



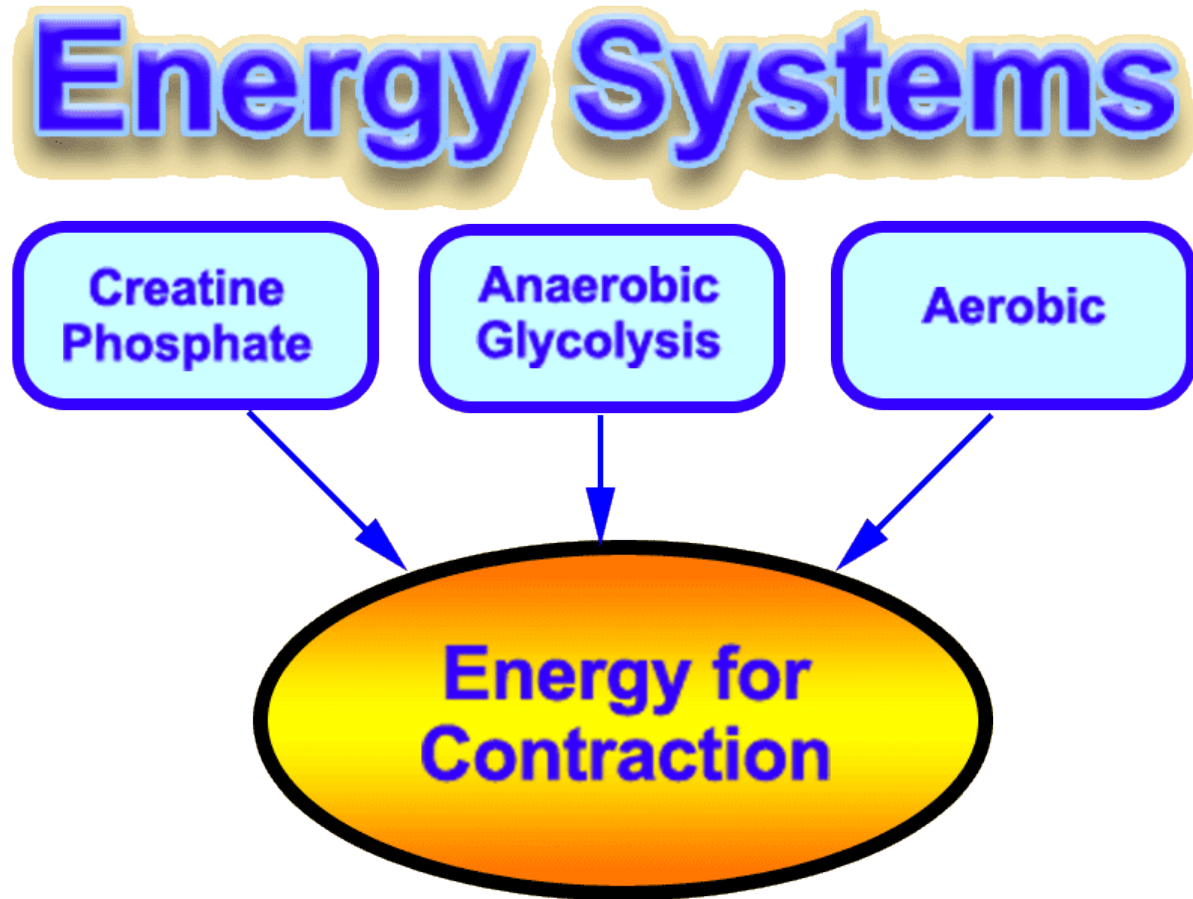
Race Warm Up and Warm Down

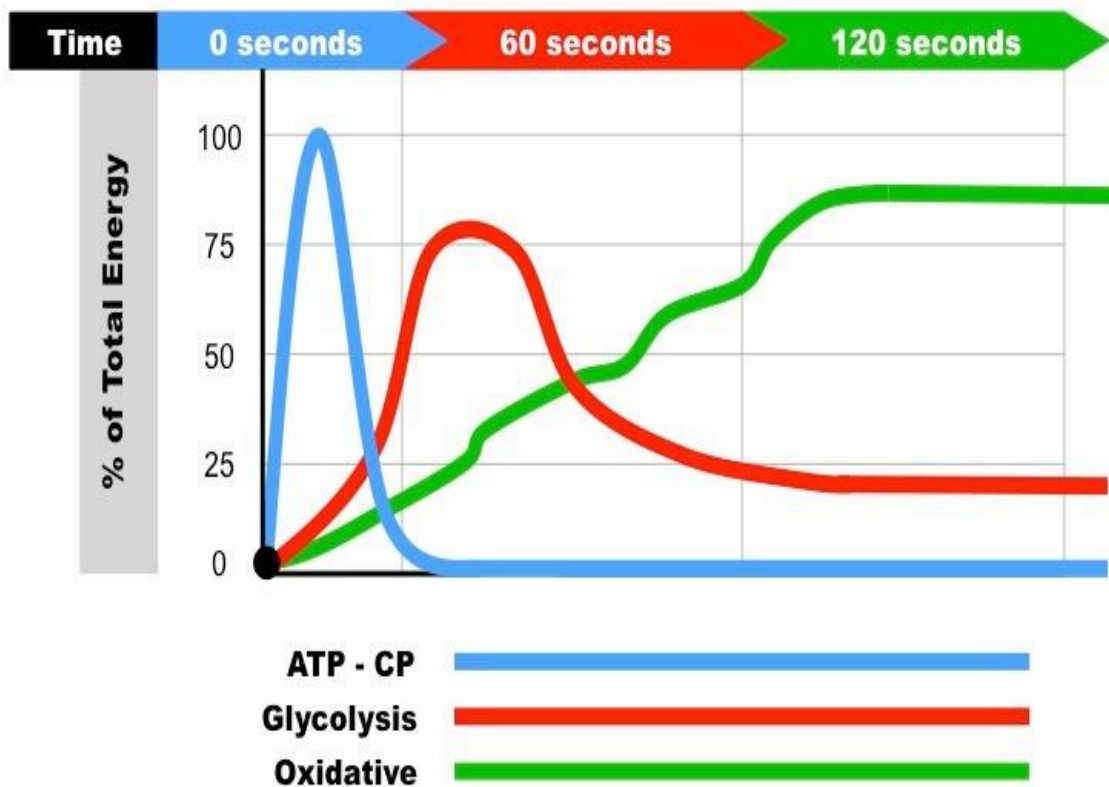
Diane Elliot with information from Mike Peyrebrune and John Watson
British Swimming

Aims of the presentation

- To review lactate production, glycolysis and the different energy systems
- To provide information about current thinking in warm down protocols
- To introduce other recovery methods

What is lactate and how is it produced ?





Phosphagen system

Sprinter

8-10 seconds (100 m)



Swimmer

Glycogen-lactic acid system

1.3-1.6 minutes (400 m)



Marathon runner

Aerobic respiration

Unlimited time (15 Km)

