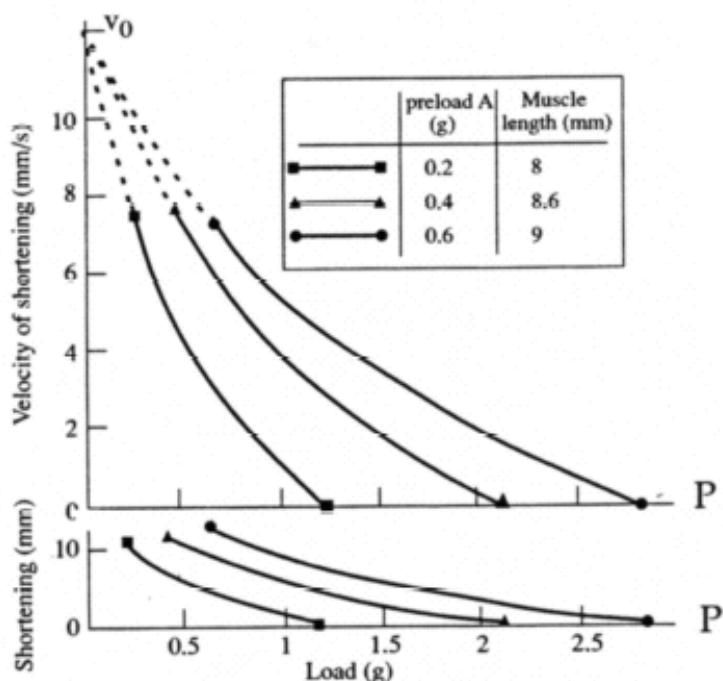


Series 7 (1 April 2025)

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**Chapter 12 : Cardiac Muscle Mechanics****Exercise 12.1**

Using the experimental results of the cardiac muscle contraction given below, determine the work and power provided during the muscle contraction as a function of pre-load. Draw the curves for work and power and discuss the shape and amplitude obtained for different pre-loads.

**Chapter 13 : Pressure-Volume Loop****Exercise 13.1**

Consider the left ventricle of a normal human heart. In the end of the diastole, the filling pressure is 5 mmHg and the internal volume is 200 ml. In the end of the systole, the pressure is 100 mmHg and the internal volume is 100 ml. The dead volume (ventricular pressure 0 mmHg) is 30 ml. Calculate and depict graphically:

- The elastance in the end of the diastole ( $E_{min}$ ) and in the end of the systole ( $E_{max}$ ).
- The ejection fraction.
- The maximum pressure for an isovolumic contraction without ejection of blood.
- The gain (in %) of stroke volume for a 50% increase in filling pressure and unchanged systolic pressure in the end of the ejection. Based on the result, discuss the mechanism of Frank-Starling.