Cardiac Contractility & Oxygen Consumption in Work-related Heat Syncope

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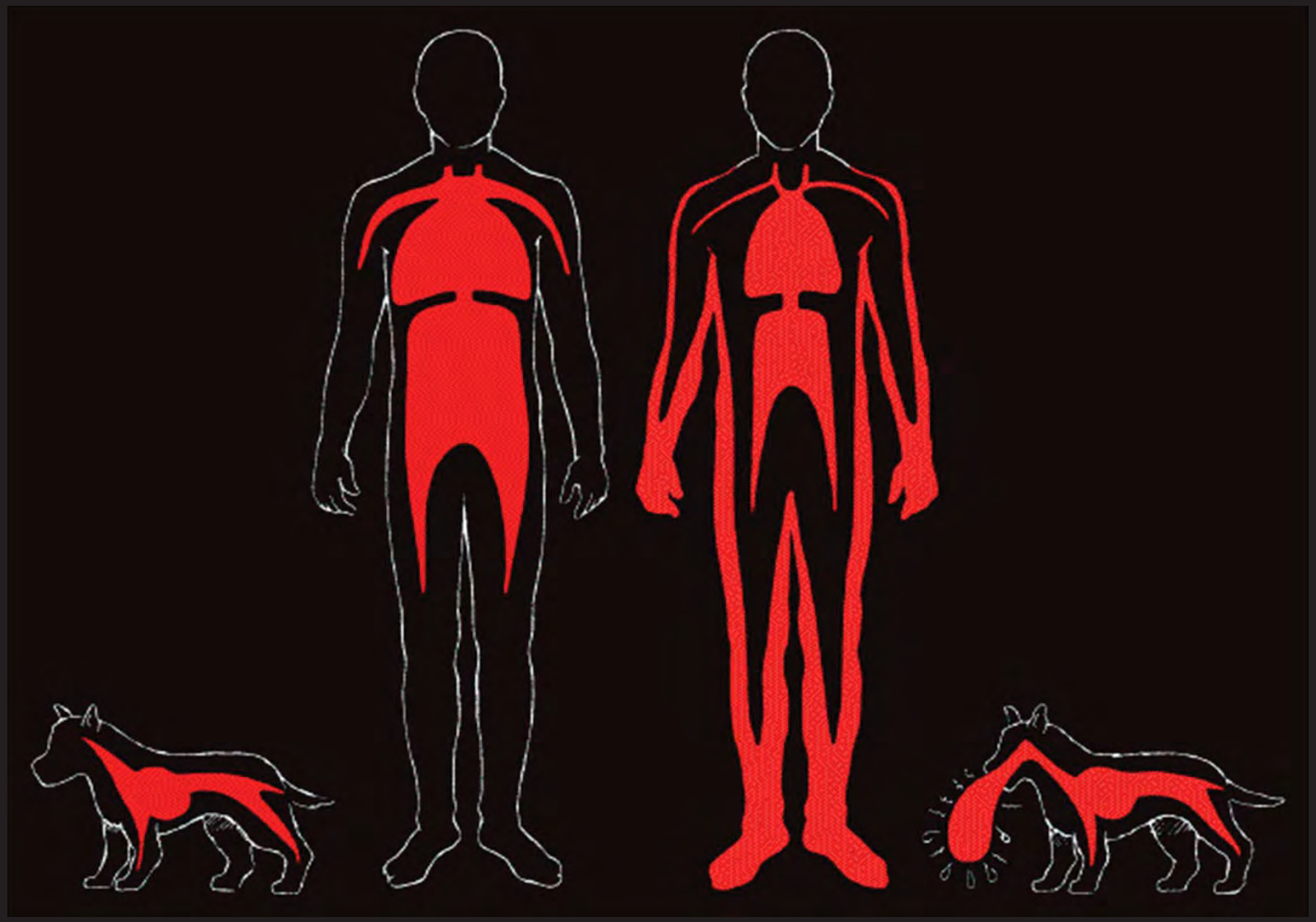
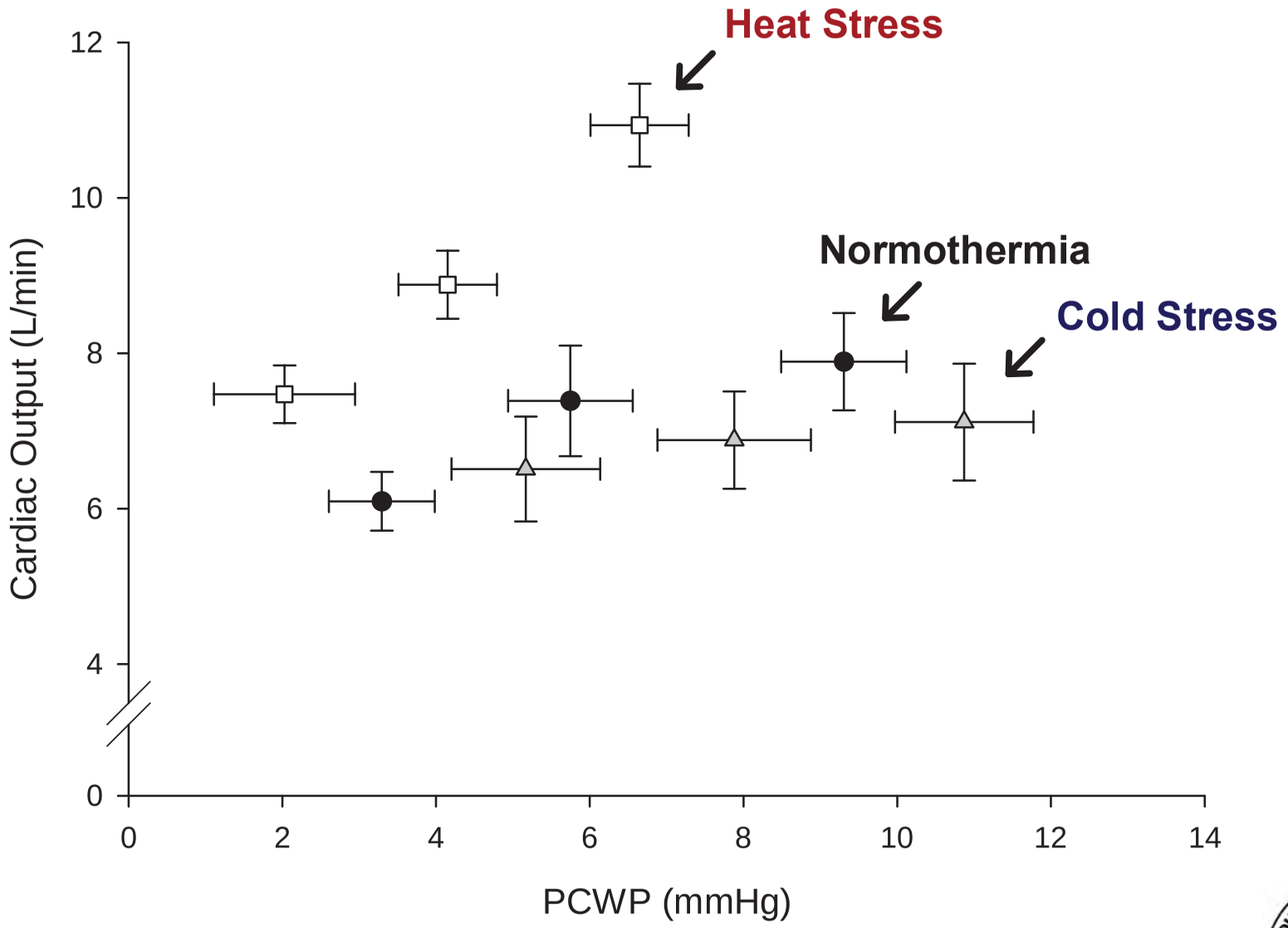