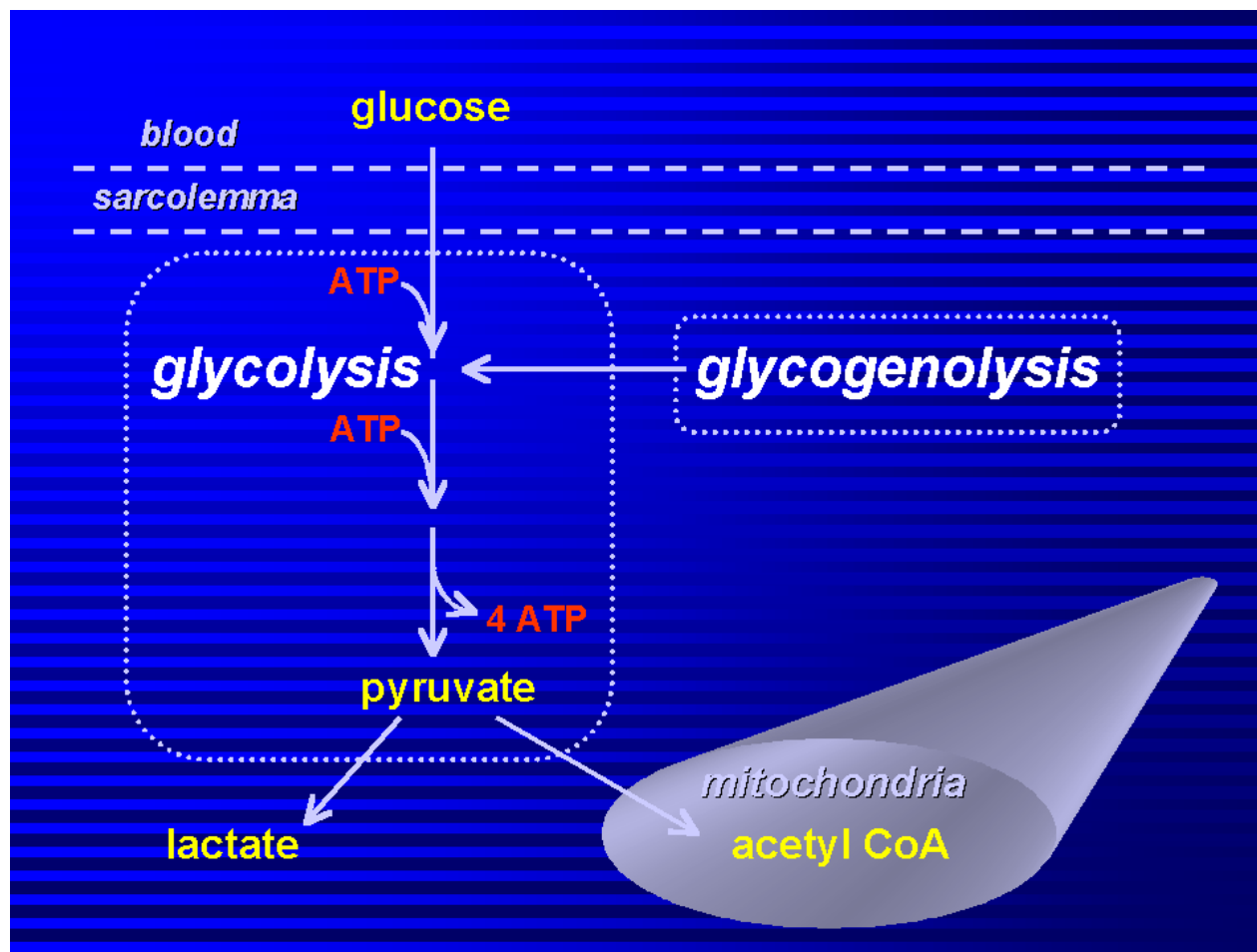
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Approximate relative contribution of energy metabolism phases to swimming races: based on experienced senior swimmers

- Adapted from Maglischo 1993

COMPETITION TIME	COMMON SWIMMING DISTANCE	ATP-PC (%)	GLYCOLYSIS (%)	AEROBIC (%)
10-15 sec	25	80	20	Negligible
19-30 sec	50	50	48	2
40-60 sec	100	25	65	10
1.30-2 mins	200	10	65	25
2-3 mins	200	10	50	40
4-6 mins	400	5	45	50
7-10 mins	800	5	30	65
14-22 mins	1500	2	20	78

