

Acclimation, Hydration & Recovery

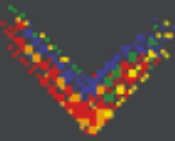
A guide to competing in hot environments

Dr. David Bailey

Physiologist

English Institute of Sport
Loughborough University





Preparation & Recovery

Preparation

- **environment (knowledge, acclimation)**
- **training (volume, duration, time of day)**
- **travel (jet lag)**
- **competition (time of day, duration)**

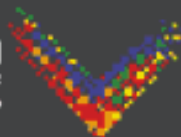
Recovery

- **Hydration**
- **Nutrition**
- **Recovery strategies**

Overview

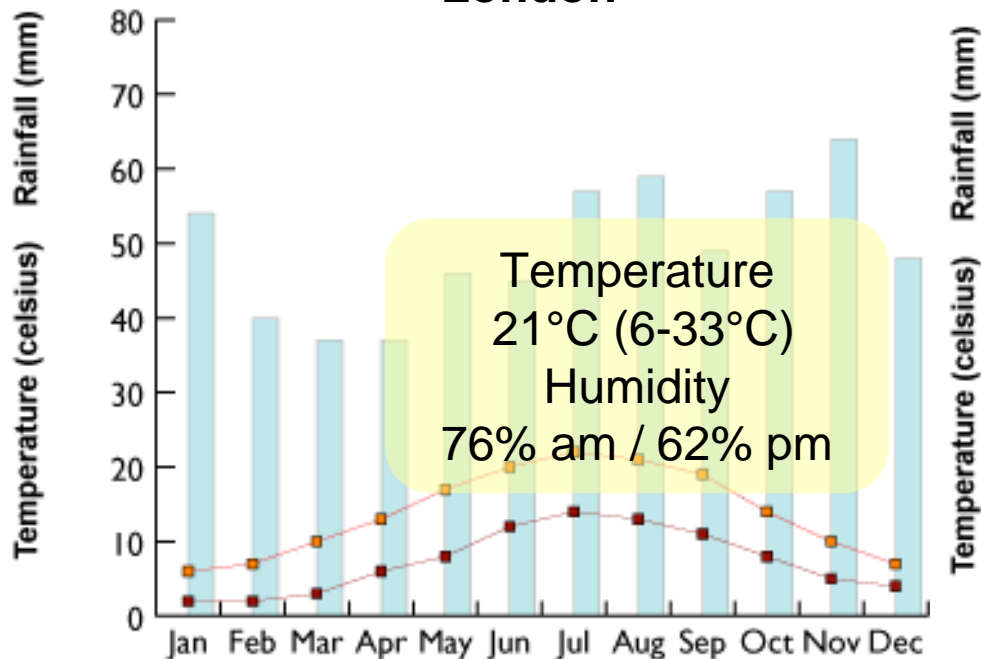
- Acclimation to hot/humid conditions
 - Environmental conditions
 - Exercise in a hot/humid environment
 - Maximising adaptations
- Importance of water
 - Affect of dehydration on performance & recovery
 - Monitoring hydration status
- Recovery strategies in hot environments
 - Nutritional strategies
 - Non-nutritional strategies





