

1 Inherent Ability

2 Motivation

3 Opportunity

4 Direction

5 ????



#1 Inherent Ability

Anatomical

Biomechanical

Physiological

Psychological



#2 Motivation

Intrinsic

Not parents

Not peers

Not coach



Types of Individuals

- 1 Great ability + High motivation Champion
- 2 Great ability + Low motivation Coach frustrator
- 3 Little ability + High motivation Self frustrator
- 4 Little ability + Low motivation No show



#3 Opportunity

Weather

Facilities

Competition

Equipment

Travel



#4 Direction

Program

Teacher

Coach

The potential for negative





We need some guiding principles



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Principles of Training

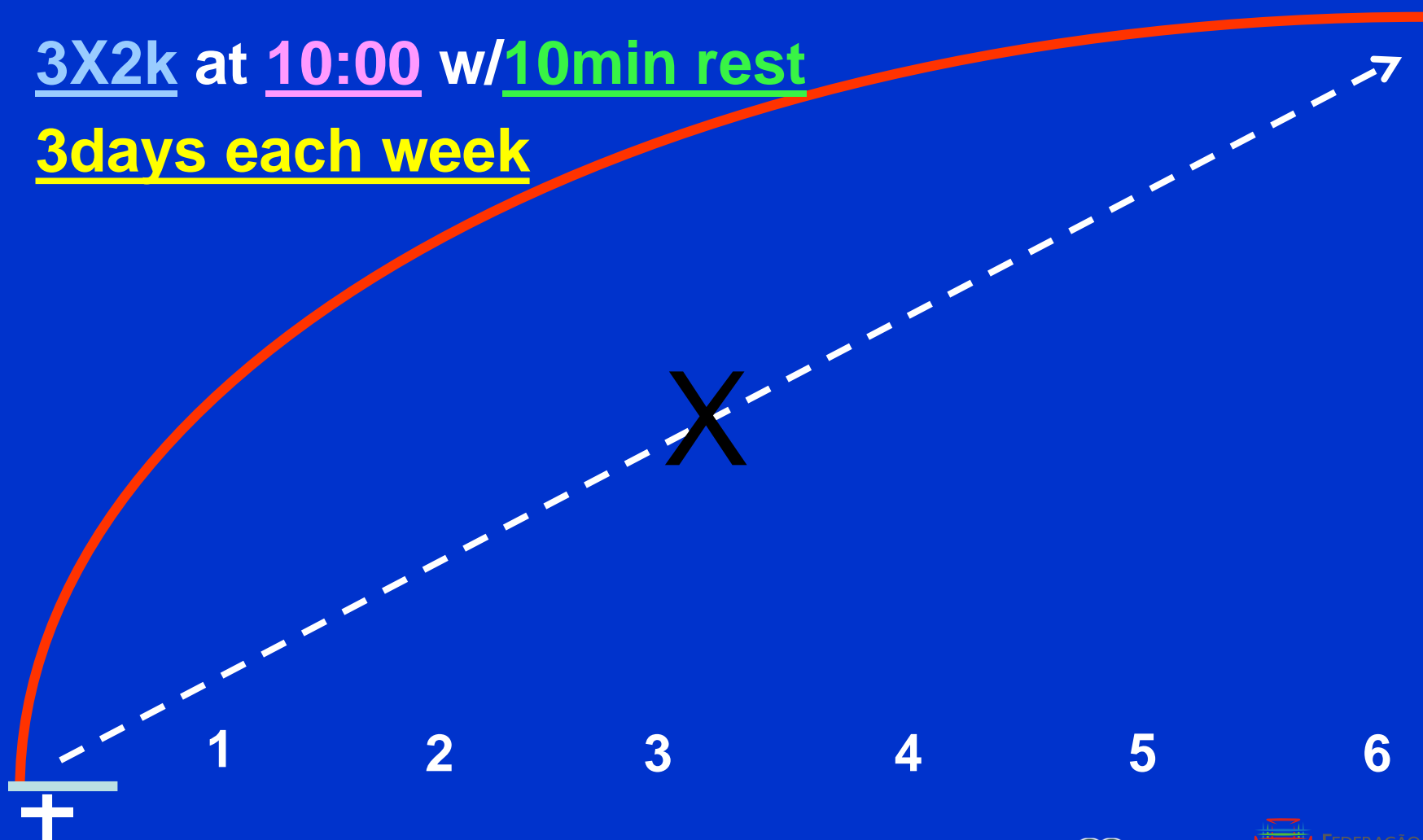
- 1 The body reacts to stress
- 2 Specificity
- 3 Benefit depends on type of stress
- 4 Ease of maintenance
- 5 Rate of achievement
- 6 Personal limits
- 7 Diminishing return & accelerating setbacks