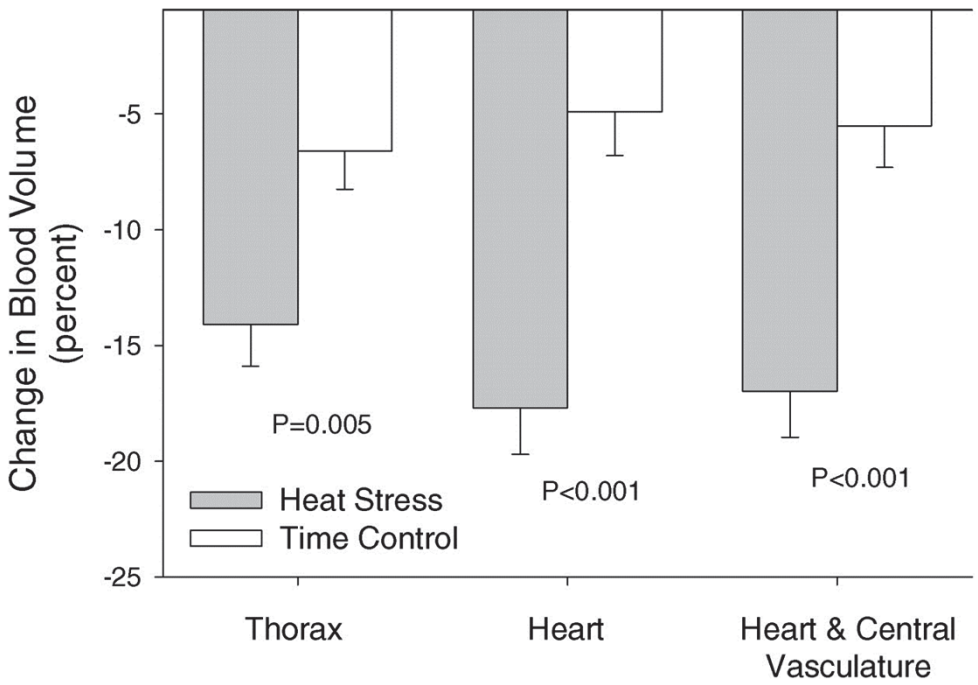
Cold Stress

Heat Stress

Rowell, LB, *Human circulation: Regulation during physical stress*, 1986

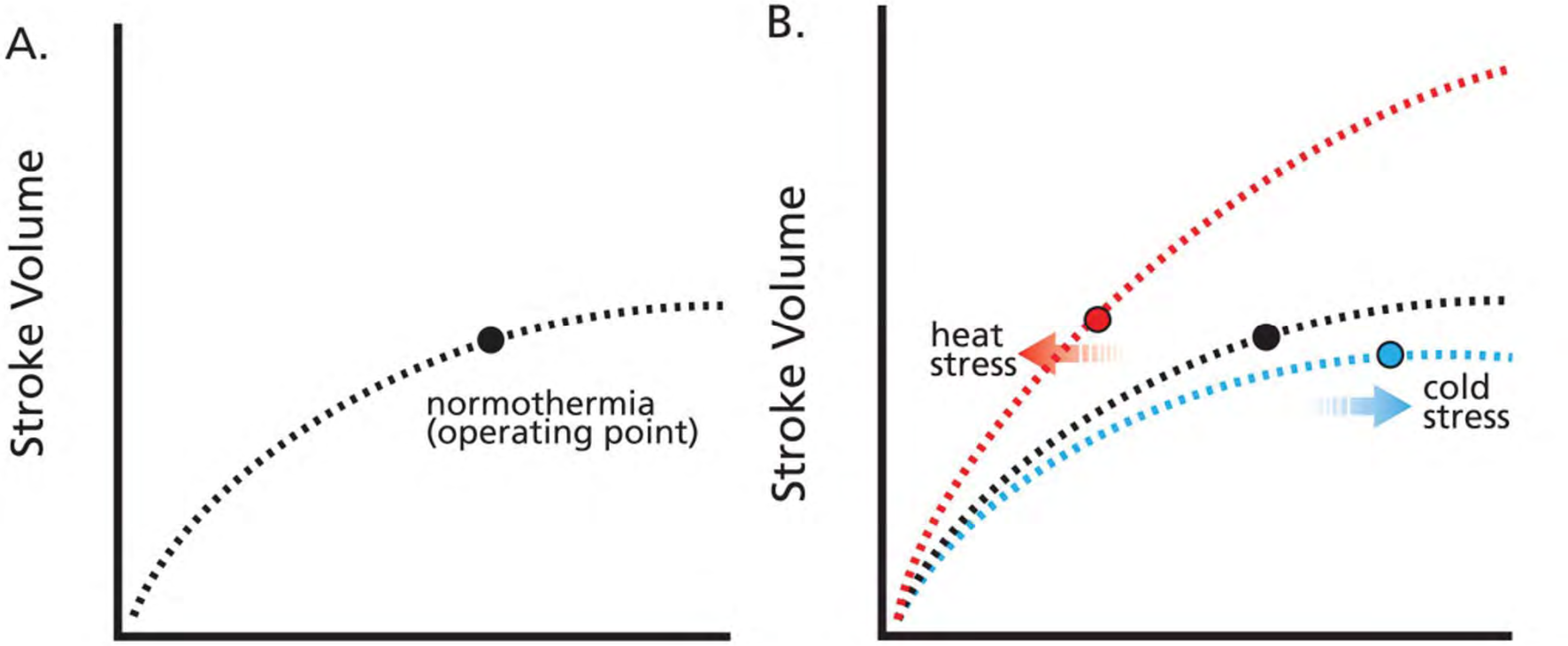


Wilson, TE, et al., *Journal of Physiology (London)*, 587: 3383-3392, 2009