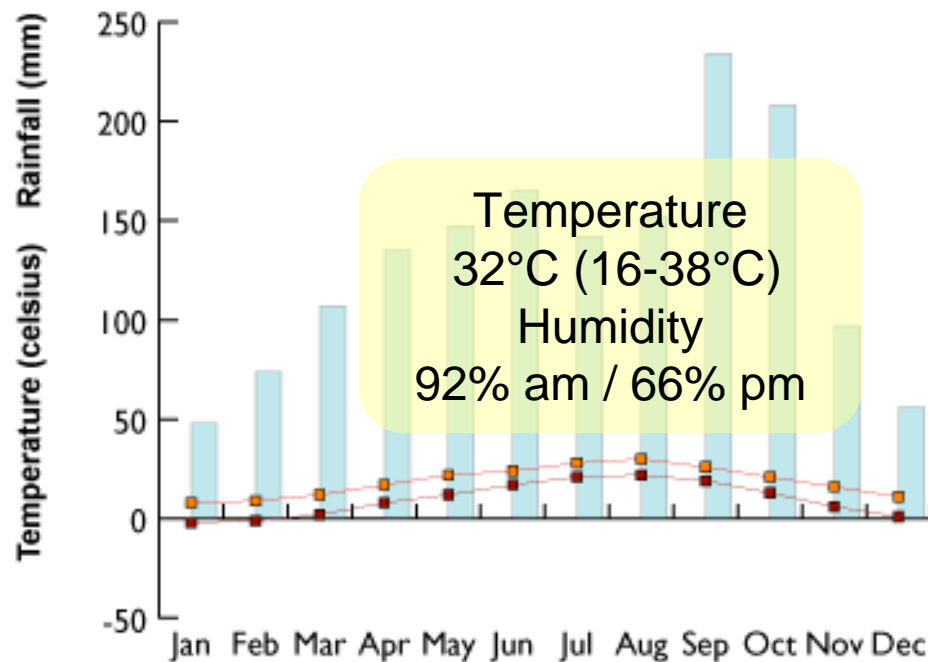
Environmental Conditions

London

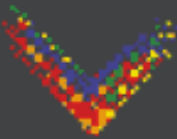


- rainfall
- average daily temperature (max)
- average daily temperature (min)