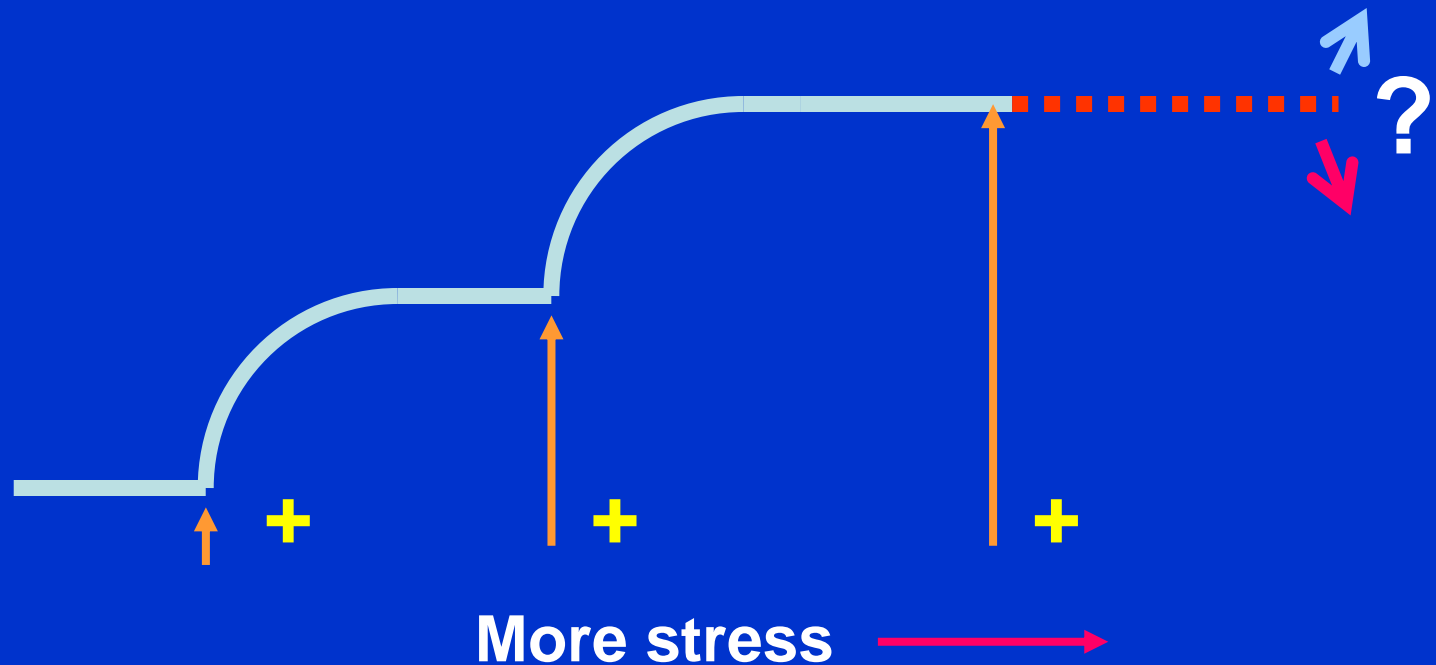


Rate of Achievement

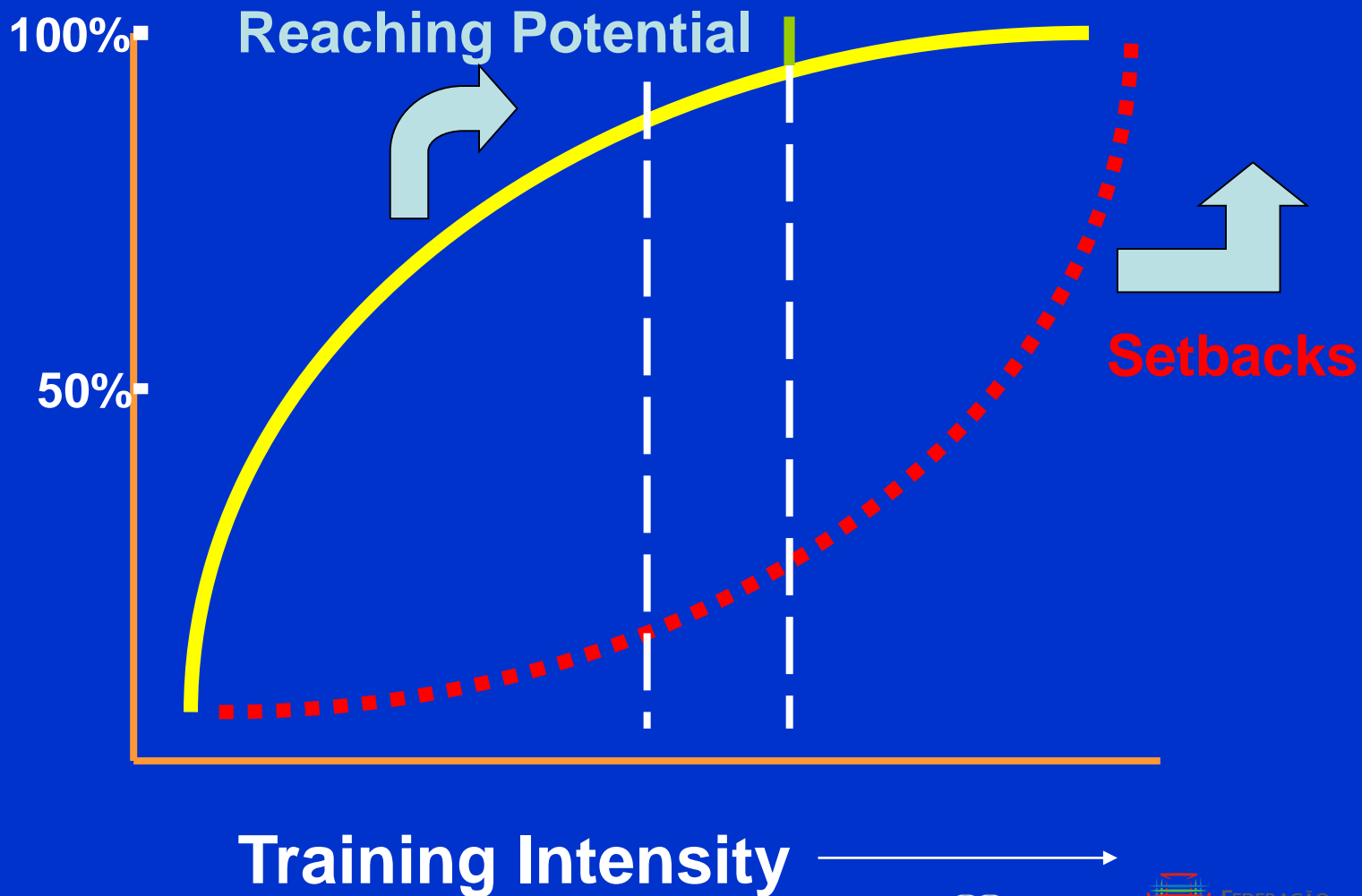
3X2k at 10:00 w/10min rest
3days each week



Improvement (or not) with Increased Stress



Diminishing Return — Accelerating Setbacks



Aerobic Profiles

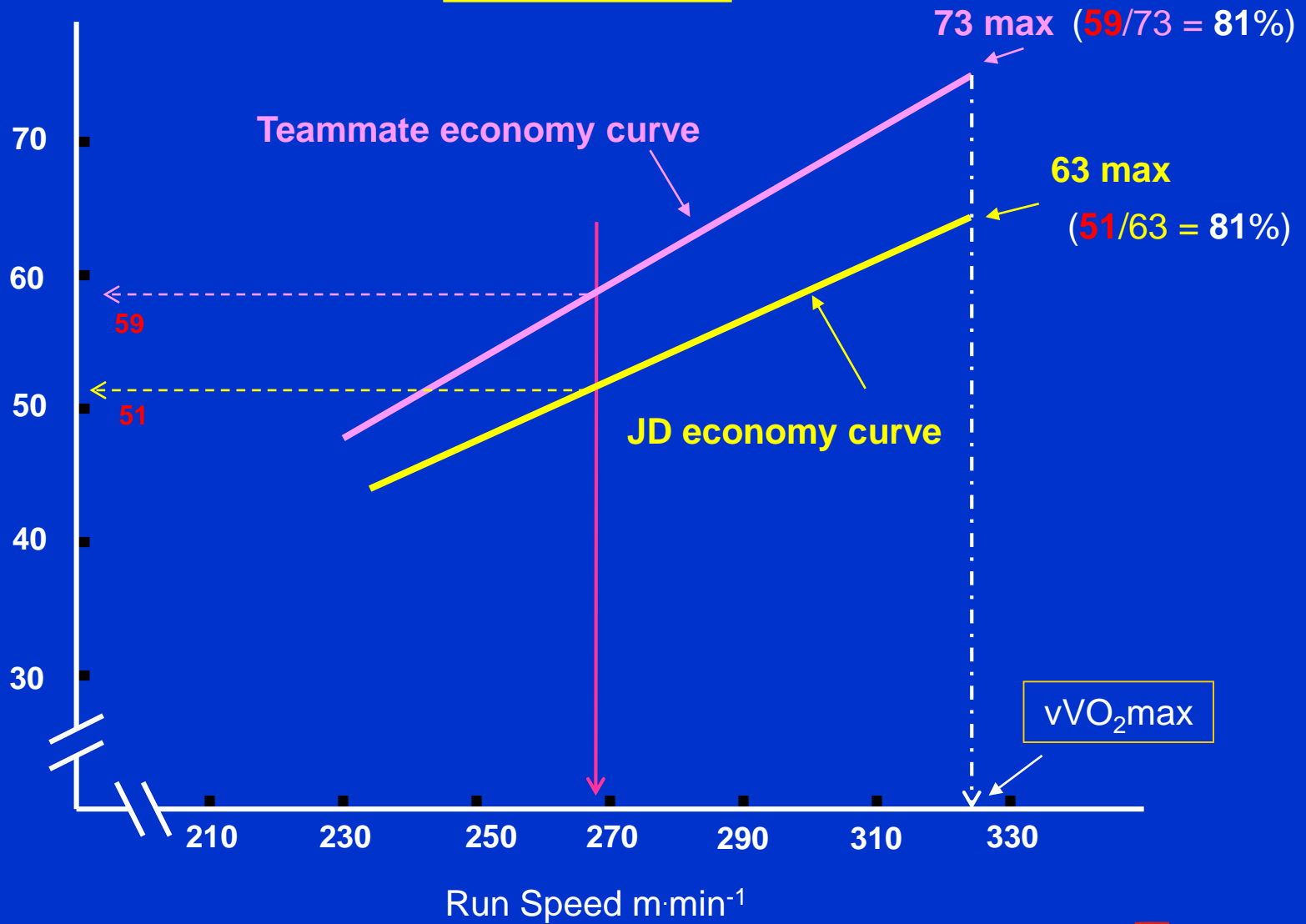


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$\text{VO}_2 \text{ ml}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$

From late 1960s



VO_2 ml·min⁻¹·kg⁻¹

70

Aerobic profiles for 3 female runners with different economy and VO_{2max} , but similar vVO_{2max} and 3k times

(Representative 65.4 VDOT Shown)

65

Common economy curve

60

55

50

45

40

0

0 190 210 230 250 270 290 310 330 350

Running speed m·min⁻¹

73

69

(65.4)

VDOT

60

VO_{2max}

(9:06)