Anaerobic glycolysis

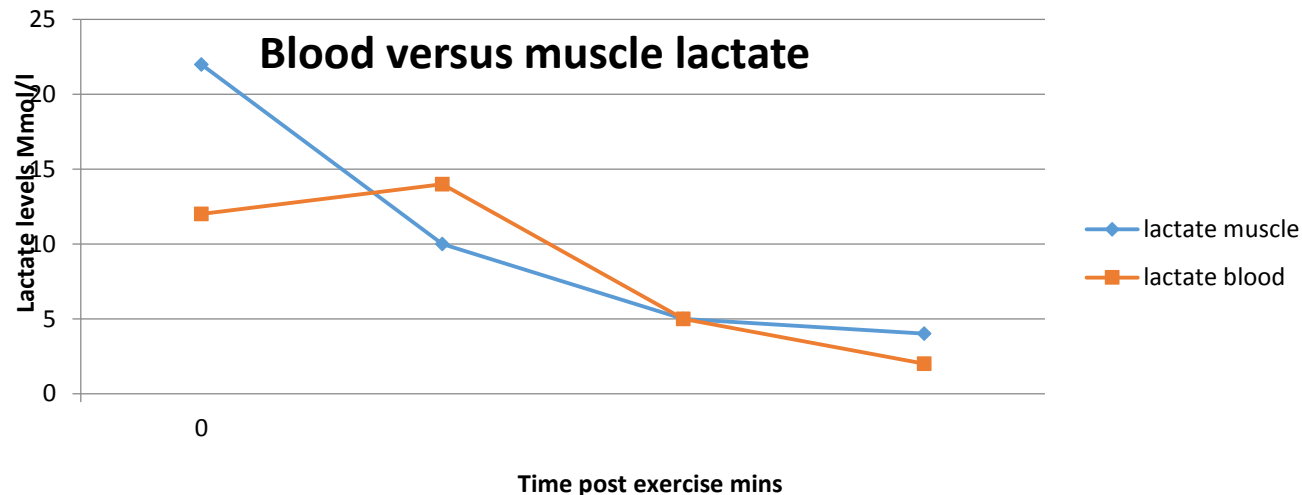


What is recovery

- The process of returning all body systems to resting levels following intensive swimming
- Removal of Lactate
- Reduce Hydrogen ion concentration
- Return muscle and blood pH to normal
- Resynthesize Phosphocreatine
- Hormonal changes
- Repair muscle
- Psychological recovery
- Replenish glycogen stores

Time Scales

- Different systems have different timescales for recovery
 - Phosphocreatine resynthesis
 - Occurs mainly within the first 6 minutes
 - Hormonal changes
 - Several hours to return to pre exercise level
 - Muscle repair
 - Several days
- Muscle lactate
 - Begins to drop immediately after exercise
- Blood lactate
 - Continues to rise for several minutes after exercises



Warm Down

- Active recovery shown to be better to aid recovery than passive recovery (Felix et al 1997, Beckett et al 1993, Denadai et al 2000, Lomax M 2011)
- Steady swimming after an intense rep or race will improve the speed of recovery
- Aim of warm down is to maximise the speed of recovery