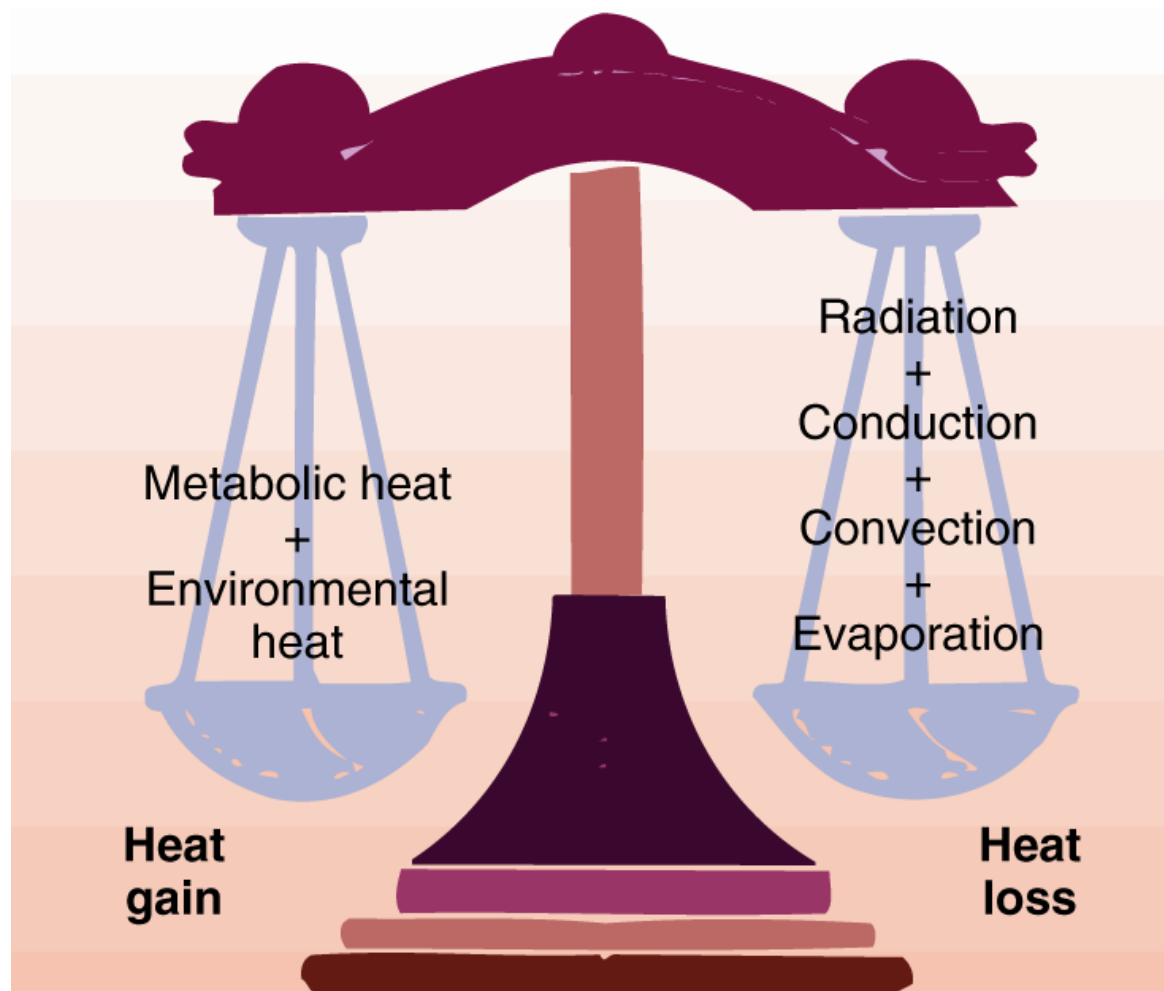
Nagoya

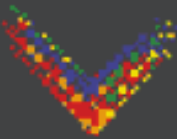


- rainfall
- average daily temperature (max)
- average daily temperature (min)



