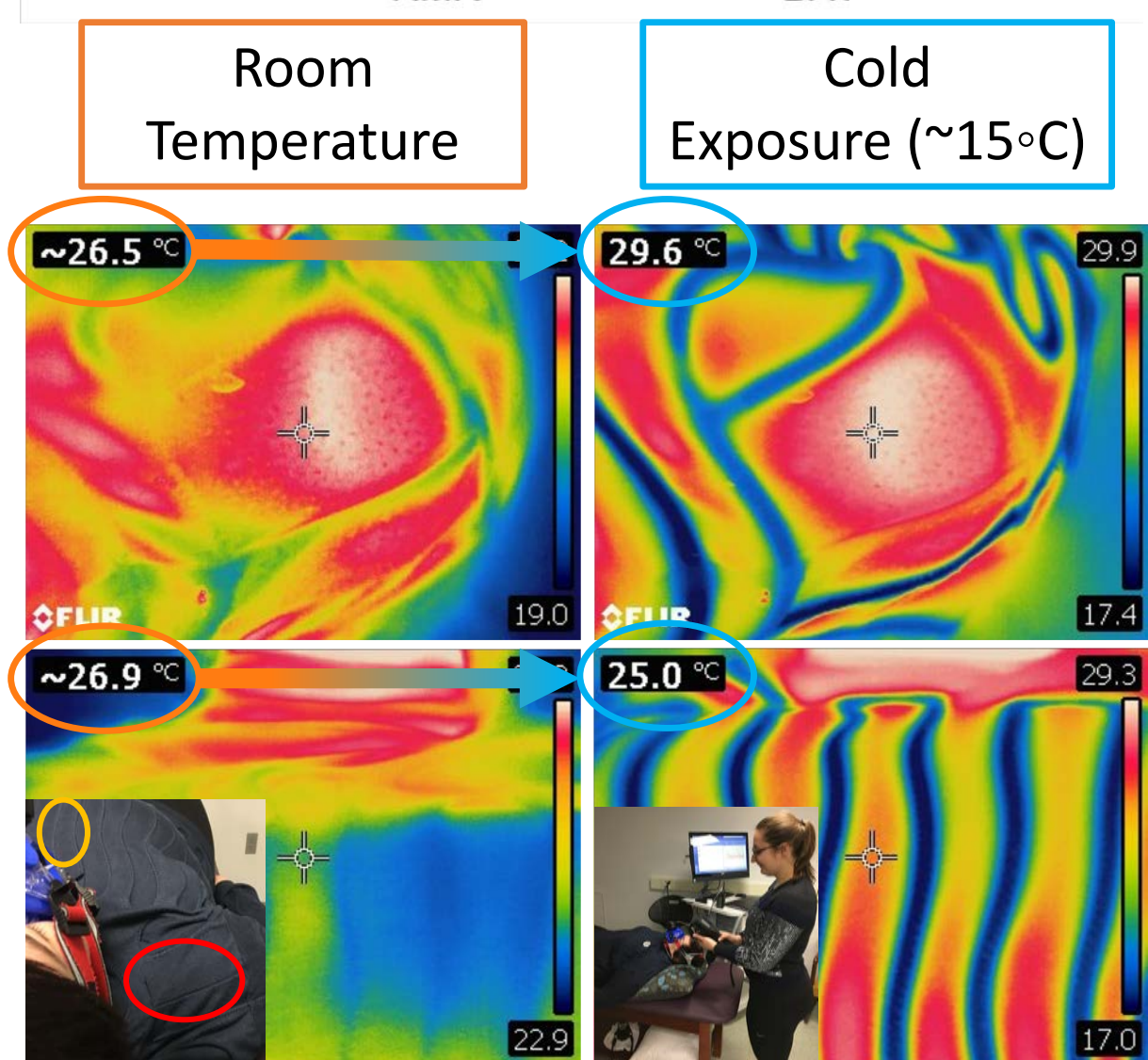
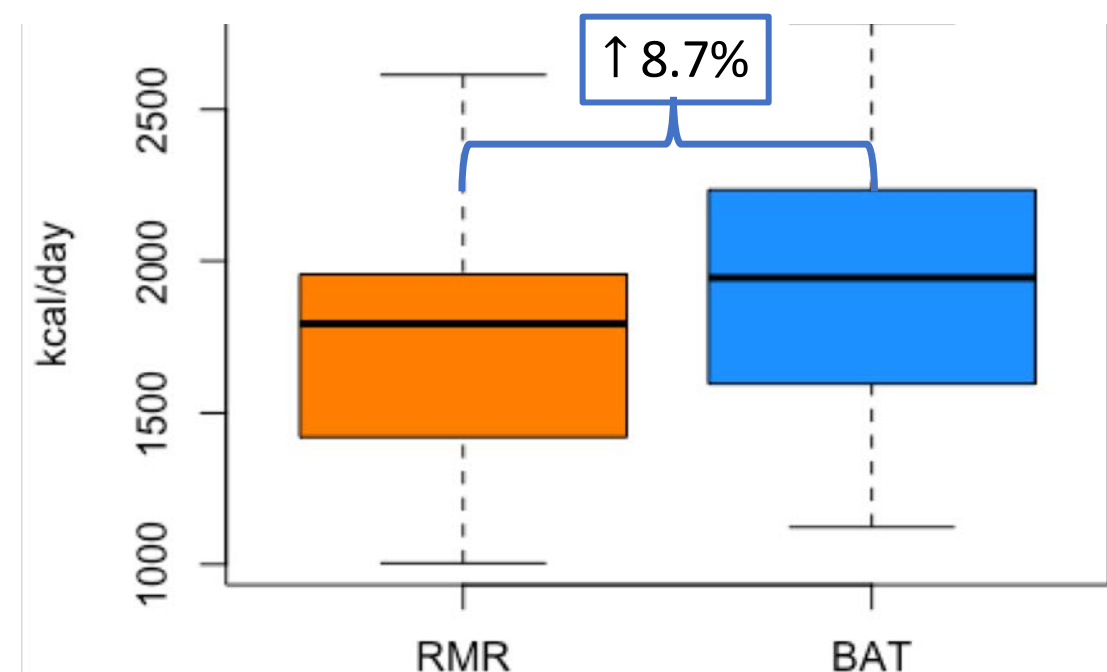