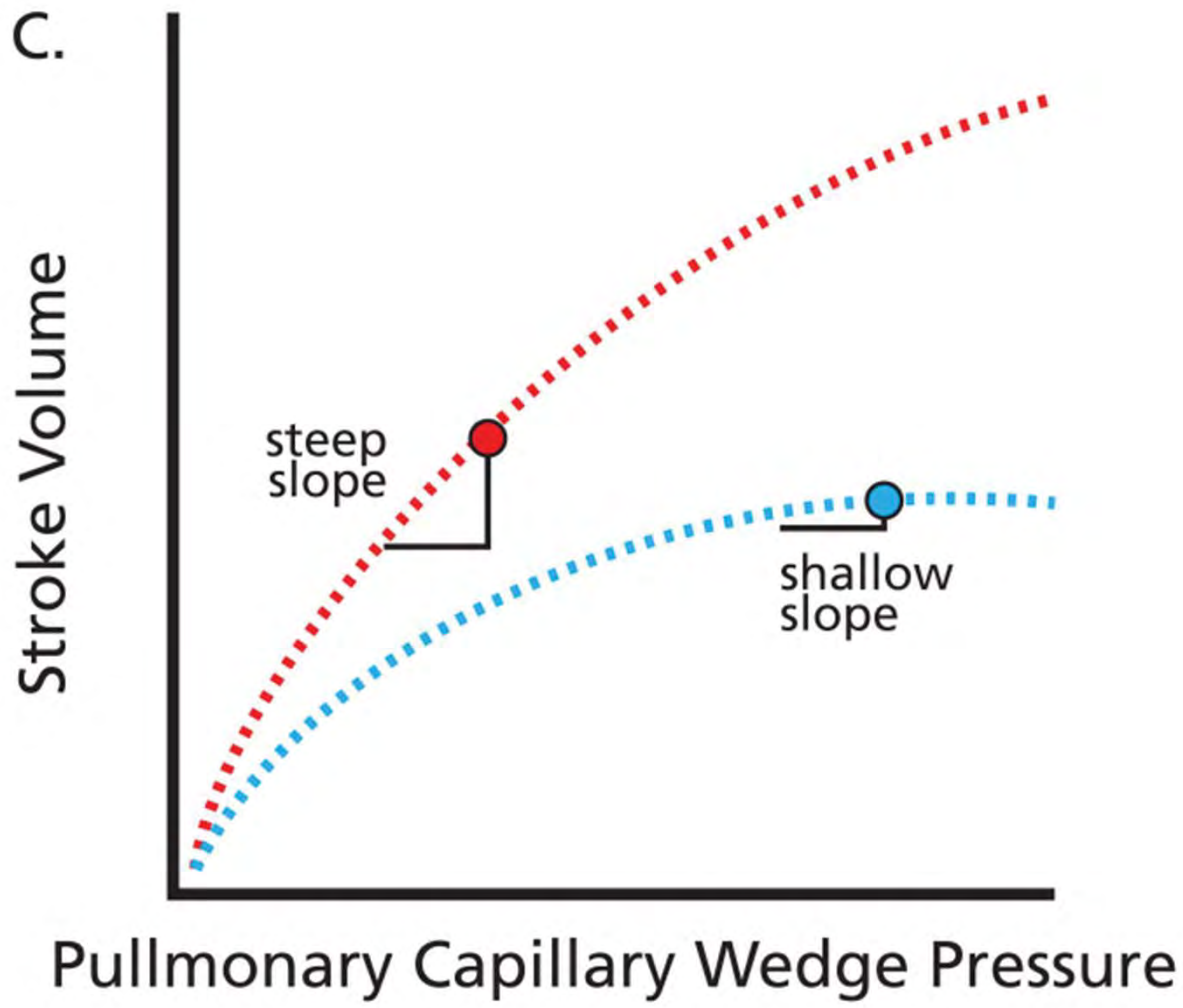


Blood volume changes are from selected regions of interest traced on Gamma counter scans following isotope labelling (Tc-99m) of autologue red blood cells

Crandall, CG, Wilson, TE, et al., *Journal of Physiology (London)*, 586: 293-301, 2008