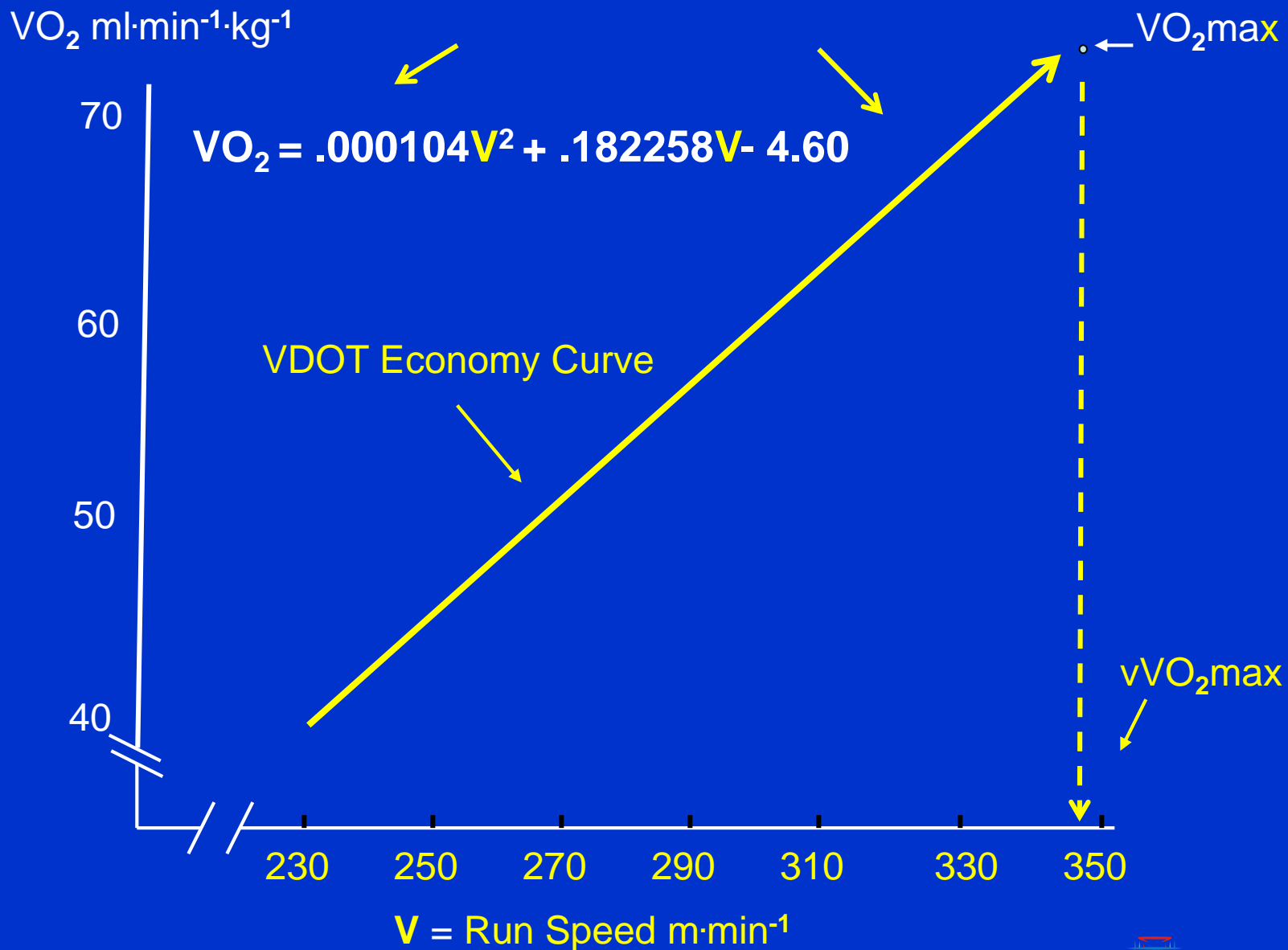
3k times

9:08, 9:07, 9:04

vVO_{2max}
328, 329, 331



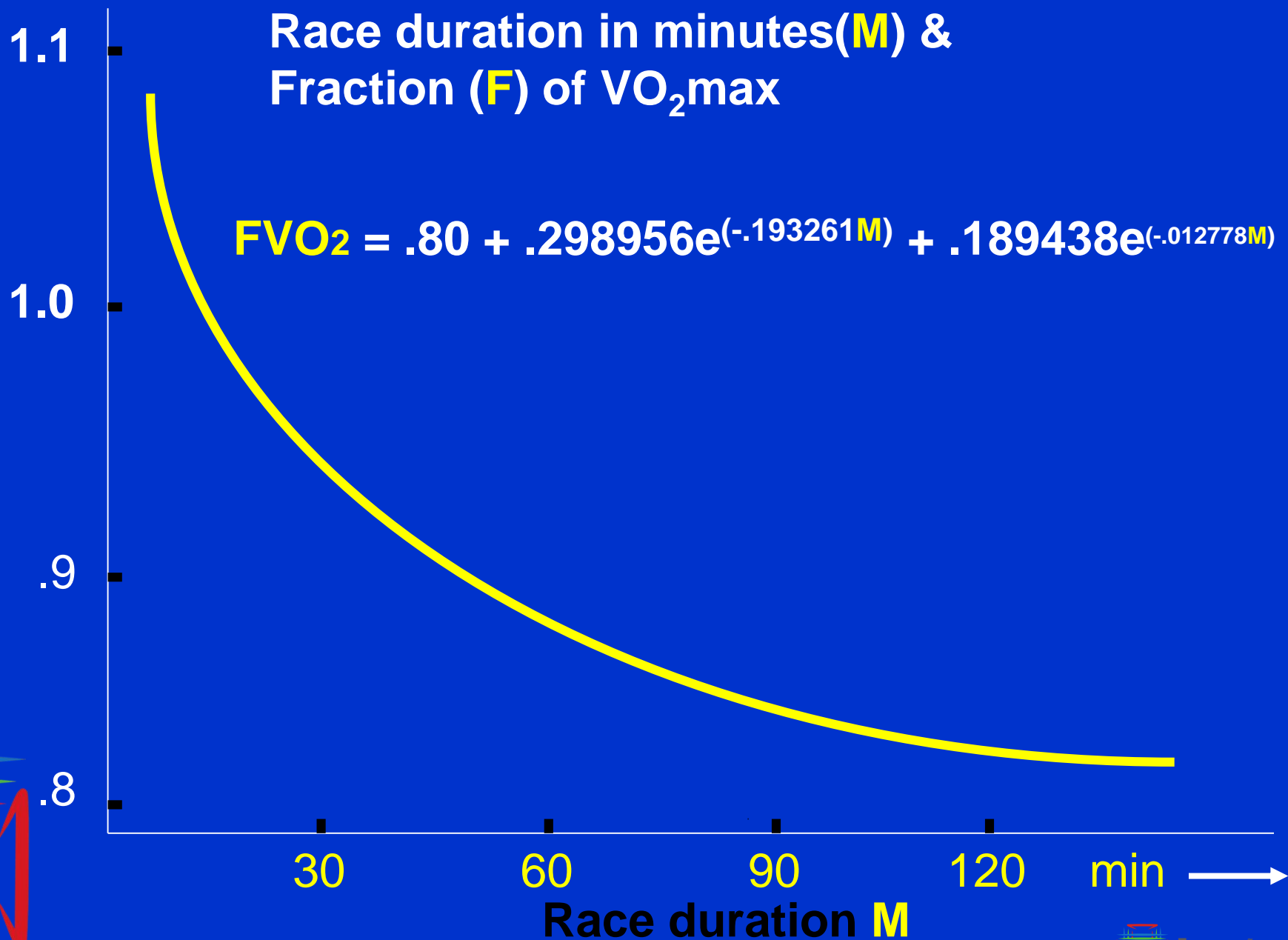
Mean VDOT Economy Curve



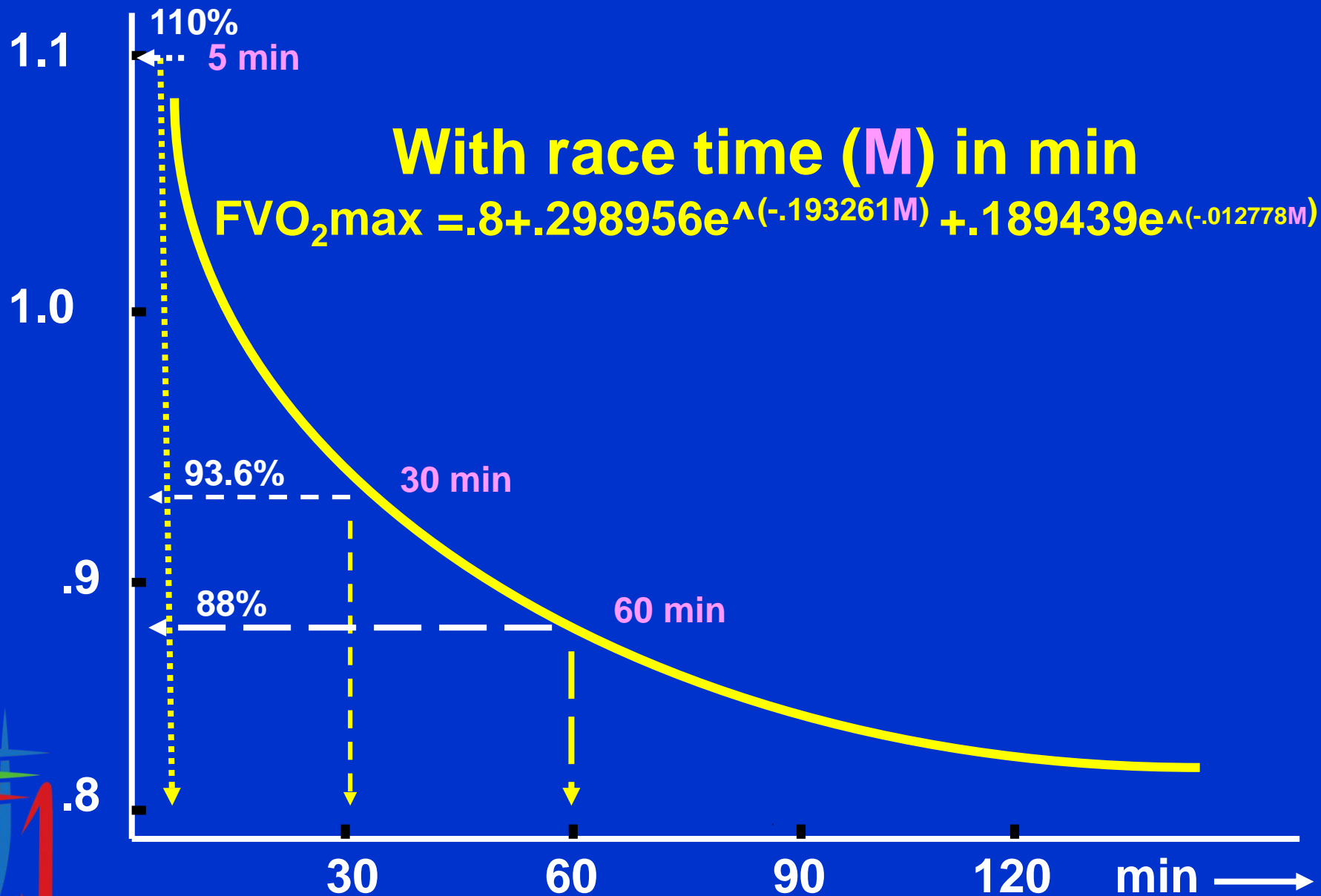
FVO₂max

Race duration in minutes(**M**) &