Neanderthals display a suite of anatomical, physiological, and cultural characteristics (Venn diagram) that enabled them to survive and thrive in their cold, glacial climates. This poster reviews some of these characteristics, as they stand alone and as they interact with one another, with a particular focus on the characteristics that require further study. Additionally, this poster is a celebration of the monumental impact Dr. Erik Trinkaus has had on our understanding of Neanderthals and on the field of Anthropology as a whole.

## BAT as Cold Adaptation

- BAT produces heat during cold exposure
- Present & active in some adult humans at supraclavicular area
- In **cold**: BAT measured with thermal images & metabolic rate changes
- Potentially important thermoregulatory mechanism for Neanderthals

### Increased metabolic rate with BAT activation

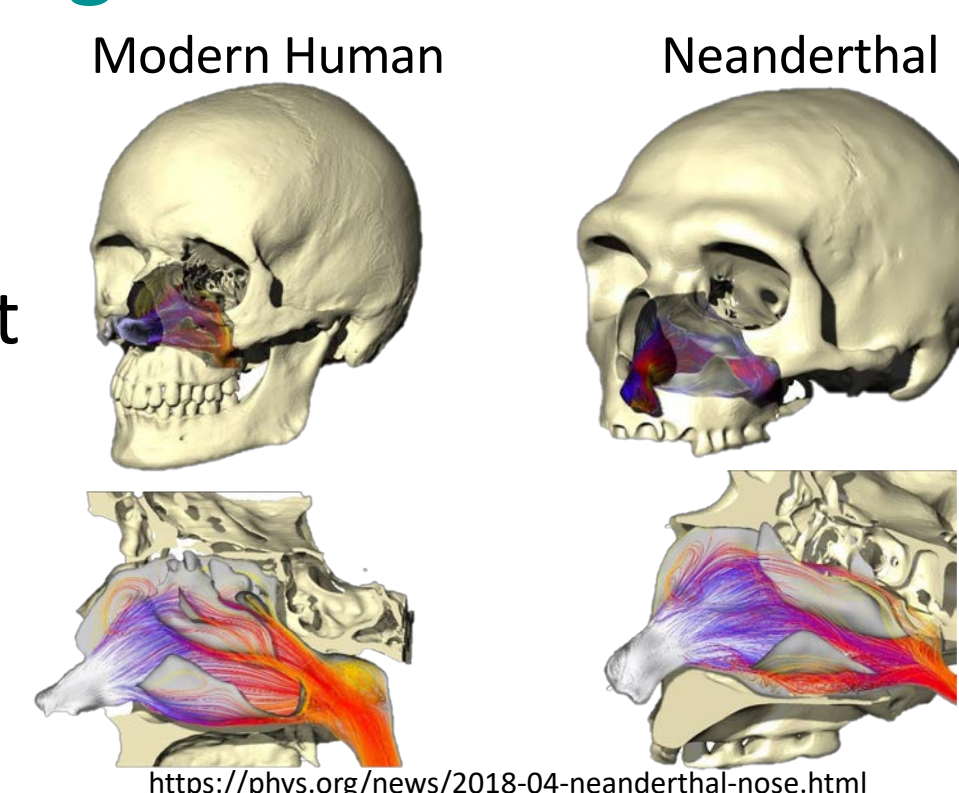


Top Pictures = supraclavicular (red circle), bottom pictures = sternum (yellow circle) Data collected among reindeer herders of northern Finland by Ocobock & Albany, NY population by Niclou.

## Neanderthal Nasal Morphology Impacts Air Conditioning and Energy Expenditure

- It has been proposed that tall, broad noses were adaptive for cold climates
- The shape and large size relative to modern humans suggests Neanderthal noses were better at warming & humidifying large amounts of cold, dry air (see right)
- The larger nose has also been suggested to be better at moving larger volumes of air which would have better supported higher Neanderthal metabolic rates
- But still physiologically **UNTESTED**

### Neanderthals conditioned large volumes of inhaled air



<https://phys.org/news/2018-04-neanderthal-nose.html>

## Allen & Bergmann Rules Still Need Testing

- Neanderthals had shorter limbs, particularly distal limbs, relative to modern humans
- Also had broad pelvises and broad, deep chests
- Following Bergmann's & Allen's rules, this reduced overall body surface area
- Reduced surface area → less heat lost to environment → higher core body temperature → reduced metabolic cost
- But still physiologically **UNTESTED**

### Neanderthal body shape & size potentially adaptive in cold climates

- | Cold "Adapted"         | Heat "Adapted"           |
|------------------------|--------------------------|
| • Short limbs          | • Long limbs             |
| • Broad torso          | • Narrow torso           |
| • Reduced Surface Area | • Increased Surface Area |