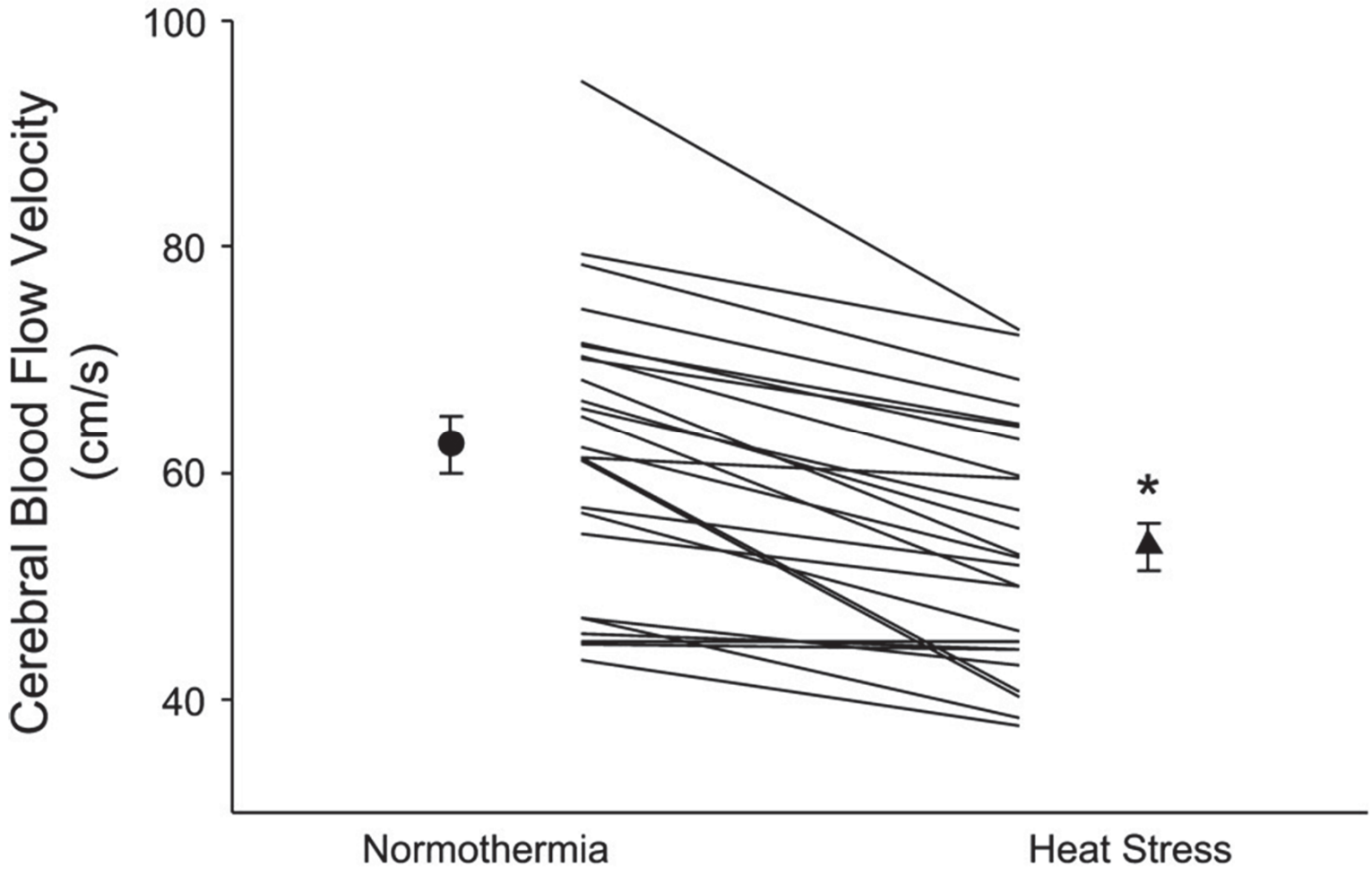


Wilson, TE & Crandall, CG, *ESSR*, 39(1): 12-17, 2011

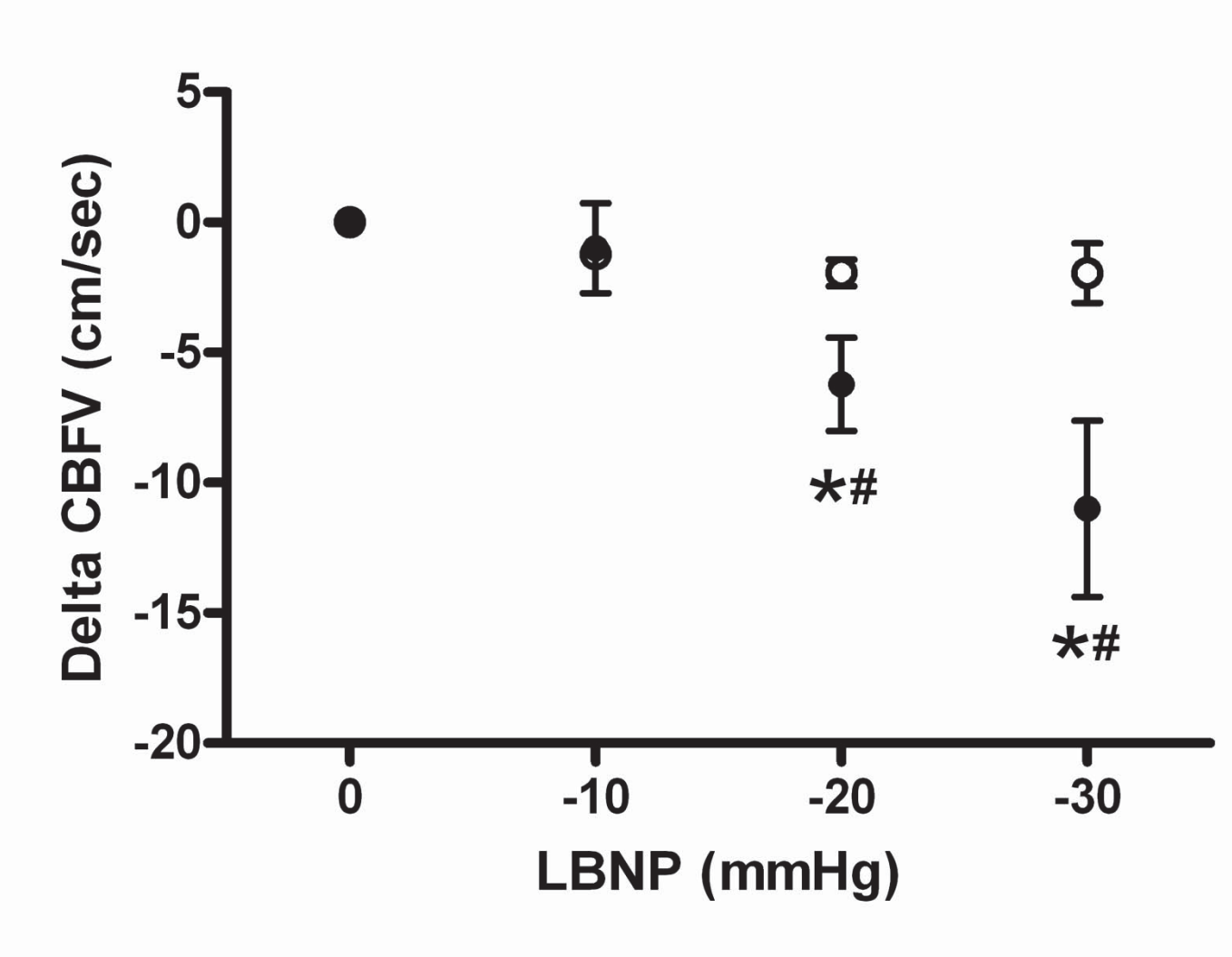


Wilson, TE & Crandall, CG, *ESSR*, 39(1): 12-17, 2011

Heat Stress & Orthostatic Tolerance

