

JOINT EVENT ON

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Right heart failure: Consequences for the mechanical efficiency of left-and right-ventricular trabeculae from pulmonary hypertensive rats**Toan Pham, Andrew Taberner, Denis Loiselle and June-Chiew Han**
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An increase in pulmonary arterial pressure increases the load on the right ventricle (RV). With time, progressive pulmonary arterial hypertension (PAH) results in RV hypertrophy, leading ultimately to right-heart failure. In contrast, PAH reduces the passive filling pressure in the left ventricle (LV). This reduces the LV workload, thereby resulting in LV atrophy. Does the structural deformation of the ventricles in right-heart failure affect their mechanoenergetic performance? To address this question, we used the PAH rat induced by a single injection of monocrotaline (MCT) (60 mg/kg) as our experimental model of right-heart failure. Six weeks after MCT injection, the hearts showed signs of right hypertrophy (indexed by increased free wall thickness) and left atrophy. Trabeculae tissue isolated from both ventricles of 'Control' and 'PAH' rats were mounted in our work-loop calorimeter, and subjected to stress-length work-loops over a wide range of afterloads while contracting at 5 Hz at 37 °C – a protocol designed to mimic the pressure-volume work of the heart. By simultaneously measuring heat production, mechanical efficiency was calculated as the ratio of work output to change of enthalpy (the sum of work and heat). The trabeculae were then required to undergo a preshortening protocol in which isometric force and heat output were measured as functions of muscle length. In right-heart failure secondary to pulmonary hypertension, RV trabeculae show a decrease in myocardial mechanical efficiency correlated with their lower stress-length work performance. The higher activation heat (ordinate of the heat-stress relationship) observed in RV trabeculae from the PAH group reflects an increased energy cost of Ca²⁺ cycling during contraction. In contrast, LV trabeculae from PAH group sustain normal energy efficiency over a wide range of afterloads.

Biography

Toan Pham is doing research, which focused on the energetics and mechanisms of the progression from hypertrophy to heart failure. He is using different techniques of measuring cardiac efficiency: Microcalorimetry on trabeculae and Respirometry on mitochondrial functions.

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