

# **Global Warming, Aging and Environmental Physiology**

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# Goals of this Presentation

1. What is a physiologist and what is an environmental physiologist?
2. How can environmental physiologists contribute to helping the elderly during global warming?
3. How does the elderly target group *respond physiologically* to the design change, to a cooling spot or to a heat wave?

# 1. What is a physiologist and what is an environmental physiologist?

- Human Physiology - "how humans perform their vital functions" (Greek Physis = nature + Logos = study)
- Physiologists study functions of molecules, cells, organs, organ systems and the whole body
- Environmental Physiologists study physiological responses in extreme environments  
e.g. heat, cold, altitude, depth

## 2. Physiological Responses and Adaptations

- Physiological responses and adaptations to hot and humid environments can be measured by environmental physiologists at different levels from the molecular to the whole body integrative level.

## 2a. Acute physiological responses of elderly to high temperatures in a 'heat island'



## 2b. Adaptation of the elderly to chronic heat stress

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- Climatic chambers create varied environmental conditions where elderly human responses can be closely monitored.
- Can vary humidity (e.g. 0-95%) & temperature (-20 C to +50 C)

## Thermal & CV responses

# Heat Acclimation

## Acute & Chronic Phases

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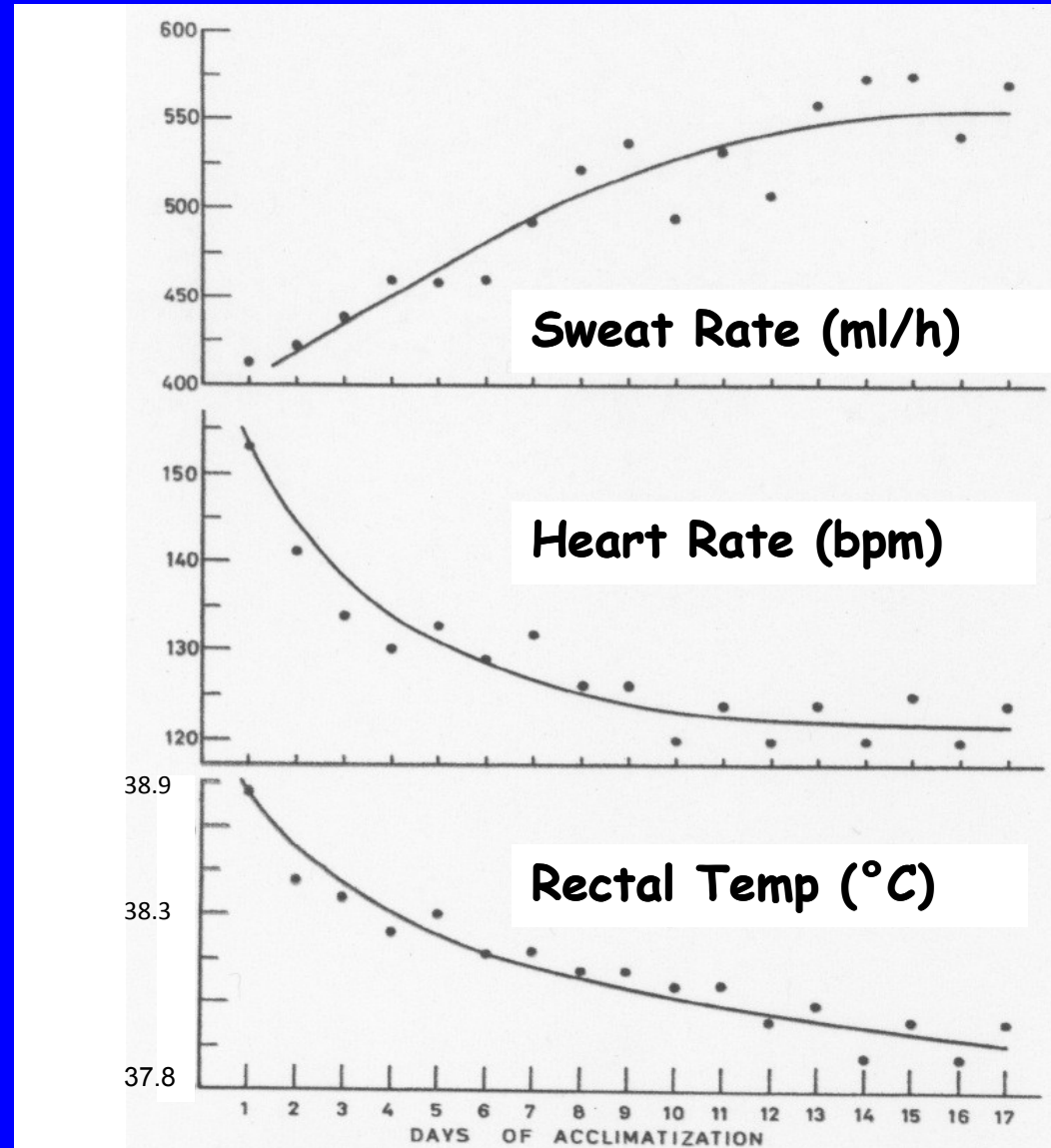


FIG. 1. Rectal temperature, heart rate, and sweat rate during acclimatization.