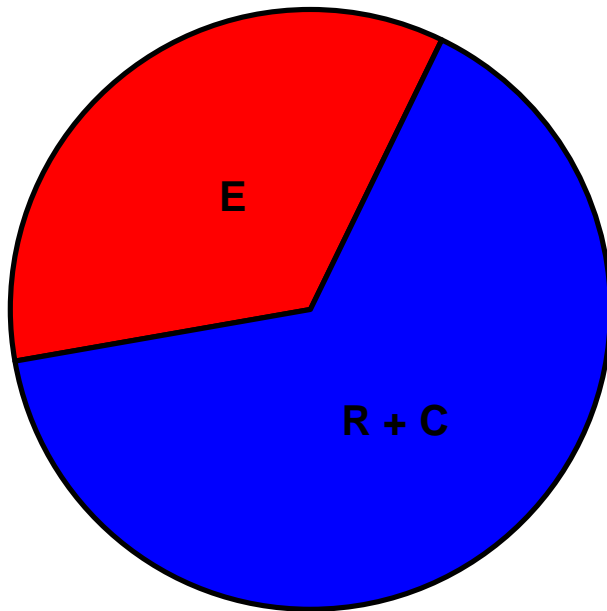
Maintaining heat balance



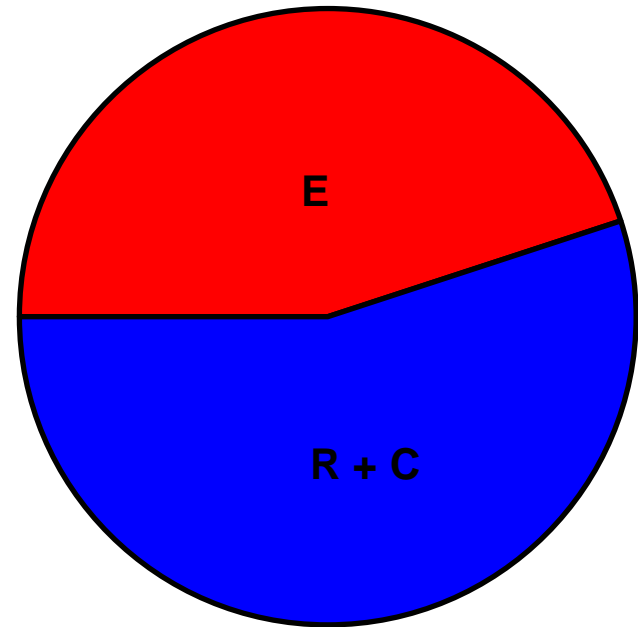


Heat loss in hot environments

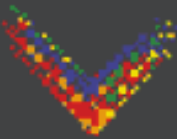
30°C, 70%rh



32°C, 20%rh

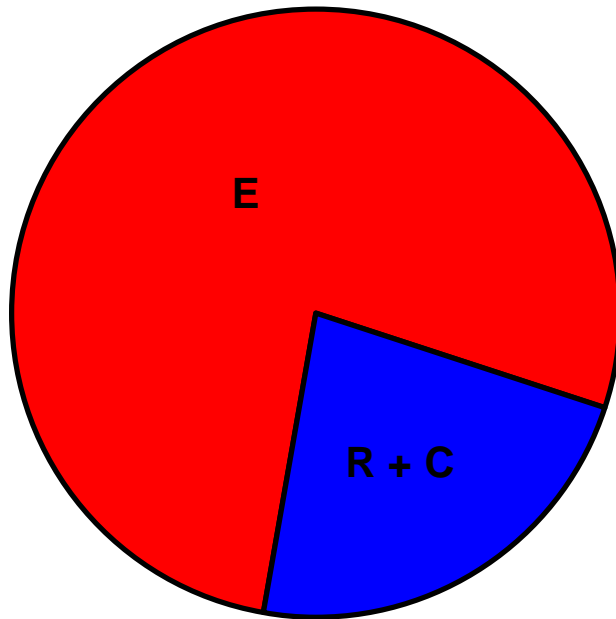


REST

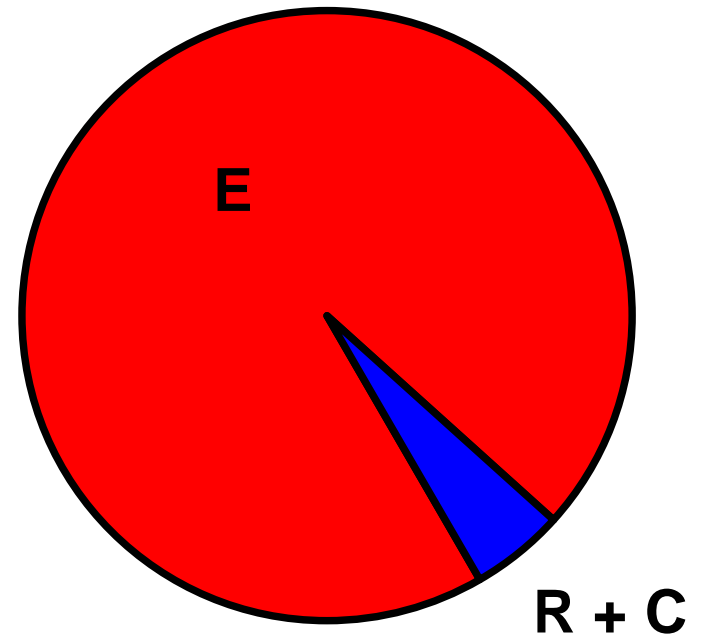


Heat loss in hot environments

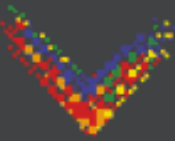
30°C, 70%rh



32°C, 20%rh



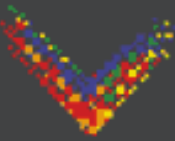
EXERCISE



Heat & Performance

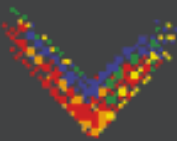
- Type of exercise
 - decreased endurance
 - limited affect on maximal strength
- Hyperthermia
 - Shift towards non-aerobic metabolism
 - Faster rate of muscle/liver glycogen usage (carbohydrate)
 - Increased cardiovascular strain (venous pooling)