Fraction (**F**) of VO₂max

$$FVO_2 = .80 + .298956e^{(-.193261M)} + .189438e^{(-.012778M)}$$



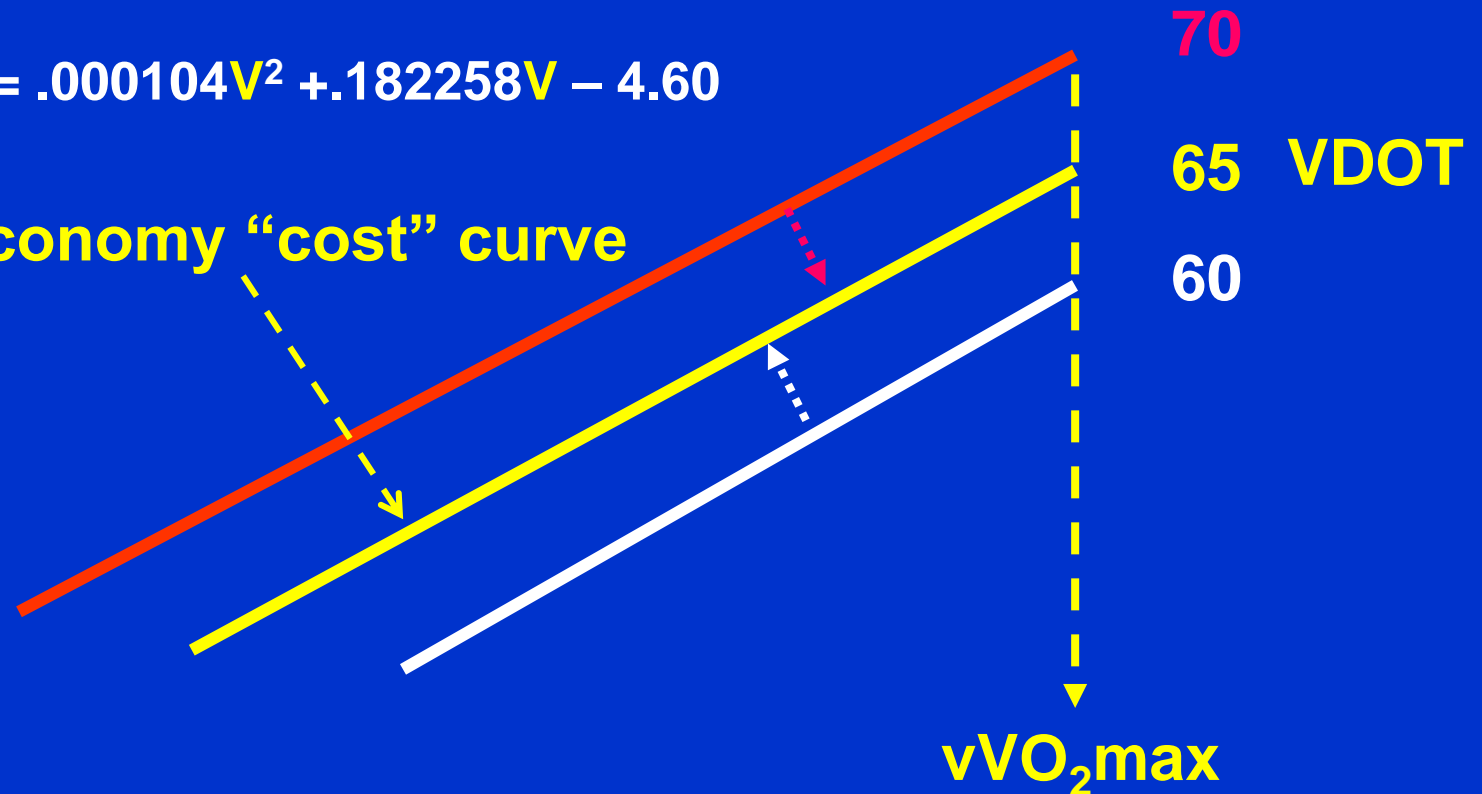
FVO₂max



Calculating a VDOT

$$VO_2 = .000104V^2 + .182258V - 4.60$$

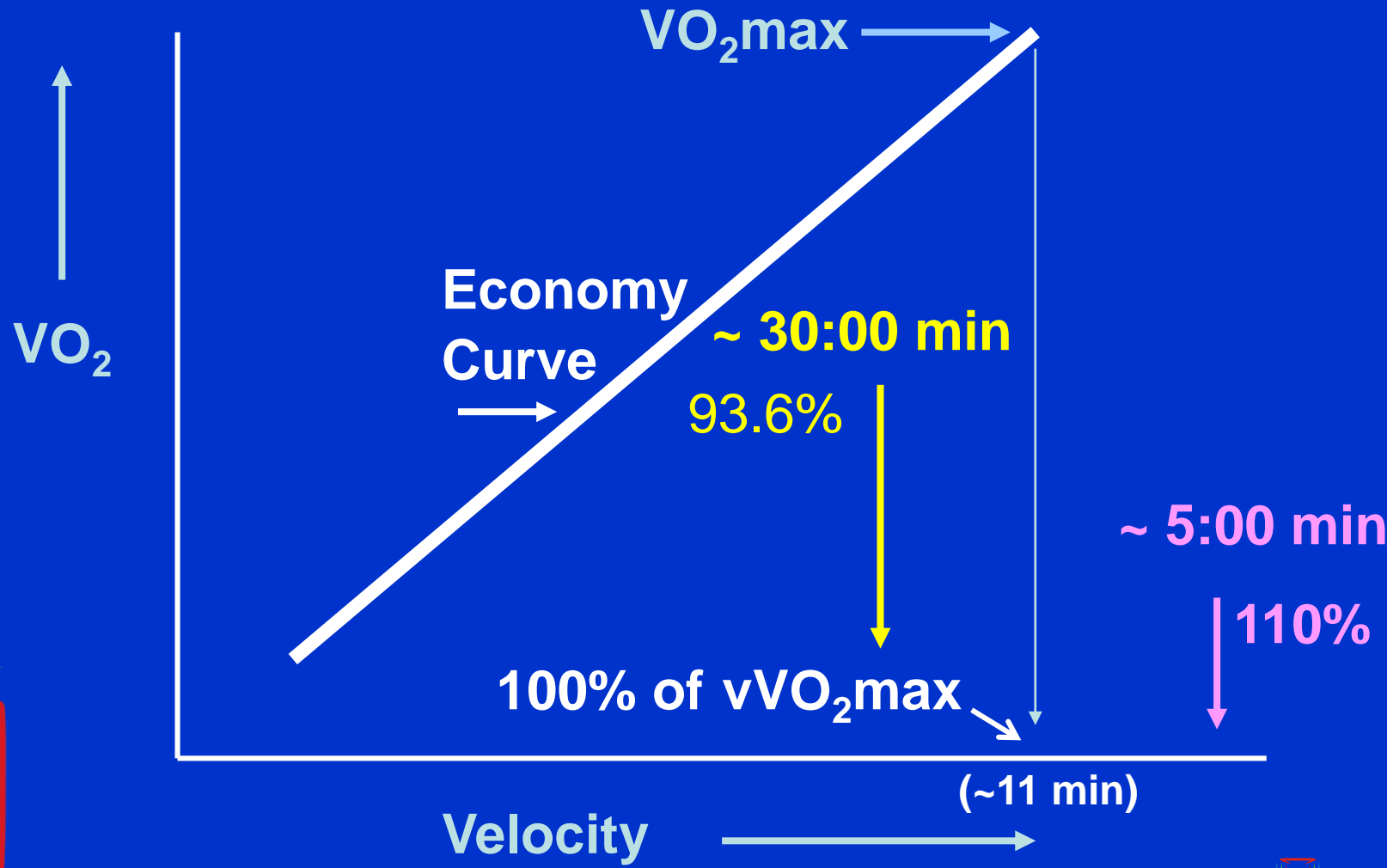