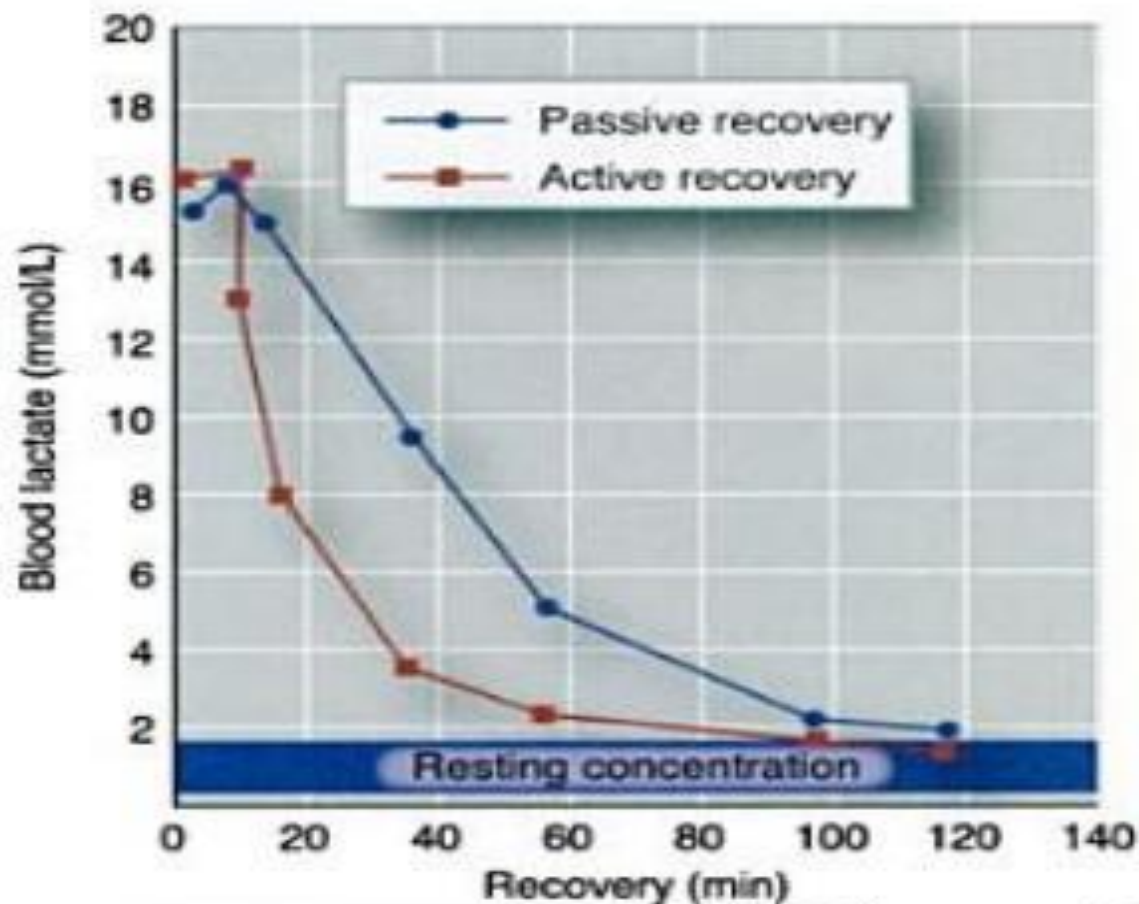
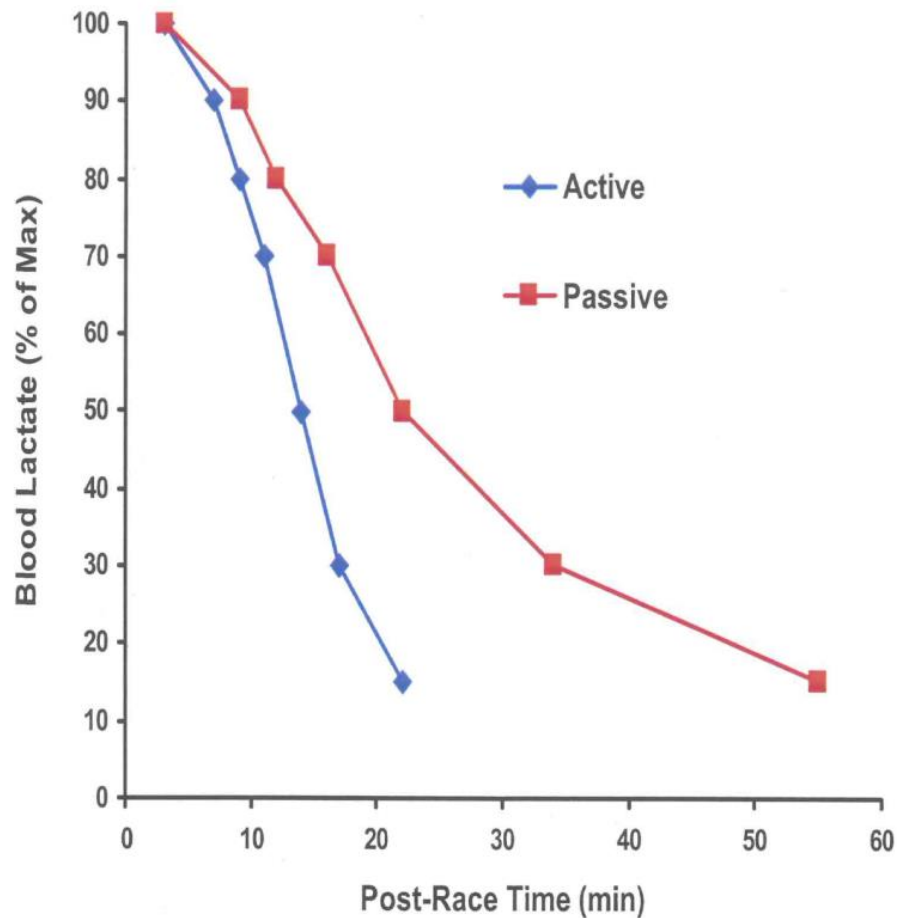


Image from (Wilmore et al., 2008)

Active Vs Passive



- Adapted Carzola et al 1983
- If both swimmers reached 10mM the 20% mark would be recovery which would be 2mM
- Swimmer a—active-reached 2mM at 20 minutes
- Swimmer B-passive-2Mmol at 50 minutes

Individual differences

- Sprinters
 - Muscle mass
 - Higher percentage fast twitch
- Individual changes to the swim down should be addressed such as event, intensity, type of swimmer, further racing
- British swimming data from 3 years—
- Average of 1400M to reduce lactate to $<2\text{mMol}$