Heart Rate x Stroke Volume = Cardiac Output
- Dehydration
 - Decrease in body weight (2 – 8%)
 - Increase sweating (0.8 – 1.4 L/h, maximum recorded 3.7L/h)
 - Rate of water absorption (0.8 – 1.2L/h)
- Hypohydration
 - dehydration >4h without rehydration

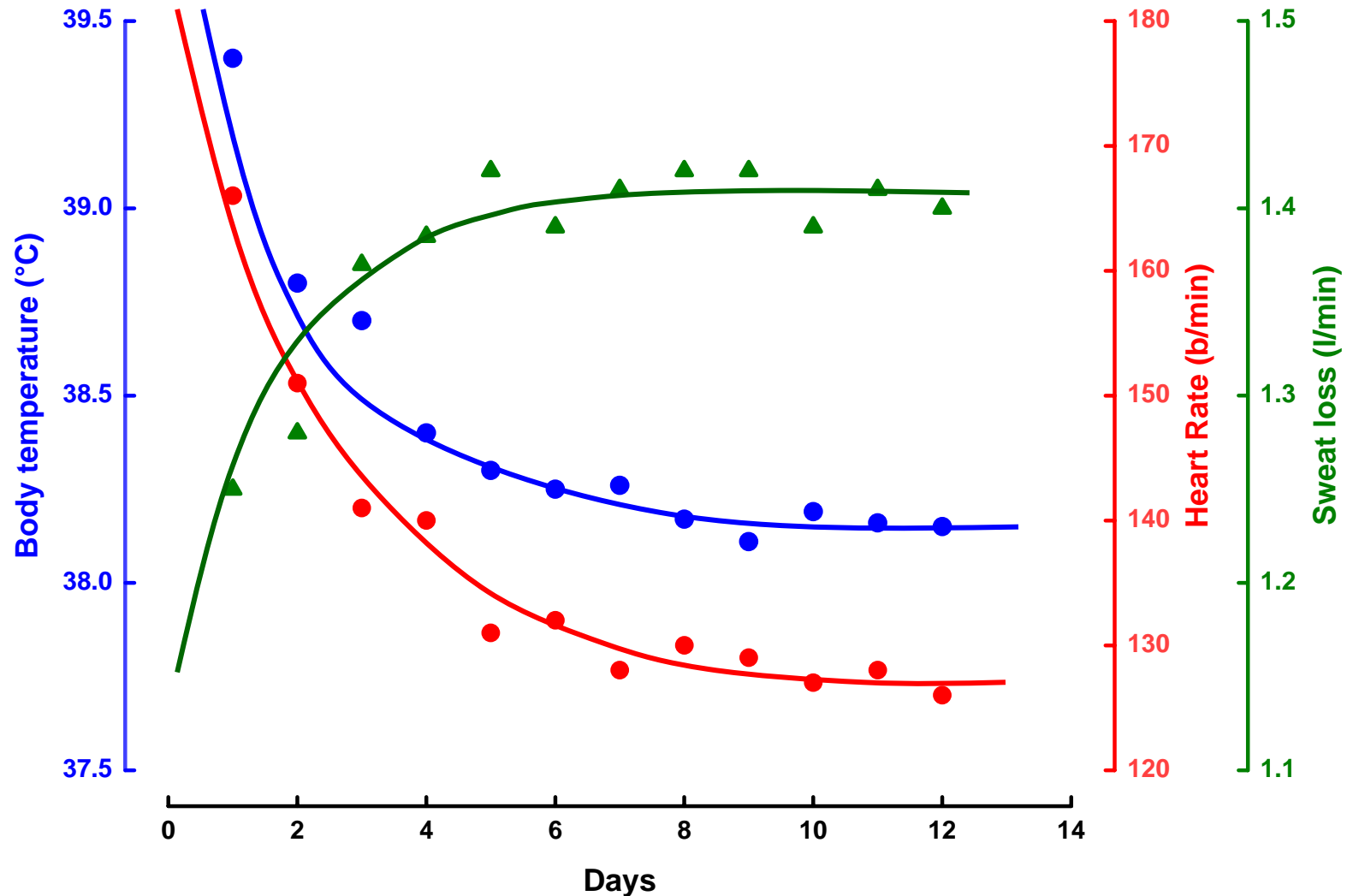


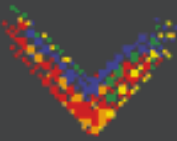
Heat Acclimatisation

- Preparation for competition in a hot environment
- What are the beneficial adaptations?
- Regular exposure to heat/humidity over 10-14days;
 - ↓ Cardiovascular strain (3-6 days)
 - ↓ Perceived exertion (3-6 days)
 - ↑ Blood volume (3-6 days)
 - ↓ Body temperature (4-8 days)
 - ↑ Sweat Rate (8-14 days)
 - ↓ Electrolyte loss (5-10 days)
- Improved heat transfer from core to the skin
- Improved cardiovascular function (dehydration & blood pooling)



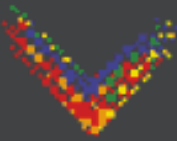
Physiological adaptations to heat





Maximising Adaptations

- Exercising in similar conditions ($\pm 2^{\circ}\text{C}$)
 - $>50\%$ $\text{VO}_{2\text{max}}$ ($60\text{-}90\%$ HR_{max})
 - Between 90-100min
 - Gradual exposure over 10-14days
 - Exercise in groups or pairs
 - Exercise in environmental chamber
 - Wear more insulated clothing
 - Monitor physiological responses
- Exercise at competition venue
 - Adapt training programme (high intensity work at cooler times)
 - Train at similar time to competition
 - Monitor physiological responses



Monitoring Acclimation

- Assess changes in body weight
 - Weigh pre & post-exercise (calculate difference)
 - Add weight of clothing if wet
 - Add weight of fluid consumed during exercise (1litre = 1kg)
 - Subtract urine loss during exercise
 - Sweat rate can be calculated

- Example

Pre-exercise = 70kg

Post-exercise (60mins) = 69kg

