AUCKLAND BIOENGINEERING INSTITUTE
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# Interventricular comparison of force-frequency and heat-frequency relationships at 37˚C in isolated rat ventricular trabeculae

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## Introduction

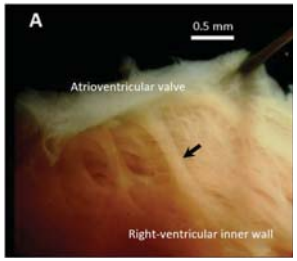
*In vivo,* the left ventricle (LV) develops five-fold higher pressure than that of the right ventricle (RV), consistent with the thicker LV wall. Does greater pressure in the LV reflect greater stress, and hence greater heat density, by the myocardium?

### Definitions

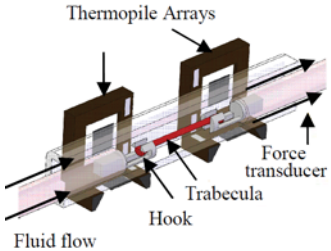
Stress = force per cross-sectional area
Heat per twitch = heat rate divided by stimulus frequency
Heat density = heat per twitch per muscle volume

## Methods

We used our flow-though microcalorimeter to investigate the mechanics and energetics of isolated trabeculae.

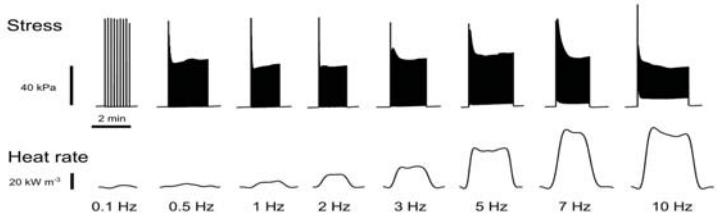



Trabeculae *in vivo*

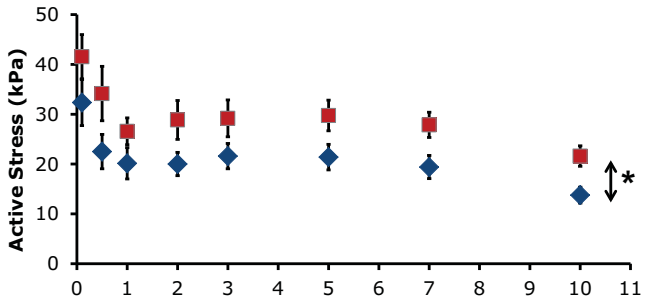


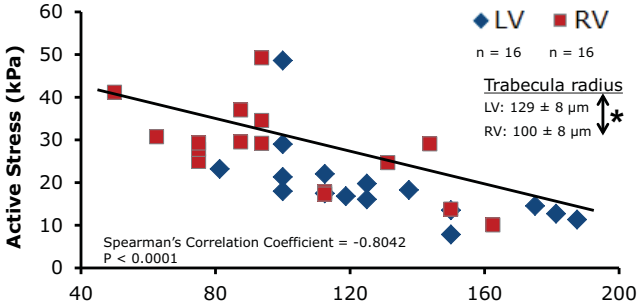

Our calorimeter system [1,2]

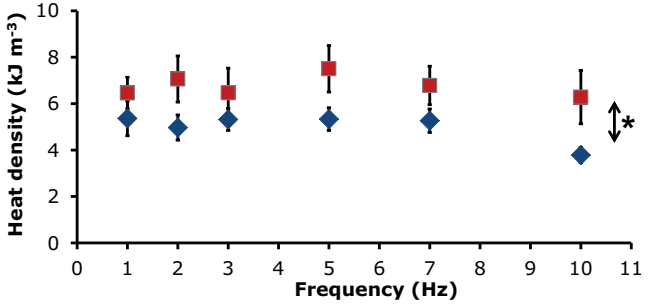
N = 16 rat trabeculae from each ventricle were studied with the order of presentation of stimulus frequencies dictated by two sets of 8x8 Latin Squares, separated by 2 min periods of quiescence, thereby allowing assessment of "rested-state contractions" and the effect of time.

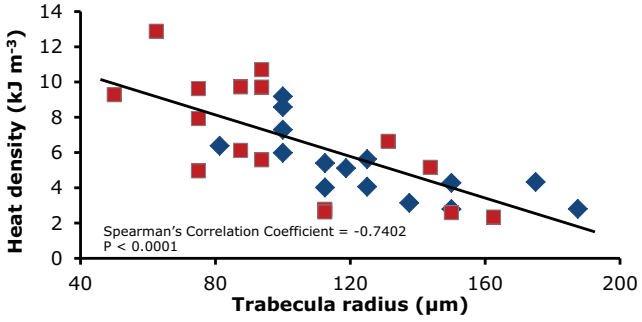



## Results




## Conclusions

Stress and heat density were significantly higher in RV trabeculae than in LV trabeculae. However, after correcting for the negative stress-radius relation, there is no significant difference in either radius-dependent stress or radius-dependent heat density between LV and RV trabeculae.

We recommend that future investigators take into account the negative stress-radius relation when reporting stress arising from two groups of muscles of unequal radii.

## Acknowledgements

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## References

1. Taberner, A.J., Han, J.C., Loiselle, D.S., & Nielsen, P.M.F., An innovative work-loop calorimeter for in vitro measurement of the mechanics and energetics of working cardiac trabeculae. J Appl Physiol, 2011. **111**: p. 1798-1803
2. Loiselle, D.S., Han, J.C., Mellor, K.M., Pham, T., Tran, K., Goo, S., Taberner, A.J., & Hickey, A.J.R., Assessing the Efficiency of the Diabetic Heart at Subcellular, Tissue and Organ Level. J Gen Pract, 2014. **02**(04)