VDOT economy “cost” curve



$$VDOT = VO_2 \text{ Cost of race } v / FVO_2$$

With cost of 58.5 & FVO₂ of .90, VDOT = 65 (58.5/.90)

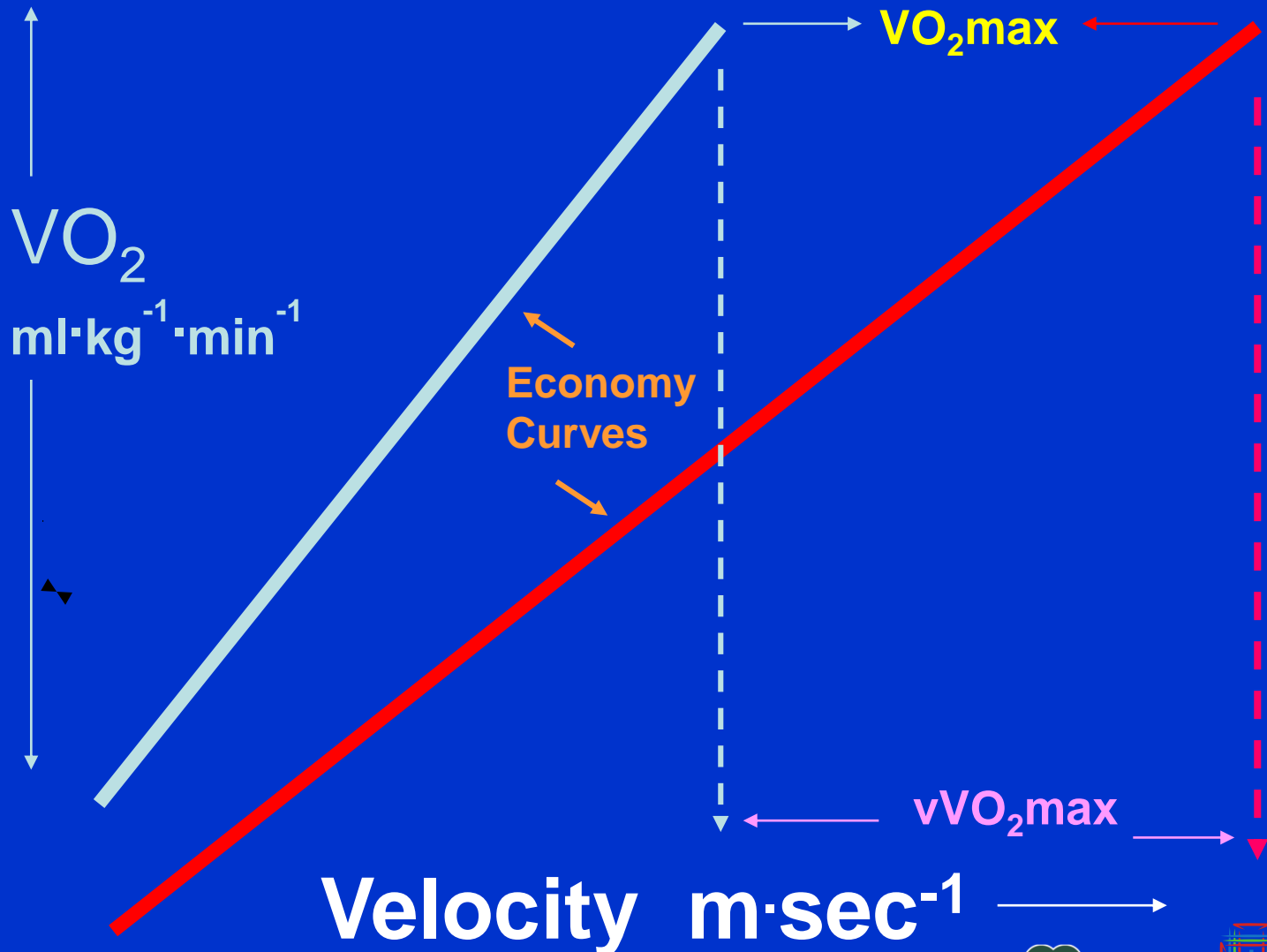
What Does $v\dot{V}O_2\text{max}$ Tell You ?