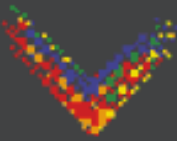
Clothing weight 1.0kg → 1.5kg

Drank 500ml = 0.5kg

Change in weight = 2kg

Fluid replacement = 2 litres





Importance of Hydration

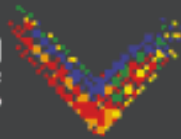
- Virtually impossible to maintain euhydration during exercise in hot/humid conditions
- Not uncommon to experience 2-8% loss in body weight
- Small body weight losses (2-4%) can result in reduced exercise capacity/tolerance
- Dehydration leads to;
 - ↓ blood volume/blood flow
 - ↓ waste removal
 - ↑ cardiovascular strain
 - > risk of heat illness
- Maintaining hydration minimises these detrimental responses





Dehydration & Performance

Body Weight Loss	Exercise Environment	Change in $\dot{V}O_2\text{max}$	Change in Endurance Capacity
-2%	Hot	-10%	-22%
-4%	Hot	-27%	-48%
-5%	Mild	-7%	-12%
-6%	Mild	-8%	-17%



Monitoring Hydration Status

Consider fluid loss during exercise + whole day

- Mild climate – 2.5L/day
- Hot climate – 10L/day

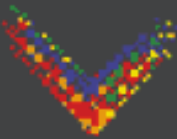
Monitor physiological changes;

- Body weight
- Body temperature (difficult)
- Urine osmolality (very difficult)
- Urine colour (colours 1,2 & 3)

Continual monitoring is important

- Rehydration isn't instantaneous
- Monitor urine colour >2 times post hydration
- Consider food intake





Hydration Strategies

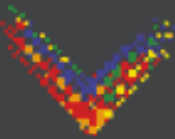
ACSM stand point (1996)

- >2h pre-exercise consume 500ml water
- During exercise drink early
- Drink at rates equal to your sweat rate
- Practice drinking at these rates
- Try to consume cooled fluids

General advice

- Be realistic
- Avoid gastrointestinal distress
- Consider event duration
- >1h hydration during exercise is essential
- Greater emphasis on rehydration
- Maximise recovery





Fluid Replacement Beverages?