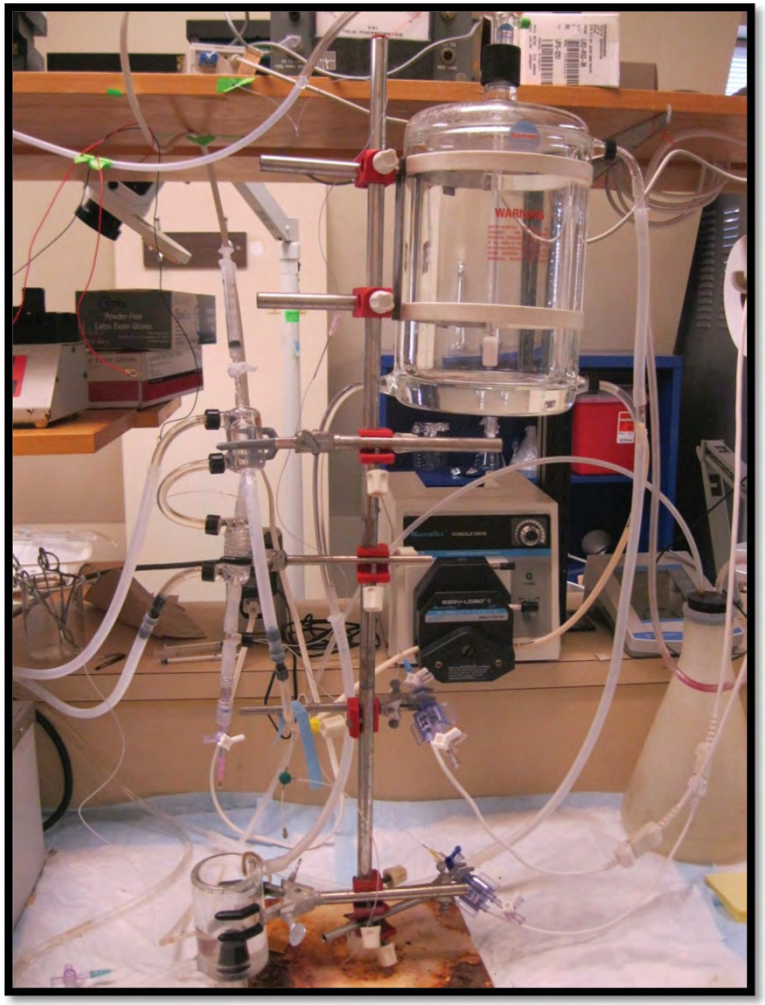


Wilson, TE, et al., *Am J Physiol Regul Integr Comp Physiol*. 291:R1443-1448, 2006



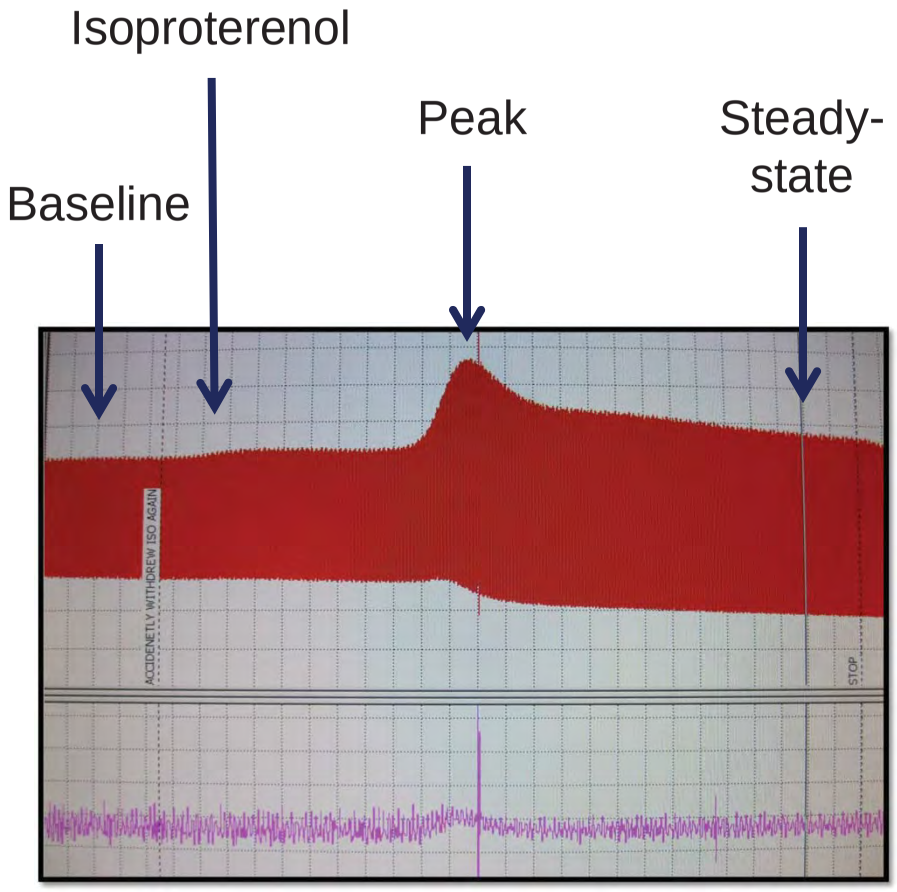
Wilson, TE, et al., *Am J Physiol Regul Integr Comp Physiol*. 291:R1443-1448, 2006