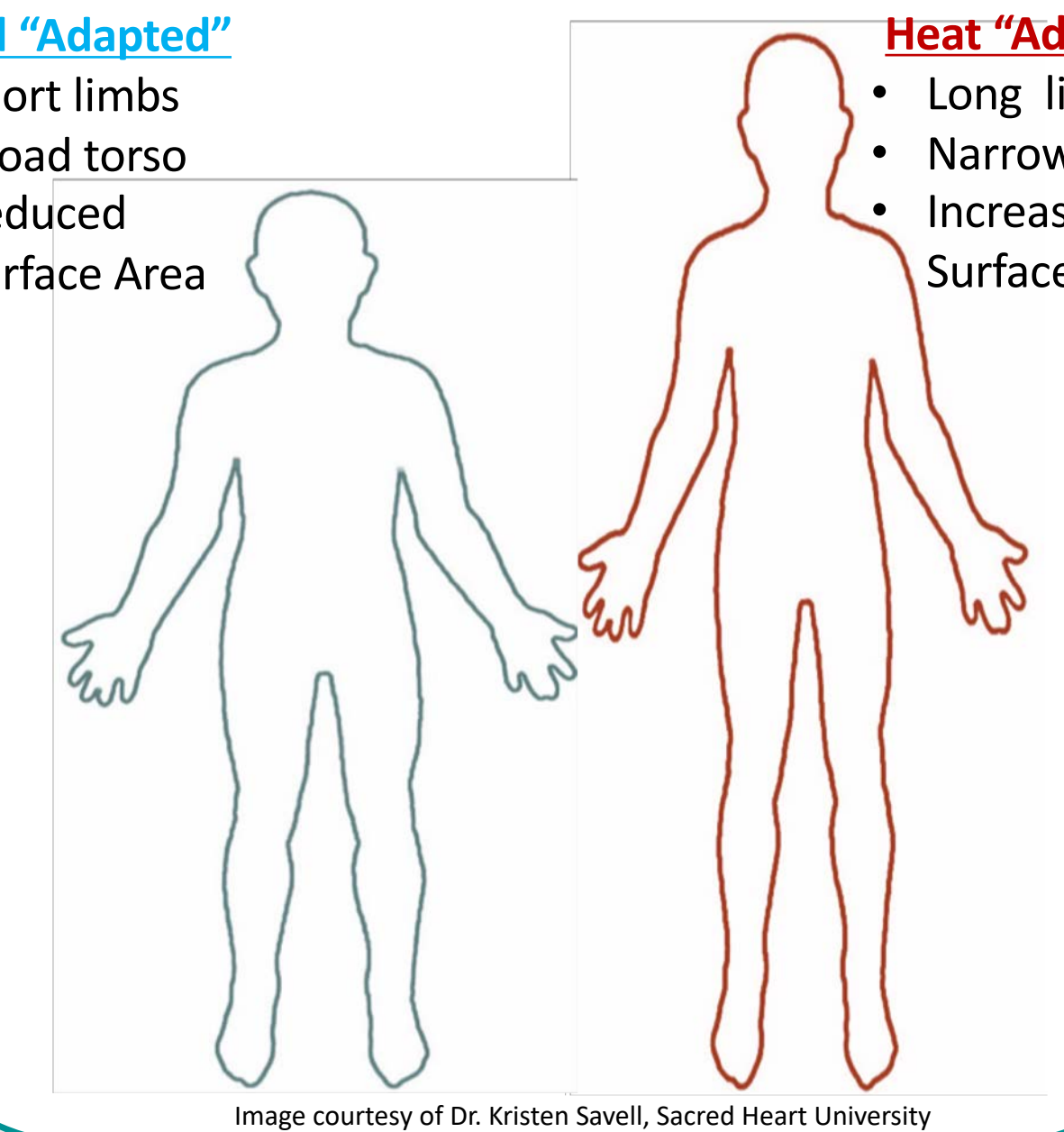