Water vs. Sports Drinks;

- Much debate (commercial interests)
- Depends on;
 - Duration
 - Intensity
 - Urgency
 - Recovery time
- Plain water → haemodilution
- Sports drinks contain;
 - Electrolytes (Na^+ , K^+ , Cl^-)
 - Carbohydrate
- Maximise recovery

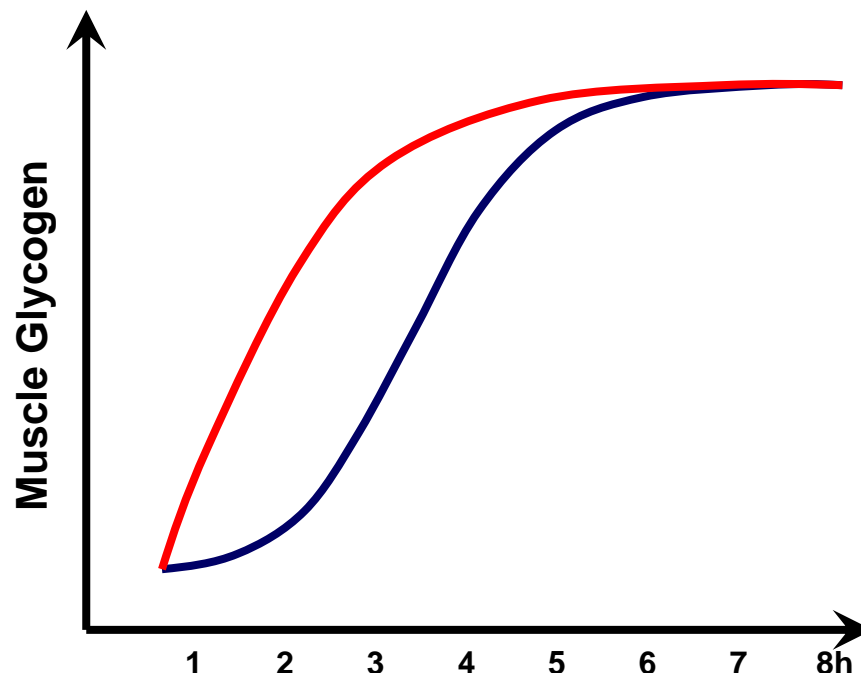


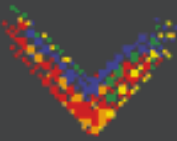


Recovery Strategies

Nutritional

- Hydration is essential
- Repletion is as important
- Source of electrolytes
- Consider recovery period
- Amount of carbohydrate
- Type of carbohydrate
- Carbohydrate & protein mixtures





Alternative Recovery Strategies

Non-nutritional
Cryotherapy;

Cold water immersion

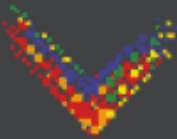
- ↑ Cooling
- ↓ Muscle soreness
- ↑ Muscle function
- ↓ Muscle damage

