

## 2.785 Homework # 4

**Thermodynamics of deformation of connective tissues.** Write a thermodynamic equation of state for a rectangular strip of connective tissue which is subjected to uniaxial tension. The strip, volume  $V$ , is stretched by an amount  $dL$  due to an equilibrium force  $f$  under conditions of constant temperature  $T$  and pressure  $P$  and undergoes a change in internal energy,  $dE$ .

You are asked whether or not you can use this equation as an analytical tool which may be used to test or describe mathematically each of the following phenomena or answer the following questions. Whether yes or no, please explain briefly.

- a. The thermodynamic definitions of an energy spring and an entropy spring.
- b. The observation that, during wound healing or during parturition, certain connective tissues associated with these phenomena undergo a more rapid stress relaxation (at constant strain) than under day-to-day conditions.
- c. Certain tissues do not show a volume change when stretched or compressed (incompressible bodies).
- d. When other relevant parameters remain constant, the stiffness of connective tissues increases as collagen fibers become increasingly oriented along the direction of principal stress.

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