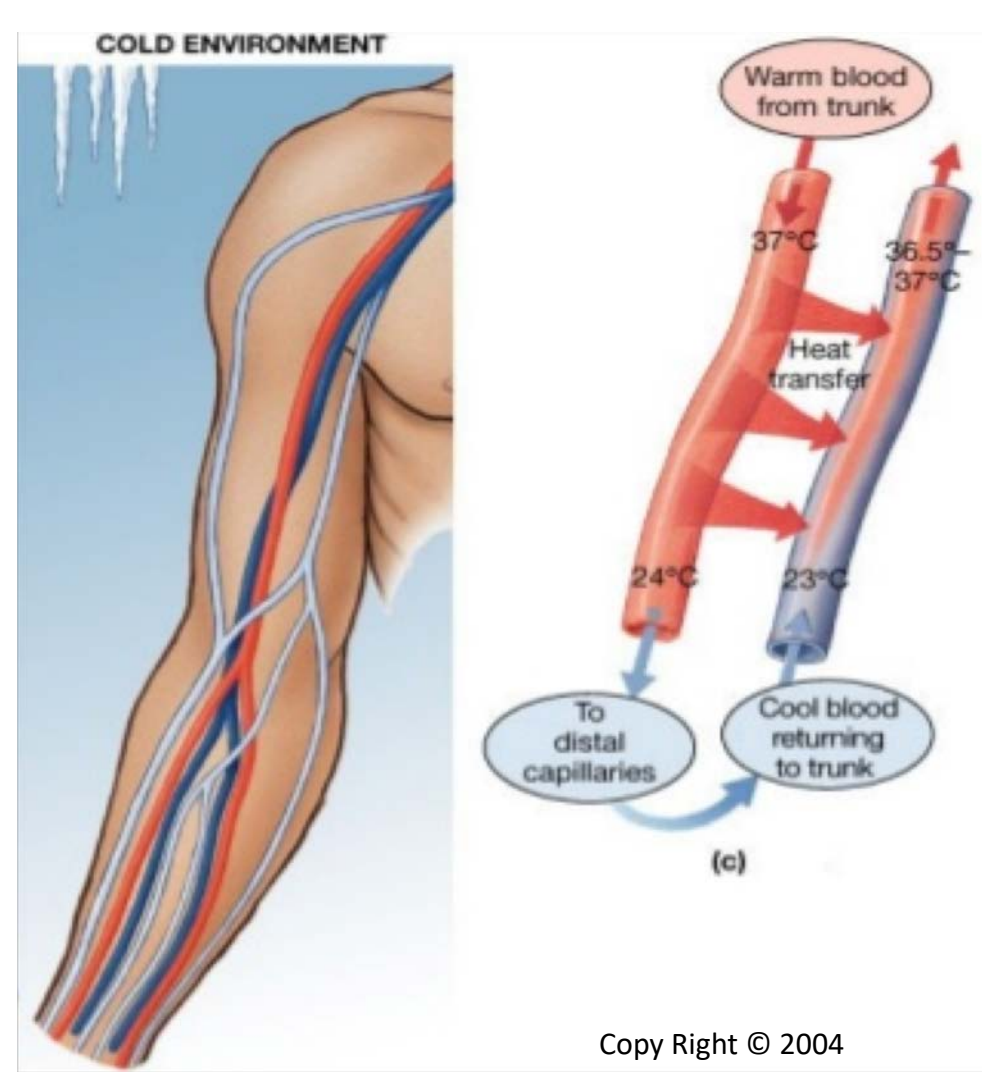