Key requirements for recovery

- Maximize Oxygen consumption to enhance PCr resynthesis
- Help reconvert lactate to pyruvate and metabolise aerobically
 - Use large muscles in legs to assist blood flow
 - Very light exercise
 - Good blood flow
- Swimming at a moderate pace to stimulate the muscle pump action
- Increases muscle circulation after the initial light swim

British swimming guidelines

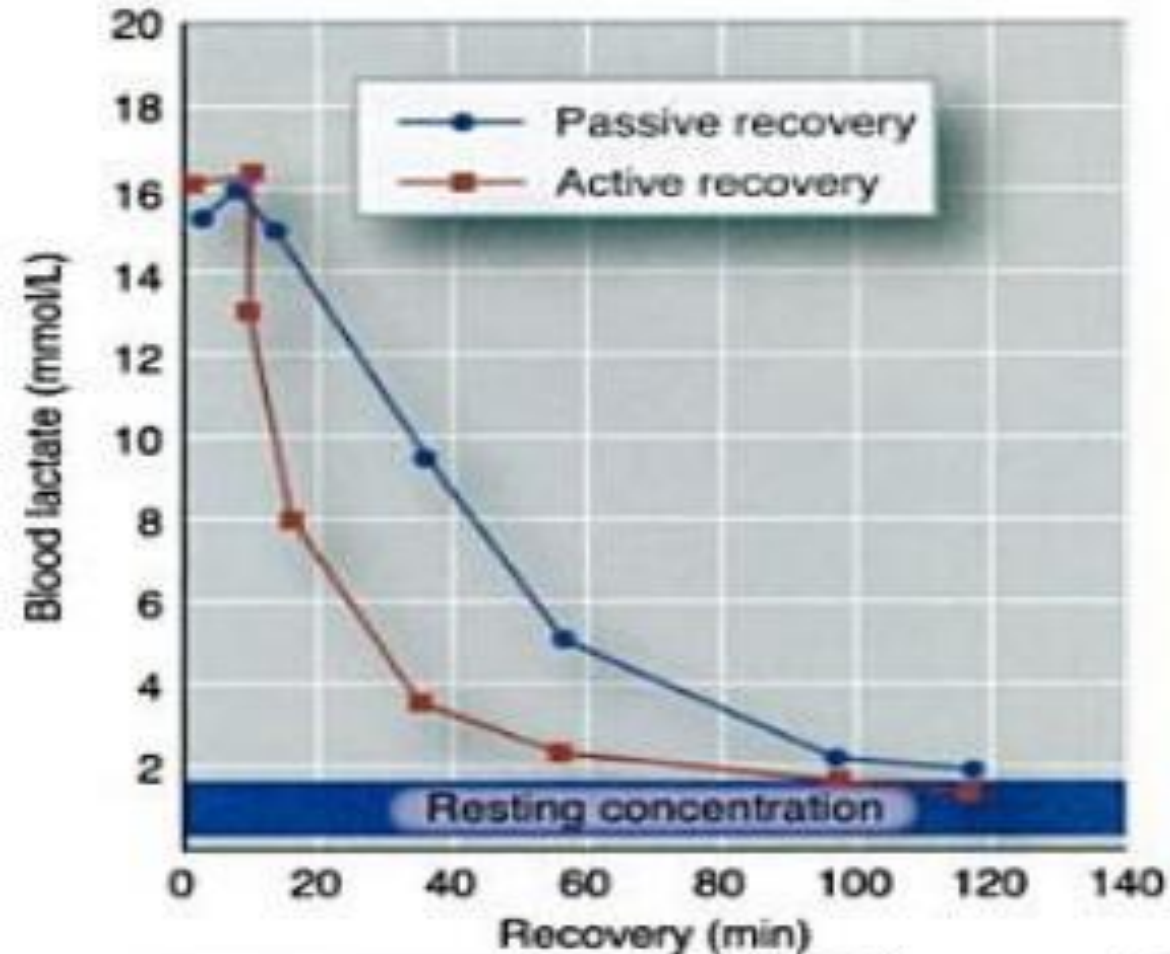


Image from (Wilmore et al., 2008)

- Blood lactate rises for the first few minutes (3-7)
- Followed by a period of rapid removal
- Then slower more constant removal phase
- Generally higher maximal lactate the longer the swim down