## 3. Field Work

### Sensors to Quantify Physiological Responses

- **Miniaturized**
- **Inexpensive**
- **Ambulatory**
- **Wireless**

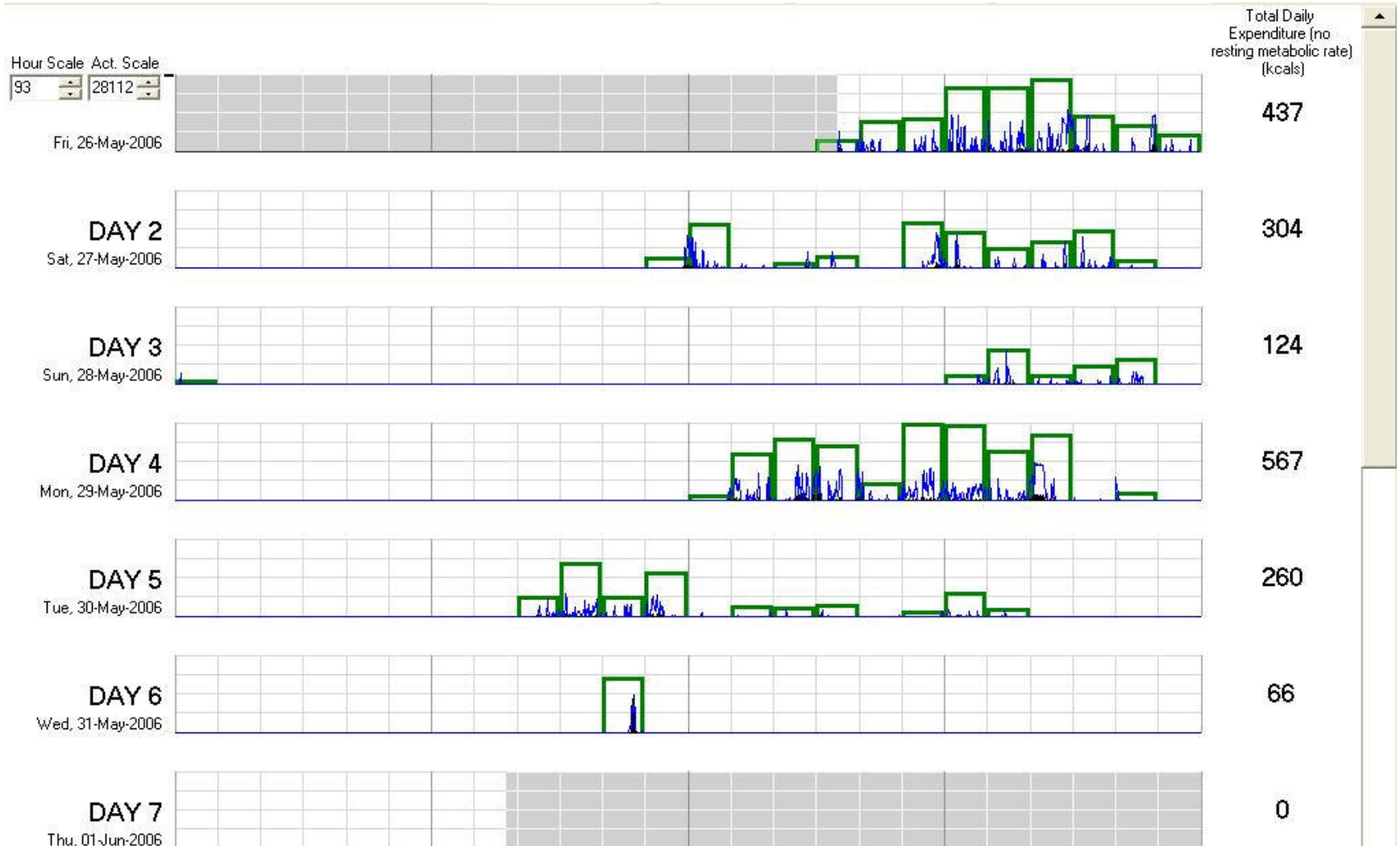


### 3. Field Work:

- Ambulatory monitoring of physiological responses
- e.g. to assess walkability design changes with device such as Actiheart 4 or SenseWear HR Armband that each give a combination of heart rate & motion with an accelerometer.