Swim Aerobic Profiles

Young age-group

Elite women

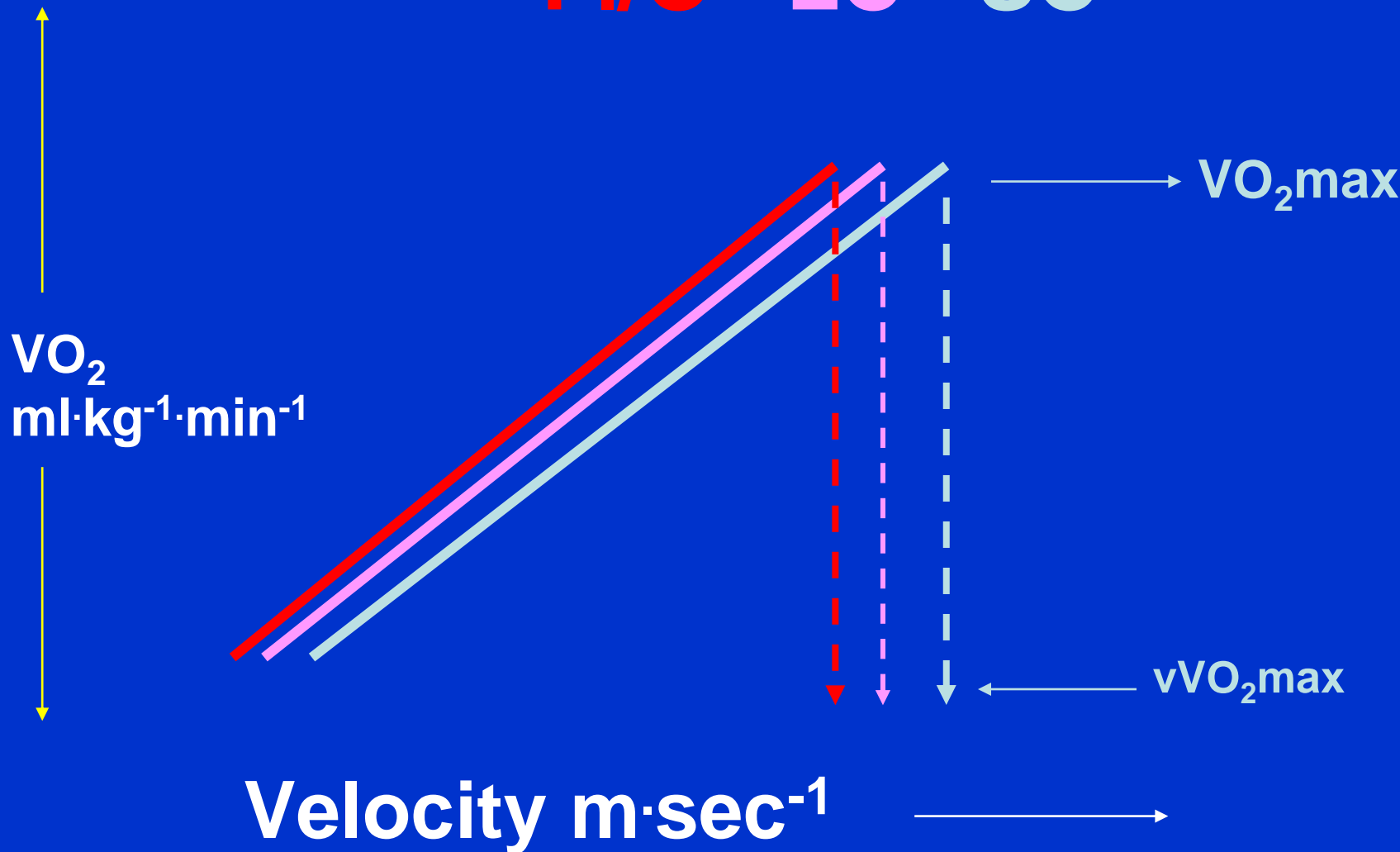


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Swim Aerobic Profiles

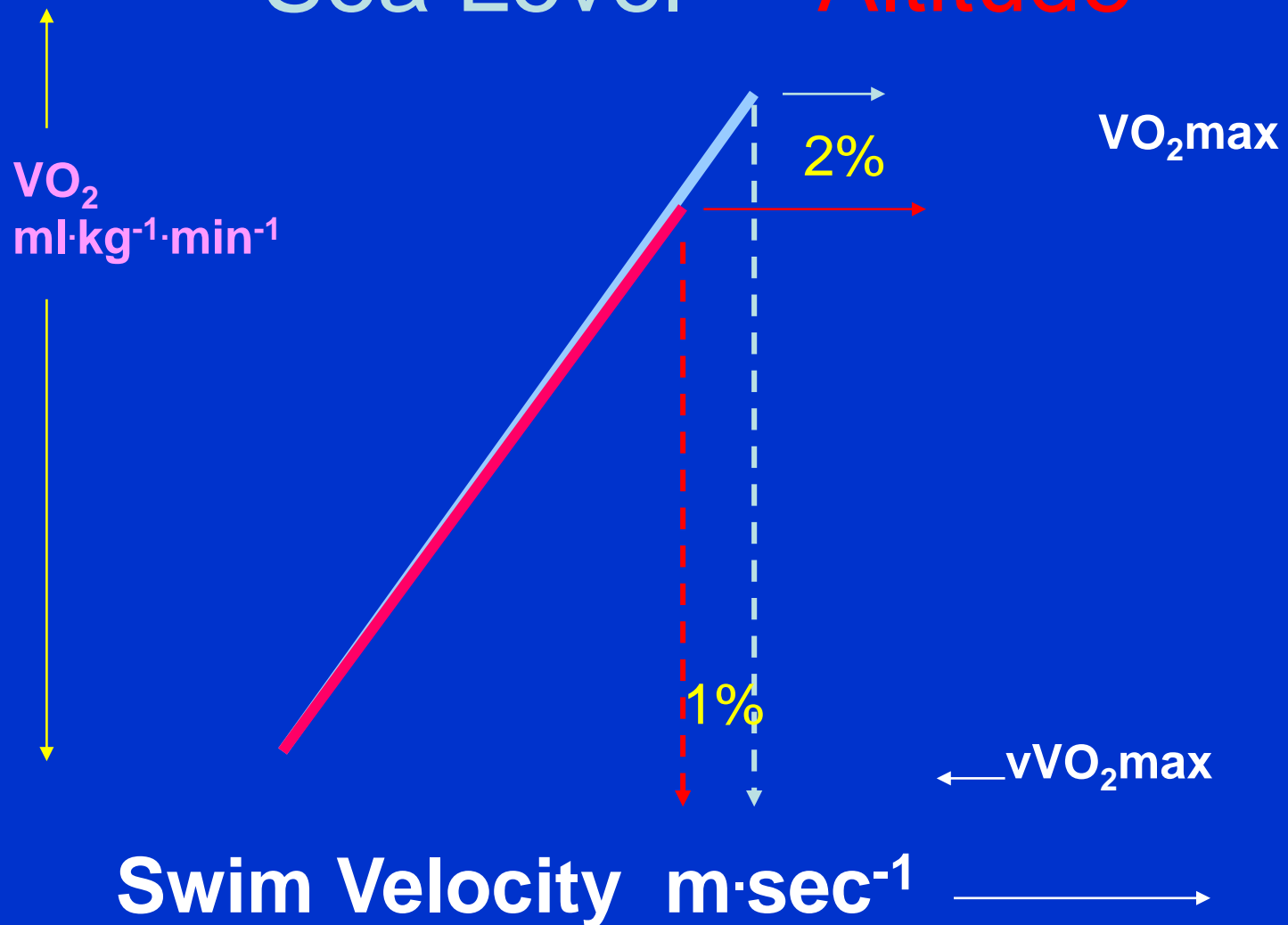
F/O LC SC



Swim Aerobic Profiles

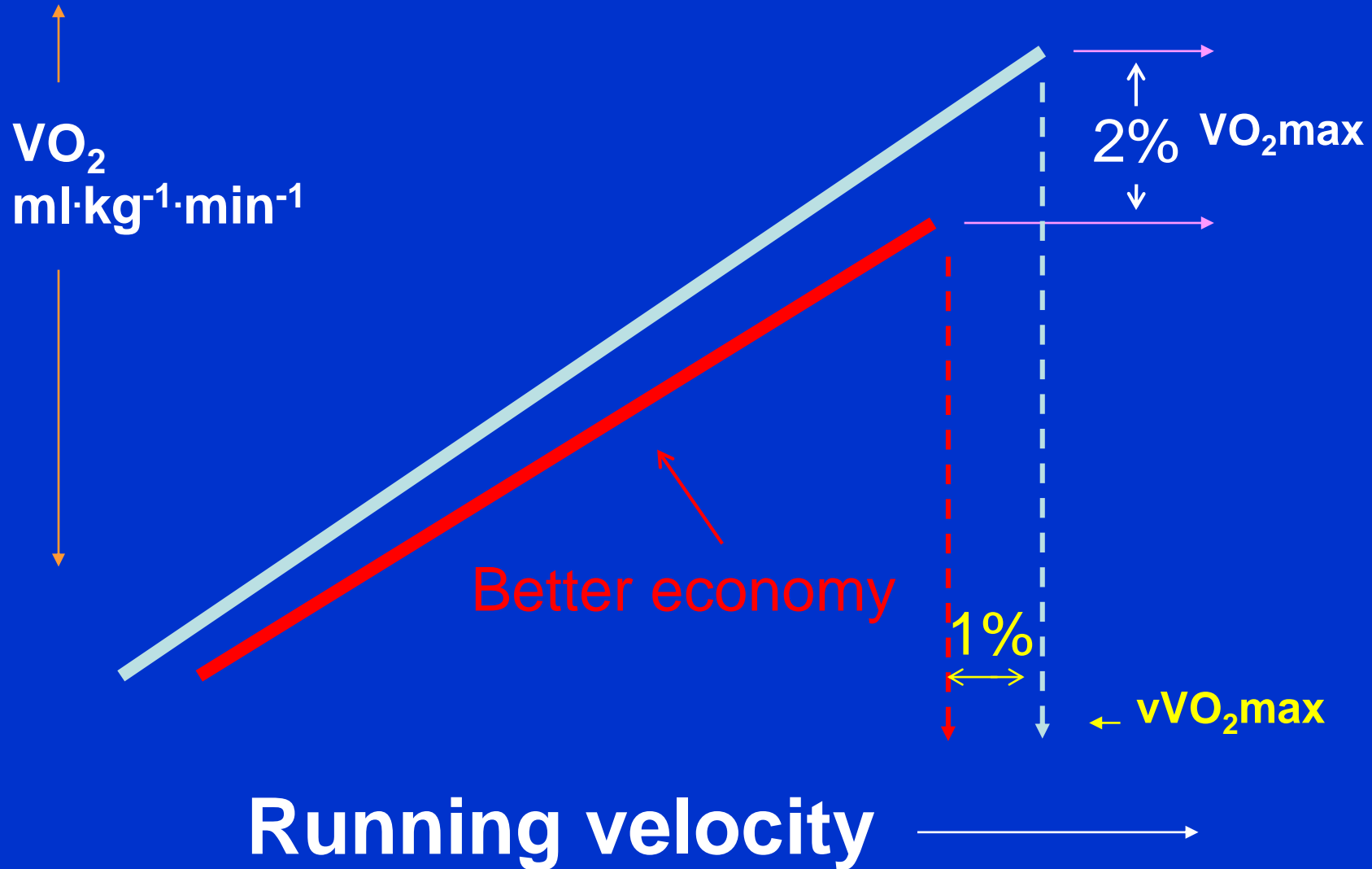
Sea Level

Altitude



Running Aerobic Profiles

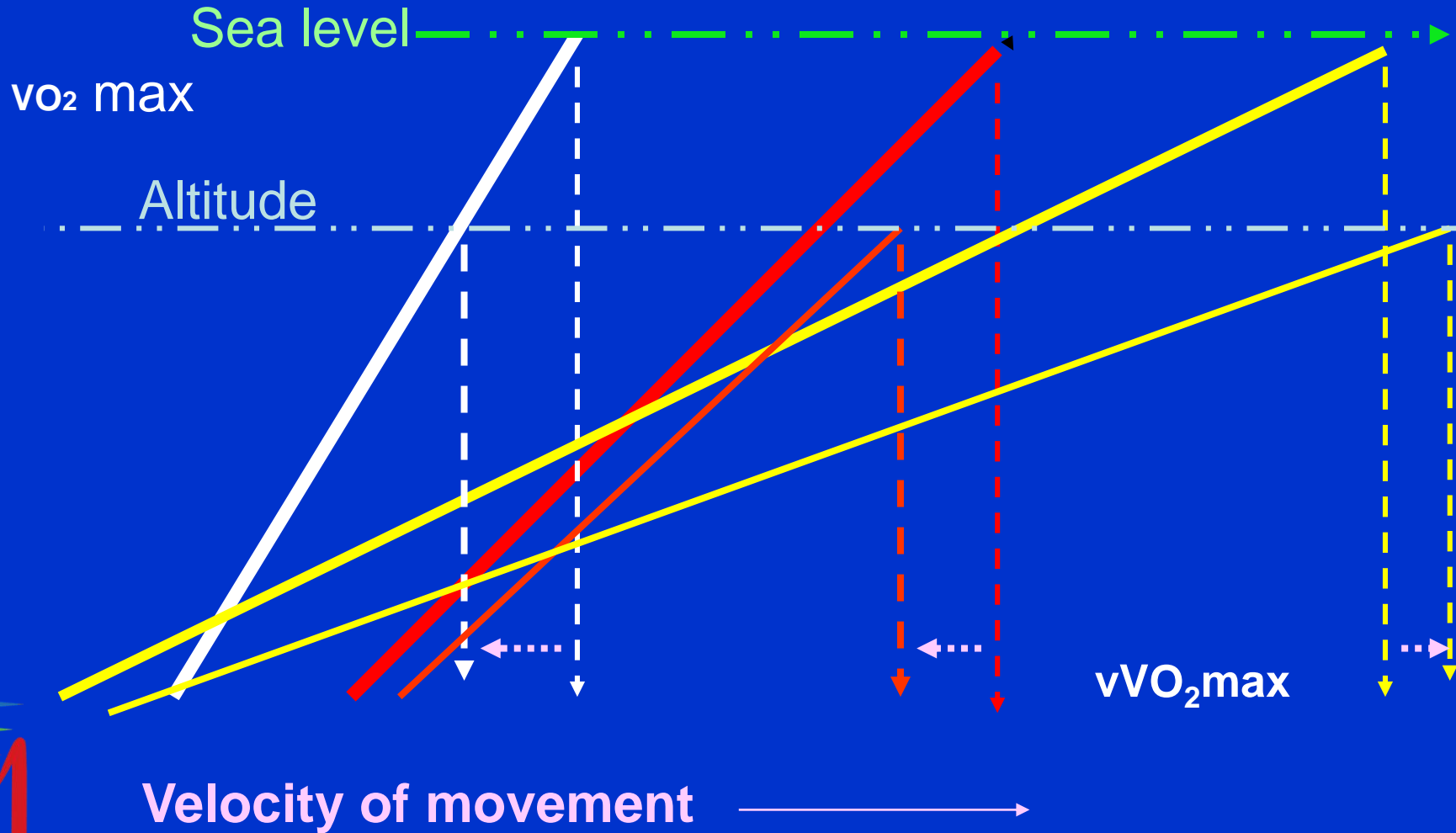
Sea Level **Altitude**



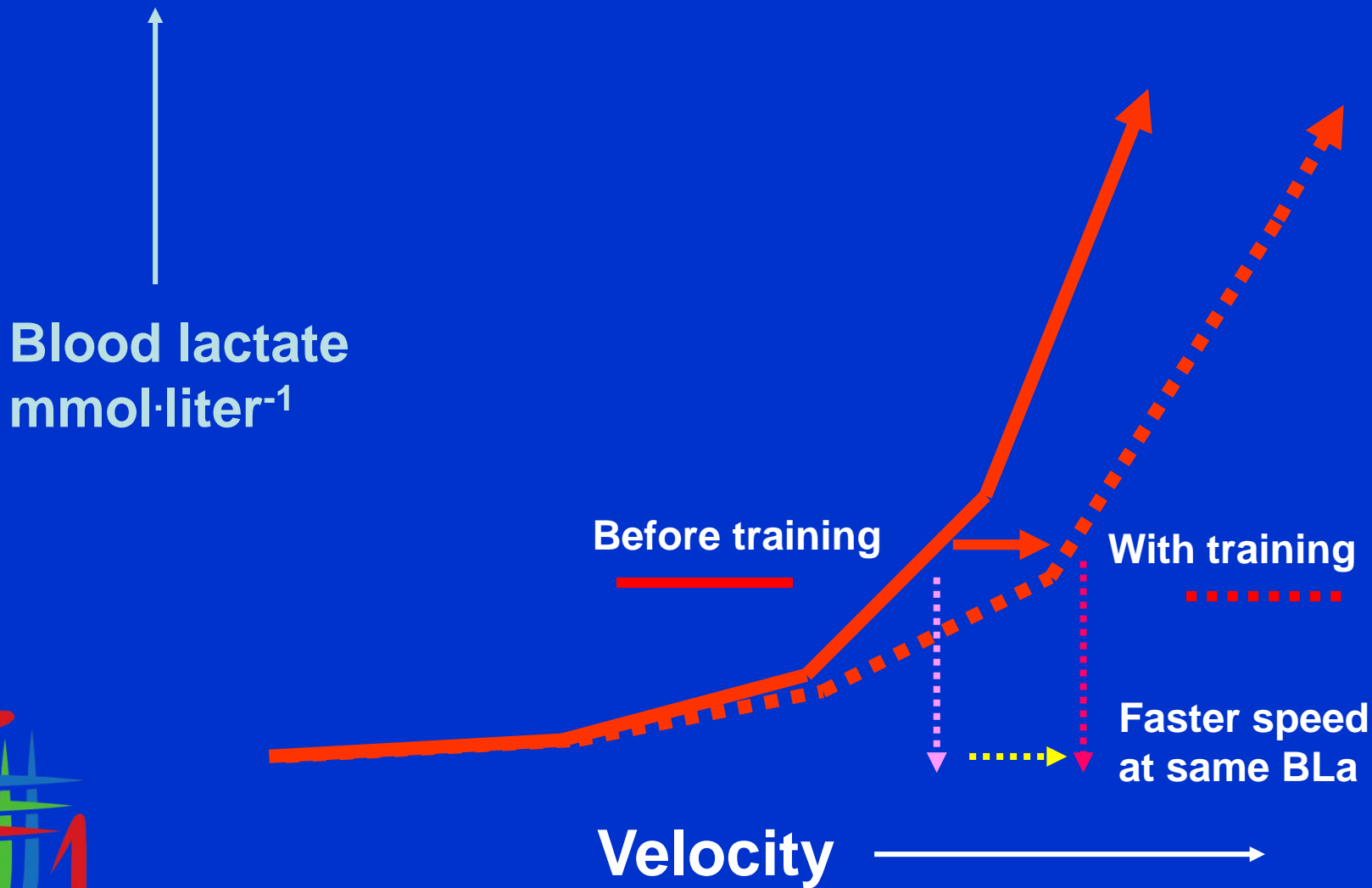
Run Profile

Swim Profile

Bike Profile

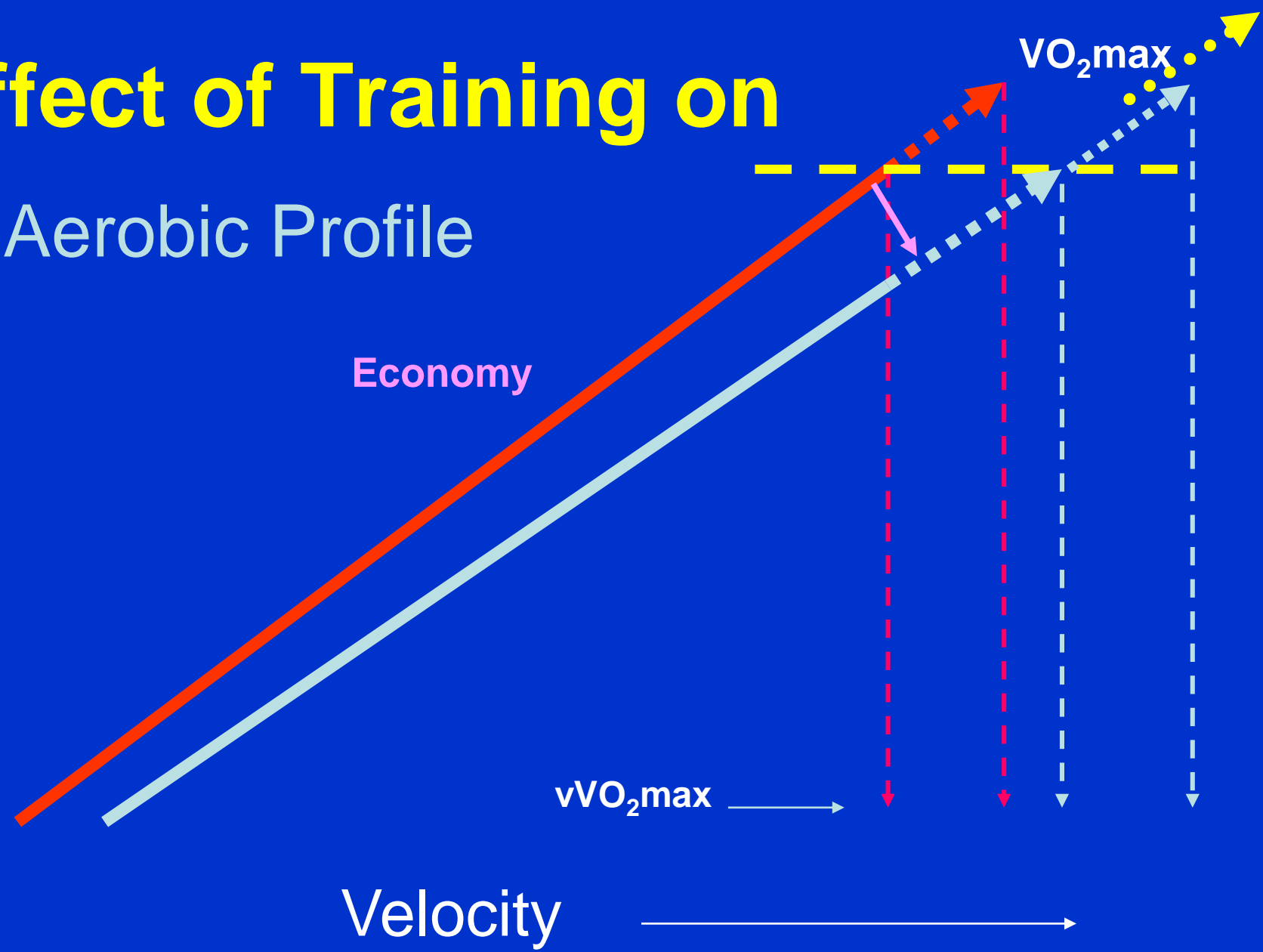


Lactate Profile



Effect of Training on