Isolated Heart Preparation

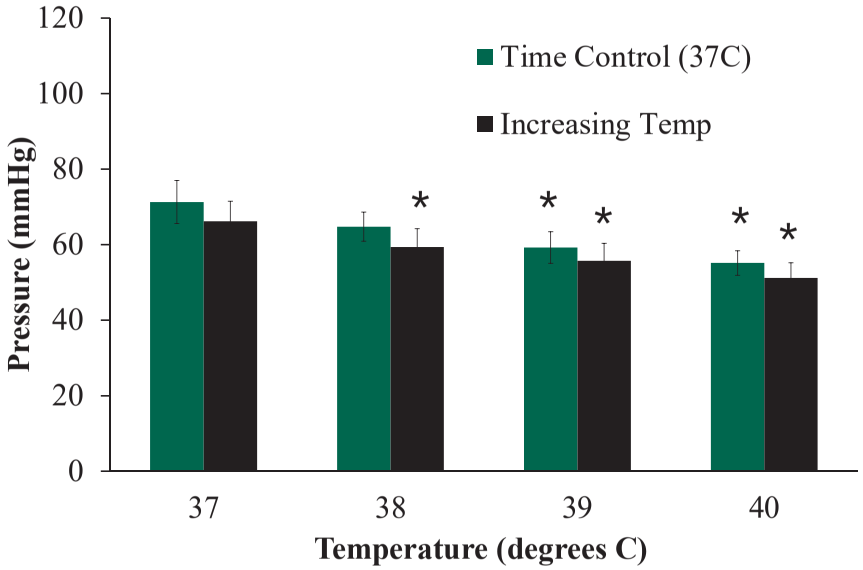


Methods

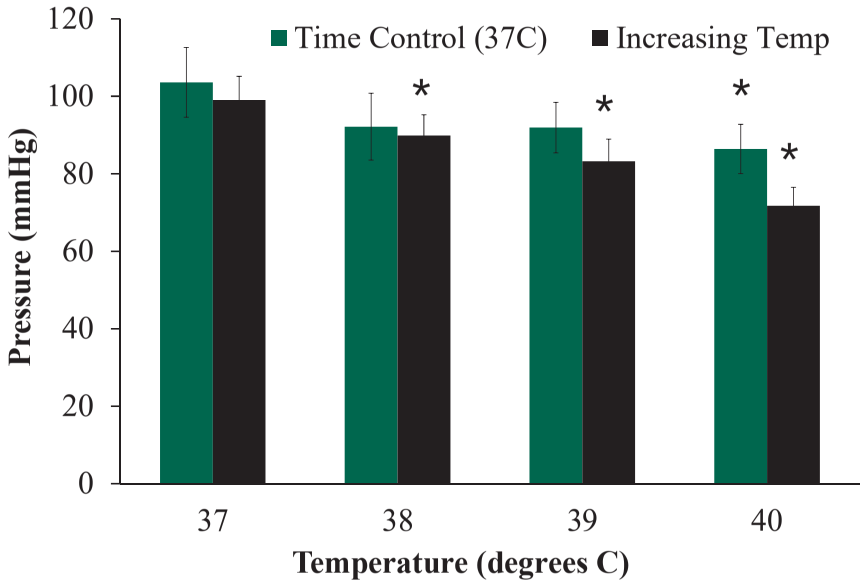
- 40 male Sprague-Dawley rats (275–325 g) were anesthetized and hearts were rapidly excised by thoracotomy.
- A balloon-tipped catheter was inserted into left ventricle and paced at 420 bpm.
- Pre-post Frank-Starling curves
- <u>Protocol #1 (Temperature Group):</u> A steady-state infusion of the β-adrenergic agonist, isoproterenol (10^{-8} M) for 90 sec at 37, 38 39 and 40º C.
- <u>Protocol #2 (Control Group)</u>: Procedure was exactly the same except that the temperature was held at a constant 37º C.