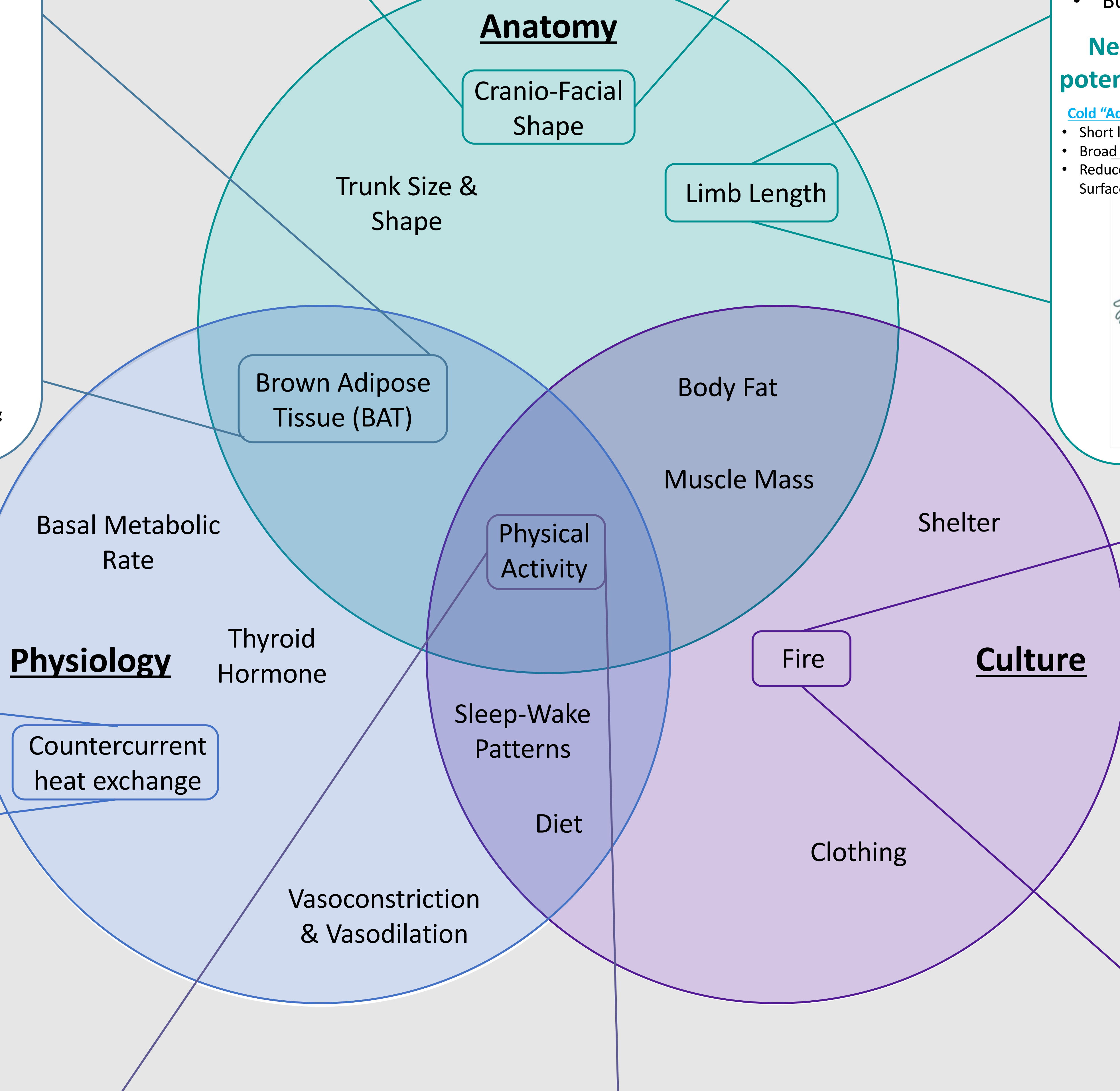
Image courtesy of Dr. Kristen Savell, Sacred Heart University