British Swimming guidelines

- Need to replace fuel glycogen stores
- High intensity exercise depletes glycogen stores
- 30 minute window but quicker refuel essential
- 50-70g Carbs and 20—30g protein, low fat
- Protein plus a high carb drink (max 8%) should be use during swim down if high intensity exercise has been performed
- Must take full drinks bottle and snack to swim down pool

Guidelines

- Swimmers should keep moving after the race
- Move arms and legs in the water and when out of the water
- Remove suits if time permits
- Get to swim down pool within 5 minutes of race finishing
- Replenishing glycogen stores essential
- Coaches shouldn't hold discussions with swimmers before swim down completed—brief points only with initial information

Swim down protocol

	Repetitions	Comments	Distance
3	200m	Easy, own pace with unrestricted breathing if possible	200m
.			
4	4 x 100m + 30s rest	Alternate FC and BC at a steady pace with good technique	600m
.			
5	8 x 50m + 20s rest	Use 3 strokes (no Fly) and focus on kicking the legs	1000m
.			
6	4 x 100m + 30s rest	Alternate FC and BC and swim at approx 50-60 BBM (adjust for individuals)	1400m
.			
7	Take Heart Rate or Lactate	If below 100 BPM or <2 mM SD complete If above 100 BPM or >2 mM continue SD	
.			
8	4 x 100m + 30s rest	Alternate FC and BC and swim at approx 50-60 BBM (adjust for individuals)	1800m
.			
9	Take Heart Rate or Lactate	If below 100 BPM or <2 mM SD complete If above 100 BPM or >2 mM continue SD	
.			

Key Points

- Too little warm down may compromise subsequent performance
- Too much warm down for a fit swimmer will not compromise subsequent performance
- Junior swimmers
 - Get used to 1400M swim down
 - Refuel ASAP
 - If no second pool consider
 - Swim down after session in main pool
 - Stretch in warm shower
 - Keep moving
 - Maintain body temperature

Other key factors in recovery

- Nutrition
 - Sleep
 - Massage
 - Ice Baths
 - Stretches
 - Recovery suits
- Rolling and trigger point ball
 - Eases muscle tension and massage effect
 - Electrical simulation
 - Common in USA and Canada



Recovery Options

Food Name	Measure	Energy (Kcal)	Carbohydrate (grams)	Protein (grams)	Fat (grams)
Apples	1 x	53	13.1	0.5	0.1
Bananas	1 x	285	70	3.6	0.9
Cheese cottage (plain)	100g serving	101	3.1	12.6	4.3
Yazoo	1 bottle	273	41	15.4	6.4
Muller Rice (original)	1 Pot	196	32	6.8	4.9
Natures Valley Honey & Oat bar	1 Pack (2 slices)	190	32	4	6
Oranges	1 x	59	13.6	1.8	0.2
Raisins	Box	77	19.6	0.6	0.1
Sandwich Chicken salad (white bread)	1 sandwich	359	46	22	10.9
Semi-skimmed Milk	1 Pint	261	27	19.9	9.7
Trail mix	Handful	173	14.9	3.6	11.4
Tuna (can)	1 can (180g)	129	0	31	0.8
Yoghurt Muller - Fruit Corner (all flavours)	1 Pot	158	22	5.7	5.7

Example recovery snacks

Banana & Tuna

Or

4 x Muller Yoghurt

Or

2 x Apple & 1 Pint of Semi Skimmed milk

Or

Nature Valley bar & Pint of milk

Or

200g cottage cheese & 2 x orange & 2 Apples

Other recovery methods

Sleep

- Sleep loss can lead to glycogen depletion
- Close connection between sleep and immune system
- Sleep deprivation linked to inflammatory system
- Body repairs during sleep

Massage

Study from Beijing
Athletes spending longest
on massage table generally
underperformed



Other recovery methods

- Stretches
 - Work on returning soft tissue to optimum length
 - Prevention of trigger points
 - Possibly may reduce the DOMS severity after overload exercise
- Recovery suits
 - Pressure garments to improve venous return and blood flow from the leg muscles back up to the heart
 - Lack of research on sports suits



Other recovery methods

- Ice Baths
 - Limits strength gains
 - Static
 - Often not deep—no hydrostatic changes



- Cold water immersion
- Deep moving water
- Cold reduces blood flow from legs
- Hydrostatic effect
- anti-inflammatory
- Reduces CK efflux
- Not in heavy training phase

Questions

Thank You