Baseline LVDP



Steady-state LVDP



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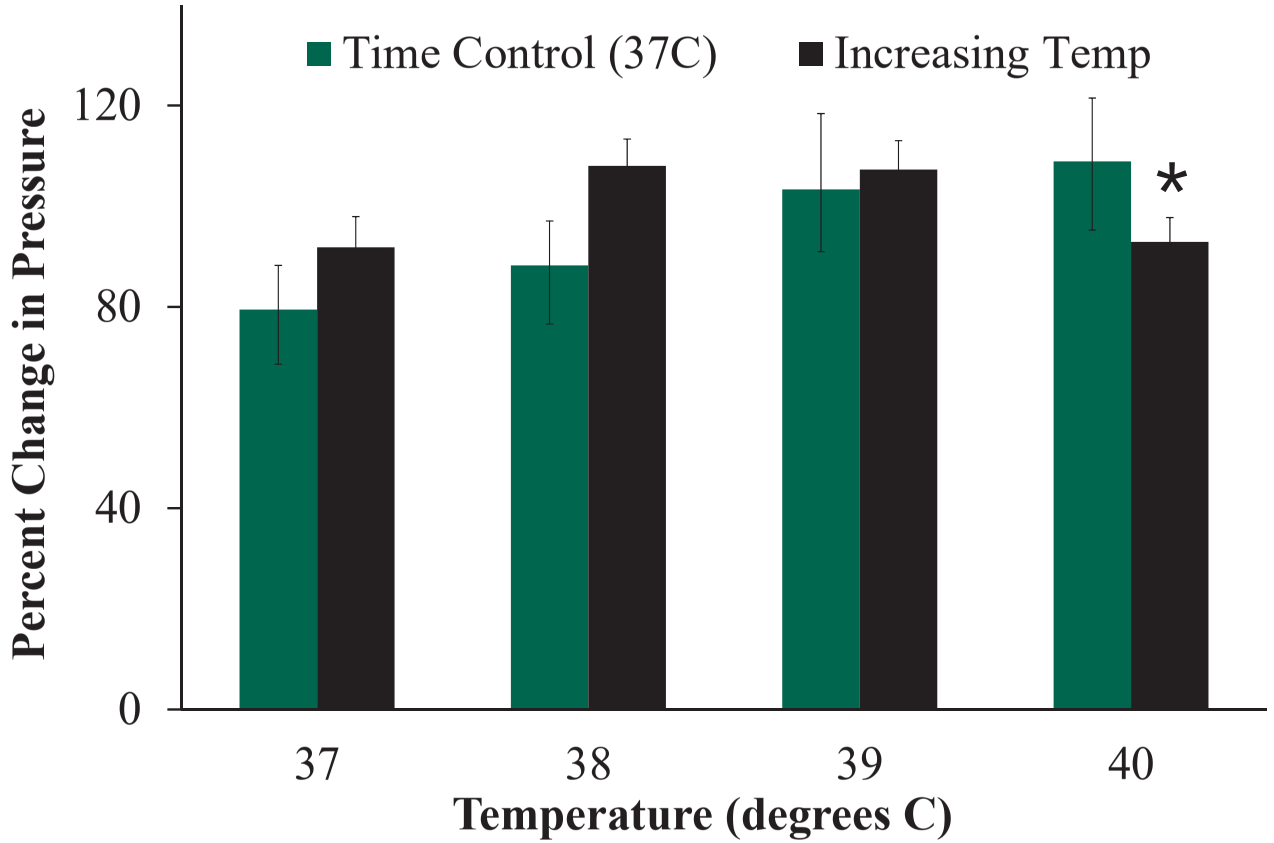
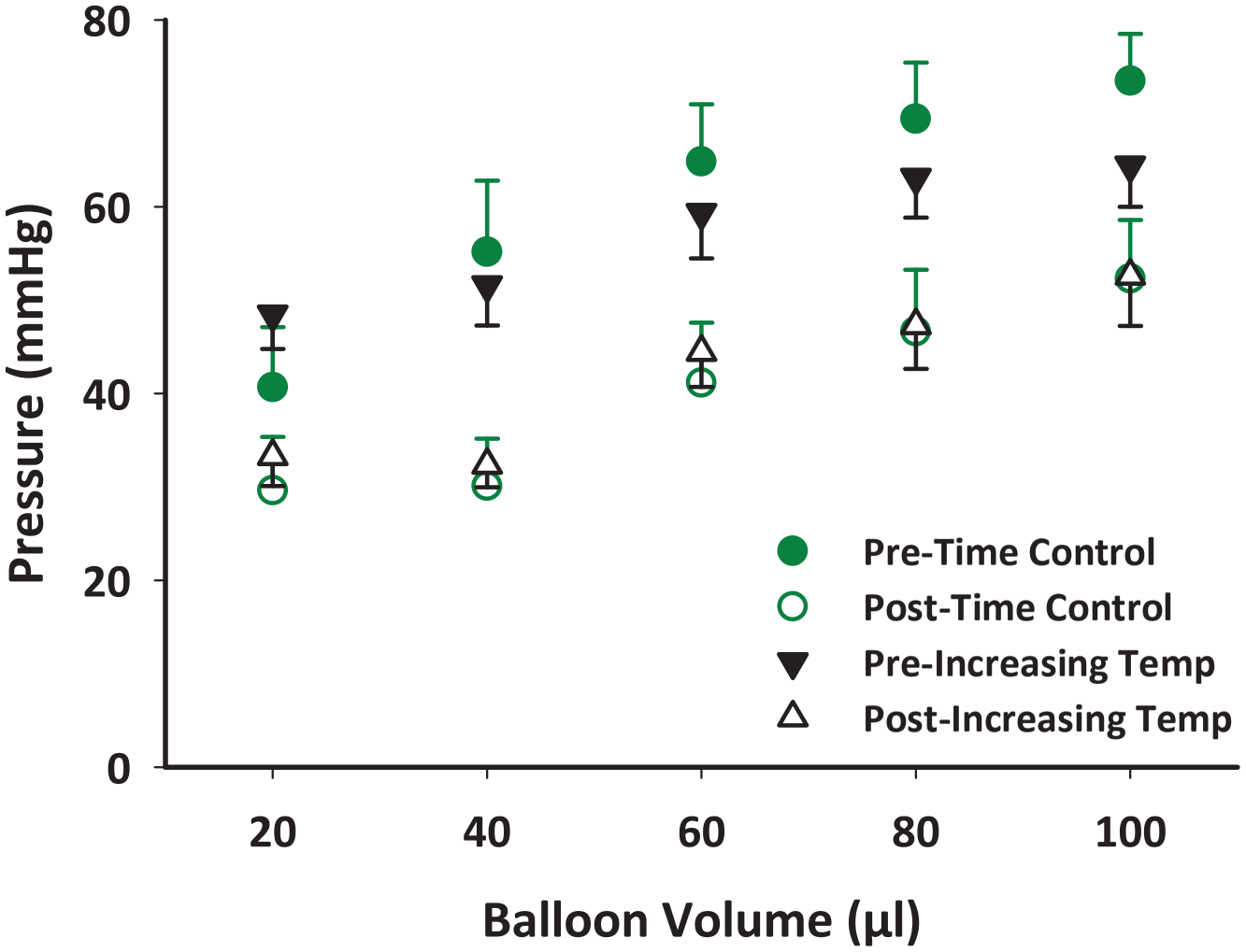
Percent Increase LVDP



Frank-Starling Relations



Conclusions

- The isoproterenol-induced % increase in LVDP was preserved until 40°C, indicating that hearts were unable to generate the same force at this temperature compared to cooler temperatures or to time controls.

- Temperature did not alter Frank-Starling relations compared to time matched controls.

- These data indicate that extreme temperatures alter adrenergically mediated force production of the heart, which could lead to compromised stroke volume in certain conditions.

- Moreover, factors other than just temperature must be altering previous *in vivo* observations of systolic function increases and cerebral blood flow decreases in mild heat stress.