## Vascular Heat Saver

- In cold, blood is shunted to deep vessels = less heat loss
- Heat from deep vessels transfers to warm up the cold returning blood & maintain core body temperature



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## Did Neanderthals Create Fire?

- Evidence that Neanderthals had fire
- Equivocal evidence if Neanderthals were able to produce & control fire vs. use fire found in nature
- Experimental archaeologists are working on this

### Controlled fire = important external heat source

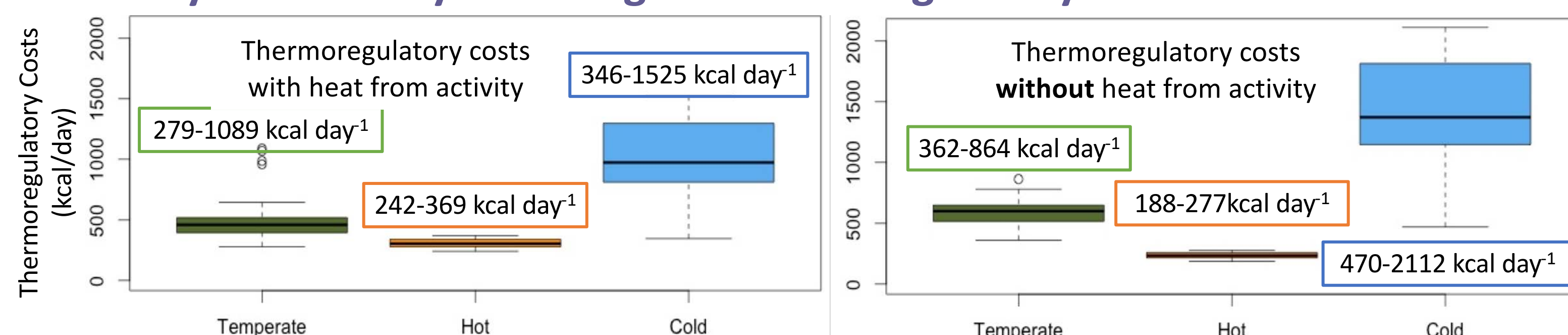


Nikola Solic Photography: <http://nikolasolic.com/>

## Human Ability to Maintain Body Temperature is Physiologically Limited - Physical Activity an Important Way to Stay Warm in Cold

- Laboratory studies demonstrate that physical activity helps maintain core body temperature in cold water submersion
- Energy expenditure & allocation assessed among National Outdoor Leadership School students taking part in highly rigorous physical activity in temperate, hot, & cold climates (Ocobock 2016).
- Physical activity decreased thermoregulatory costs in temperate & cold climates, but increased thermoregulatory costs in hot climates
- Suggests a critically important interaction between culturally driven physical activity and thermoregulatory demands in cold climates

