Top Things to Know
Assessing Cardiac Metabolism

1. The heart pumps 7200 liters of blood per day and accounts for close to 10% of the body's total fuel consumption, yet there are significant gaps in basic knowledge of the heart's metabolic regulation. Increased awareness of the relationship between cardiac metabolism and cardiovascular health is evidenced by emerging interest in the components of cardioprotective diets.

2. The heart is a metabolic omnivore and can degrade numerous metabolic substrates to produce ATP depending on their availability, the physiologic environment, functional demands for pumping, cellular biologic processes and overall body fuel homeostasis.

3. Research methods for studying cardiac metabolism are rapidly evolving, with many only documented in original papers. The statement provides a curated resource of the basic science models and validated tools and techniques used to assess known and emerging aspects of cardiac metabolic research.

4. Key biological concepts include:
   - The heart has the capacity to adapt to altered physiologic or metabolic environments and select the most efficient substrate for ATP production.
   - Intermediary metabolites are active participants in cell signaling via protein acetylation.
   - Metabolic processes are intimately orchestrated by circadian regulation.
   - Metabolites are intermediates in the building and breaking down of cell structure.
   - Mitochondria are emerging as significant sources of signaling molecules in addition to producers of ATP.
   - Subtle changes in metabolic fluxes can rapidly impact protein function, localization and stability via reversible post-translational modifications.
   - Cytokines and the immune system are emerging as regulators of cardiac metabolism.
   - Evidence is accumulating for specific sequential interactions between glycolytic enzymes and structural and glycolytic elements of the cell.
   - The heart appears to play a pivotal role in whole body fuel homeostasis.

5. Specific research topics covered include:
   - Metabolic pathways and networks.
   - Systems biology and mathematical modeling of cardiac metabolism.
   - Measuring metabolite concentrations and fluxes.
   - Considerations for animal, tissue and cell models including species, age, sex, and circadian influences.
   - Radionuclide tracers and methods.
   - Turnover of intracellular macromolecules such as proteins, glycogen and triacylglycerols.
   - Proteomics and post-translational modifications.
   - Metabolomics and identification of a wide array of molecules involved in metabolism that may be associated with a genetic, pharmaceutical or pathophysiologic stimulus.
   - Genetic and non-genetic models for cardiac metabolic manipulation including dietary strategies.
   - Metabolic considerations in the newborn heart, and in ischemia and reperfusion.
   - Approaches to studying metabolism and cardiovascular disease.

6. The availability of diverse analytic tools necessitates a clear strategy to effectively study a system as complex as cardiac metabolism. Qualitative and quantitative assessment of multiple concurrent biological processes is expected to facilitate the discovery of novel regulatory mechanisms.

7. This scientific statement provides a comprehensive technical resource for the metabolic researcher in the exploration of cardiac metabolism and its relationship to overall function and health. Advances in cardiac metabolic knowledge can lead to improved treatment for patients with cardiovascular or metabolic disorders such as obesity or diabetes.