Contrast therapy

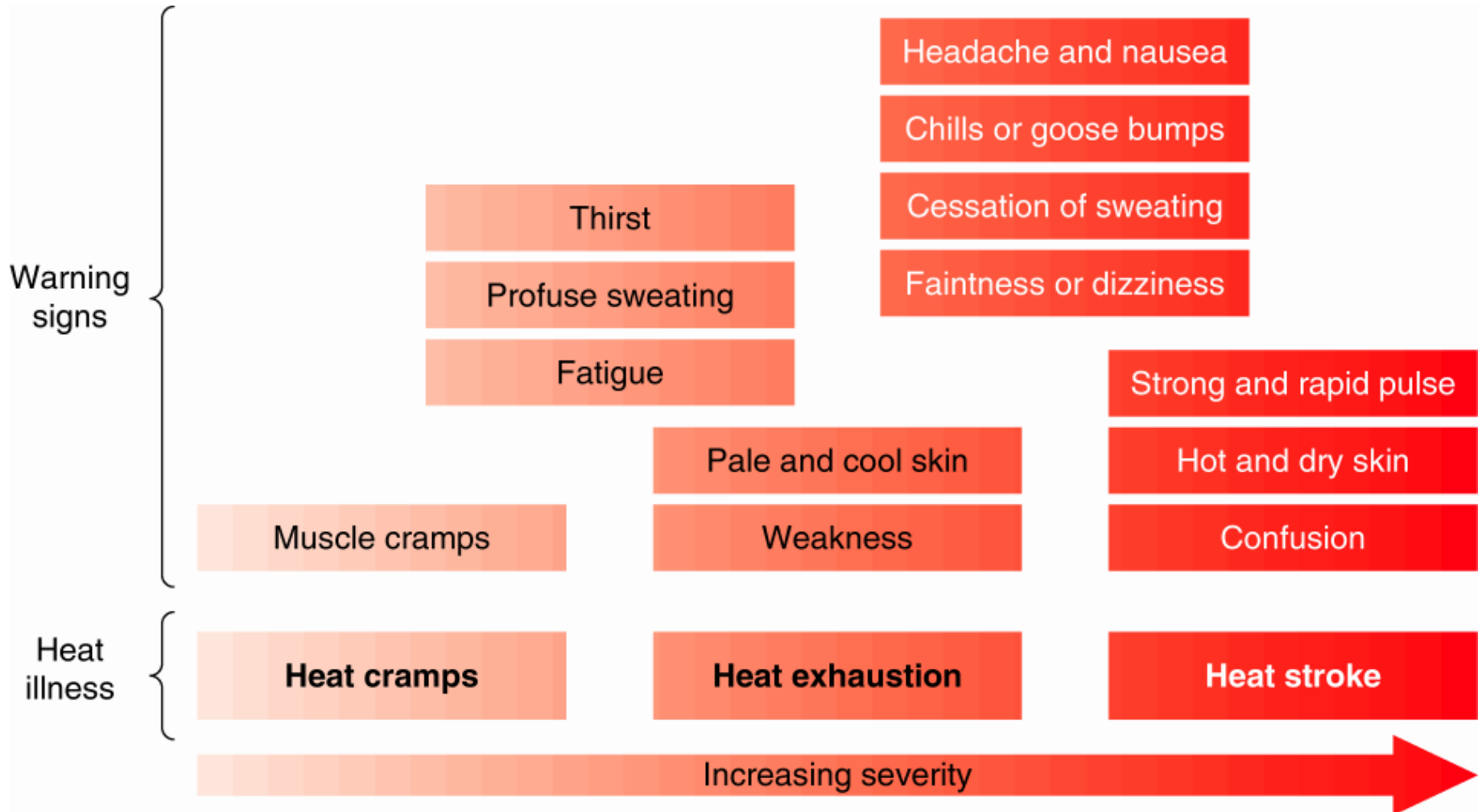
- ↑ Blood flow
- ↑ Waste product removal

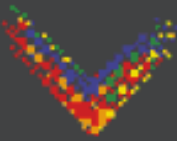
Cooling (pre vs. post)





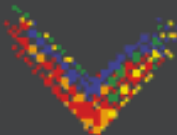
Warning Signs of Heat Disorders





Key Points to Remember

- Preparation is key
- Allow sufficient time for acclimation
- Maintain good hydration both during exercise & at rest
- Monitor hydration status regularly
- Continually assess tolerance to hot/humid condition
- Replace lost fuel as well as fluid
- Support fellow competitors/training partners
- Be aware of signs of hyperthermia



Thanks & good luck in Japan!



Any questions?
(David.Bailey@eis2win.co.uk)