Aerobic Profile



Velocity

$vVO_2\max$

$VO_2\max$

Economy

Tracking Training Intensity

E/L = 0.20 X minutes of **E** (easy) running
(60 min = 12 points)

M = 0.40 X minutes at **M** pace
(60 min = 24 points)

T = 0.67 X minutes at **T** pace
(30 min = 20 points)

I = 1.00 X minutes at **I** pace
(20 min = 20 points)

R = 1.50 X minutes at **R** pace
(12 min = 18 points)



Tracking Training Intensity

<u>Example Week</u>	<u>Points</u>
60min E 60 X .2	= 12
60min E + 6X3min I = 12 + 18X1	= 30
60min E + 20min T = 12 + 20X.67	= 25
100min E + 10min R = 20 + 10X1.5	= 35
60min E + 40min T = 12 + 40X.67	= 39
100min E 100 X .2	= 20
<u>60min E + 20min I = 12 + 20X1</u>	= <u>32</u>
500 E = 100 Week Total 93Q =	193



Example

3k **E** (4:00) + 15k **M** (3:30) + 2k **T** (3:20)
+ 8k **M** (3:30) + 2k **T** (3:20) + 2k **E** (4:00)
= for 32 k in 1:43 (45 points)



Stride Rate 180

and

Breathing Rhythms

4-4, 3-3, 2-2, 2-1, 1-1



$$f \times TV = VE$$

$$22 \times 4.0 = 88 \quad 30 \times 3.5 = 105$$

$$45 \times 3.0 = 135 \quad 60 \times 2.5 = 150$$

$$90 \times 1.5 = 135$$



The Final Ingredient of Success

#5 Luck

(Focus On the Task at Hand)