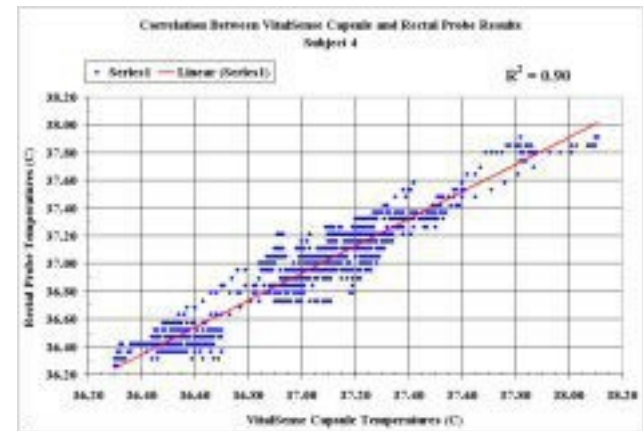


# 3. Field Work: Sample Actical Record



# 3. Field Work: Wireless Core Temperature

- Ingestible capsule
- Pill size
- Continuous core body temperature monitoring



### 3. Field Work: Dermal Temperature Patch

- Measures surface skin temperature



## 4. Mathematical modeling of elderly physiological responses.

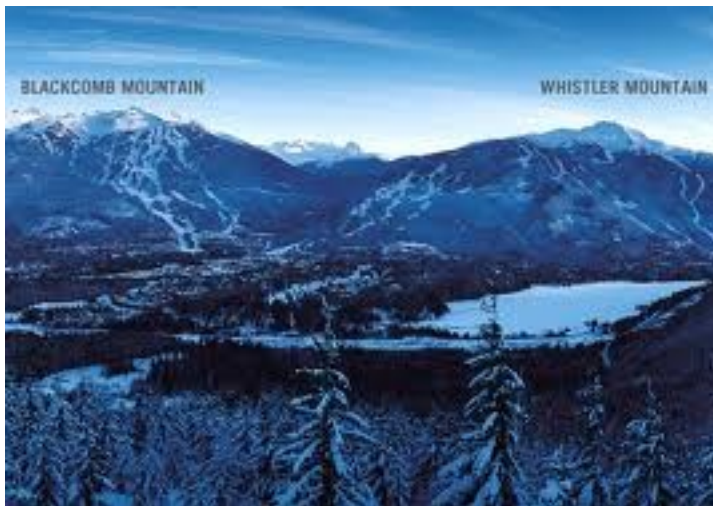
- e.g. Mathematical model to estimate and predict human body temperature responses, human level of comfort or stress, level of exertion or perception.
- The physiologist provides data to validate & refine the mathematical model.

## 5. GPS to monitor elderly movement and physiological responses

- e.g. Grand Fondo used GPS tags to monitor time and position of 5000 cyclists



e.g. Whistler Blackcomb Resorts use GPS tags to monitor position of children during ski lessons



- For the elderly employ GPS to monitor movement on walkways or in the built environment while assessing physiological responses.
- Was a design change effective at give less physiological stress?

## 6. *Cooling Spots* for the Elderly?

- How long does an elderly person need to cool down? People vary in size, body composition and gender. This directly affects their cooling rates.
- Are cooling spots effective at reducing their temperatures, heart rate & how long will it take?
- How long should they stay at a *Cooling Spot* and how often should they visit the cooling station?
- Environmental physiologists can answer these questions.



# 7. Fitness & Aging



- Many benefits of fitness
- Better responses to acute heat stress
- Improved adaptation/heat acclimation to temperature stress is evident with better fitness
- Acquiring heat acclimation is faster with better fitness
- Assessing fitness of the elderly in a physiology lab prior to and following design or built environment changes



## 8. Future Directions and a Proposal

- Cross disciplinary research that includes environmental physiologists
- Bring an environmental physiologist into your group, project or study so as to allow assessment of elderly responses to a new living environment, a city design change or to predict anticipated changes with a mathematical model.
- There are readily available and inexpensive physiology monitors that an environmental physiologist can employ to assess elderly responses during these times of global warming.
- Let environmental physiologists help the elderly live longer, healthier and happier lives!