Physiologic Adaptations to Reduced CO

• Cardiac dilation
  — Results from
    • reduced contractile force: lowers amount of blood ejected during systole, causing end-systolic volume to rise
    • Increased venous pressure: increases diastolic filling, which causes heart to expand
  — As heart fails, its volume expands & contractile force increases causing an increase in stroke volume

• Heart tries to adapt
  - some changes work for a little bit, but some other changes make the heart worse (even the good changes only work for a period of time)
  - heart gets larger (find definition for this)
  - causes more force, cardiac output increases for a period of time
  - heart starts to fail ¬ volume expands

• Frank-Starling law of the heart (look up)
  - if heart cannot keep up with the force of blood in the ventricles, there is an increase in diastolic volume (starts to accumulate)
  - when heart stops pumping, the blood accumulates over time
  - ejection fraction goes down

• Increased sympathetic tone
  • Increase HR: If HR increases too much, there will be insufficient time for ventricles to fill & CO falls
  • Increase contractility: Increases oxygen demands of heart
  • Increase venous tone: If venous pressure too high, blood backs up from failing ventricles & leads to pulmonary & peripheral edema; can also further dilate heart
  • Increase arteriolar tone: Heart must pump against greater resistance & in HF the heart may not be able to pump any harder so CO falls

• Not only does the heart get bigger to work more effectively, but the heart rate increases
  - If heart rate increases too much, the ventricles do not have time to contract and the chamber fills
  - heart muscle contractions increase in order to keep up with the decreased perfusion of tissues (oxygenated blood is supposed to go to the tissues)
  - also increased venous tone and arterial tone