Acknowledgements

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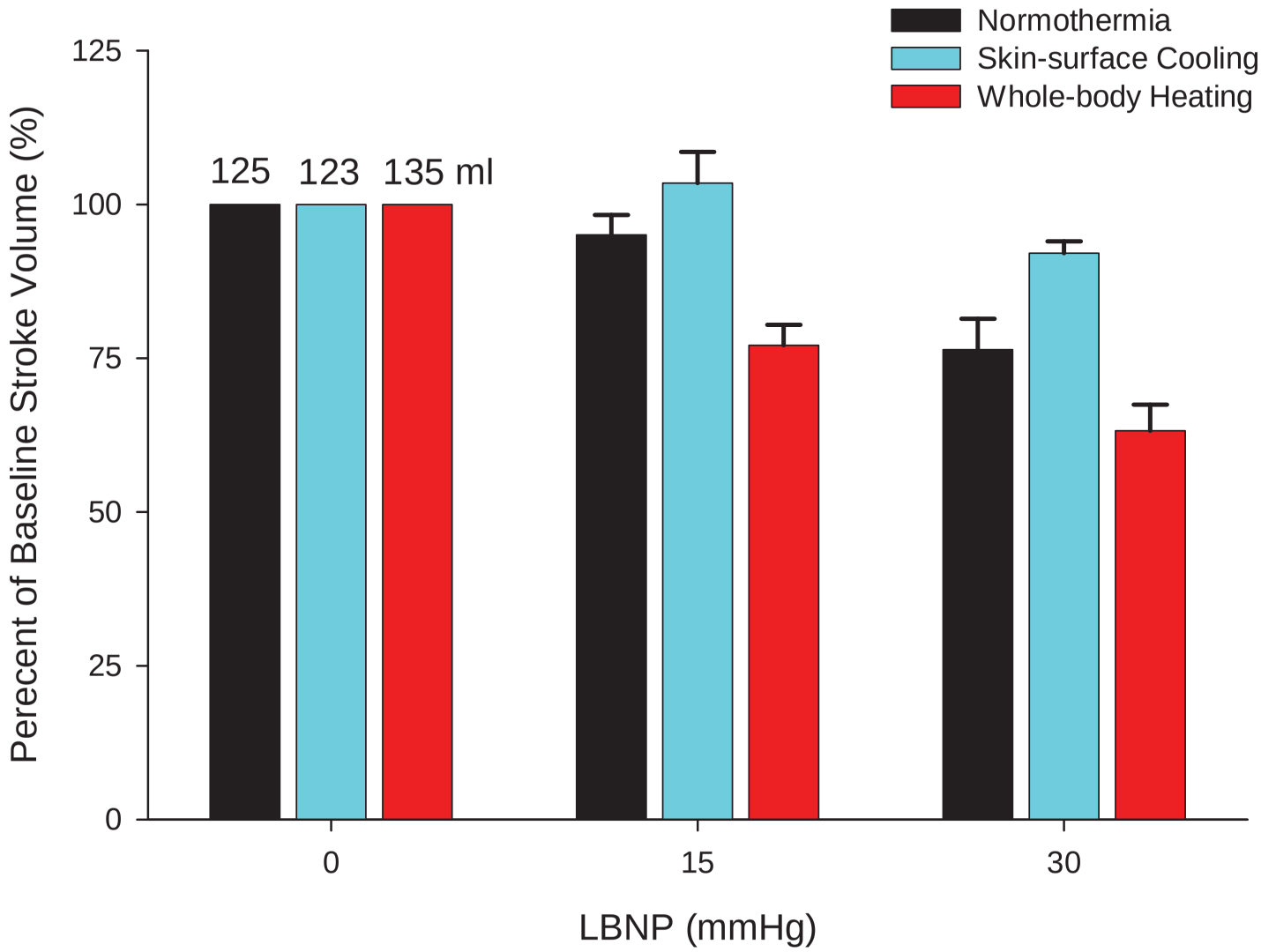
  - Andrew LePorte, year-one medical student (OMNI)
  - Sarah Hirsh, undergraduate student (SURF program)

Countermeasure Development



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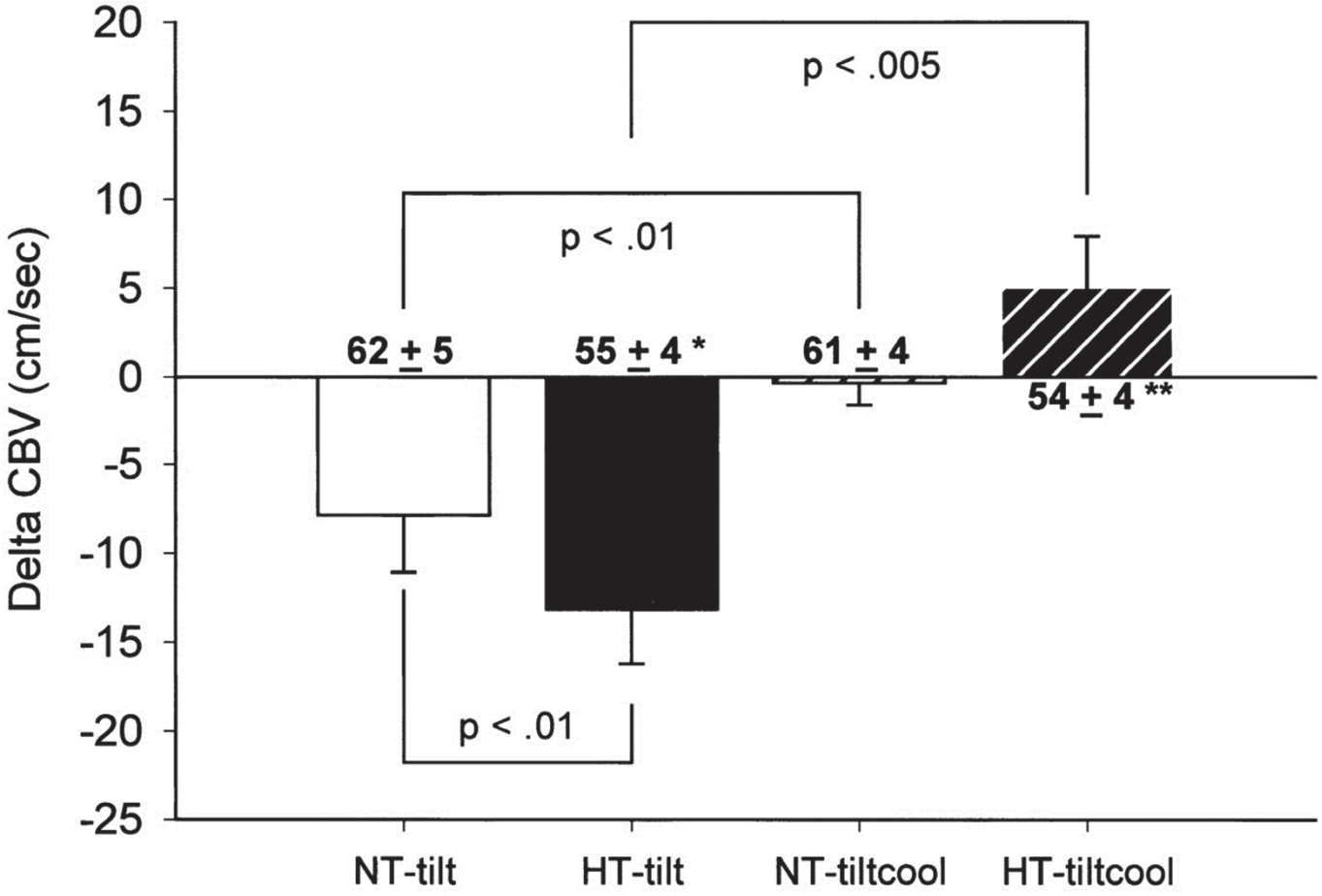

Wilson, TE, et al., *J Appl Physiol* 93: 85-91, 2002

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