Key questions defining research program:
1) Studying the microvascular mechanisms of microbubble facilitated sonothrombolysis. This involves the application of ultrasound to acoustically active bubbles which resonate in the vicinity of blood clot to cause mechanical disruption and clot lysis. The bubbles can be targeted to clot and loaded with drugs to facilitate clot lysis. I am using a high speed (25 million frames per second) microscopic camera to study microbubble-clot surface interactions. These studies involved both in vitro and in vivo models.

2) Studying microembolization and no reflow, which occurs during coronary stenting. This process involves the iatrogenic release of atherosclerotic debris from the vessel wall downstream into the microcirculation. We will investigate endothelial function, flow reserve, and functional capillary density.

3) Studying the microvascular mechanisms of microvascular obstruction. This involves microvessel pressure measurement with the servonull technique, velocimetry to detect RBC velocity and flow, cell free layer (on the luminal side of blood vessels and that part of the vessel where there are no red blood cells, only plasma) assessment to determine red blood cell distribution and plasma skimming, and white blood cell endothelial cell interactions.

4) Using venous compliance to estimate filling pressures. We are using ultrasound to assess the compliance of the internal jugular vein as a tool to noninvasively rule out elevated right heart filling pressures.

5) Studying angioplasty balloon pressure-volume relation before, during, and after vessel wall contact.

Key words describing research program:
1) Microcirculation
2) Microvascular obstruction
3) Ultrasound
4) Microbubbles
5) Venous compliance

Titles for shovel-ready research projects:
1) Optimization of sonoreperfusion for microvascular obstruction
2) Use of bedside ultrasound to guide volume management in acute CHF
3) Balloon deployment pressure feedback for optimizing stent-vessel apposition

Data sources for shovel-ready research projects:
2) Am Heart J 2010;159:421-7
3) EuroIntervention: 2005;2:244-251