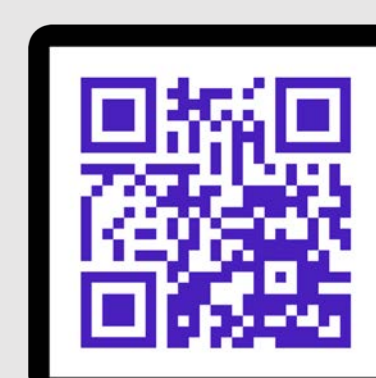
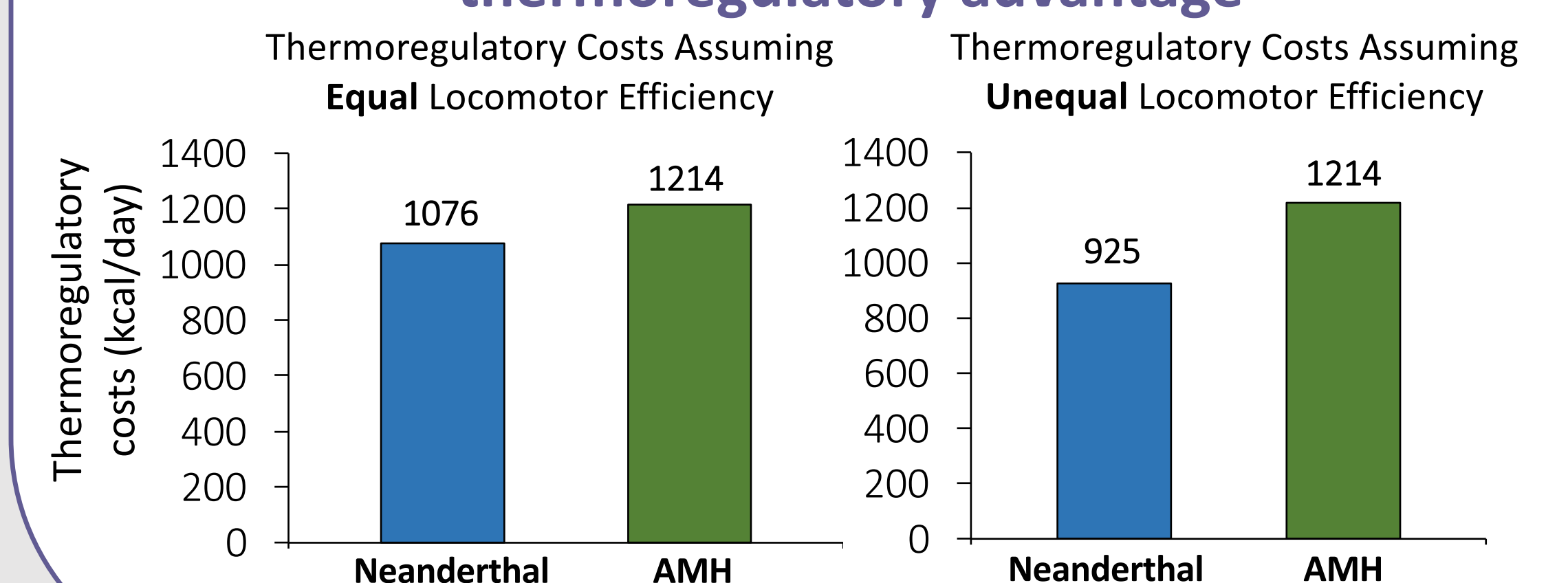
### Physical activity can mitigate thermoregulatory costs in cold climates



## Neanderthal Physically Active Lifestyle May Have Helped Keep Them Warm

- Suggested Neanderthals had inefficient locomotion compared to anatomically modern humans (AMH) due to shortened limbs (see limb length box above)
- This inefficient locomotion would have produced excess heat
- Estimate the thermoregulatory benefit of this inefficiency using the Allocation & Interaction Model (Ocobock 2016)

### Inefficient Neanderthal locomotion may have given thermoregulatory advantage



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