





Pediatric cardiac surgery

Clinical problem: single ventricle heart disease (e.g. HLHS)

- 1.4% congenital heart diseases
- high mortality rate (25%)
- HLHS is the most common
- underdeveloped LV and Aorta (or aortic atresia)
- as the heart systemic perfusion is provided by the PA through the ductus arteriosus (DA)
- PA is clamped and DA closes after birth cause a volume shift from systemic to pulmonary circulation, which further impairs systemic perfusion

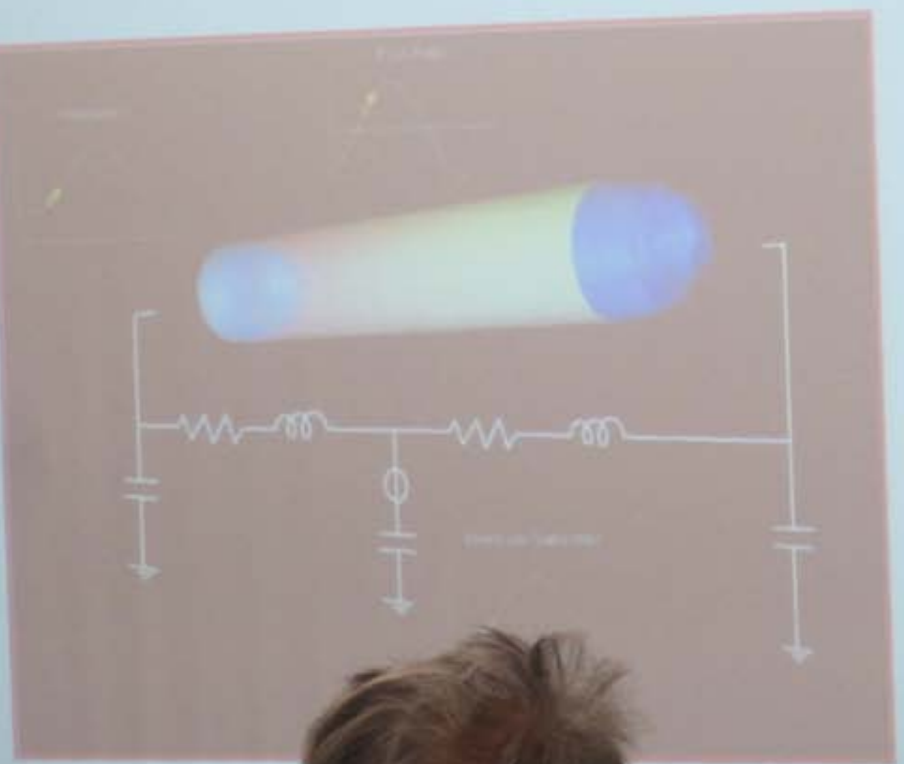
Hypoplastic left heart syndrome



(From: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2700000/>)

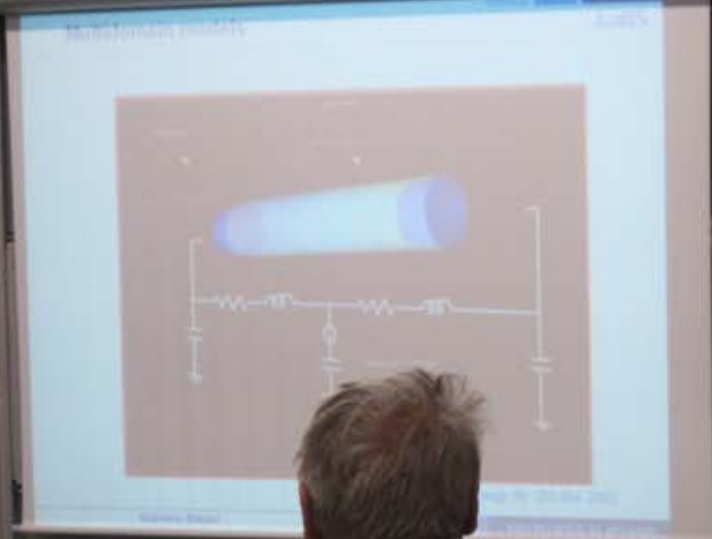






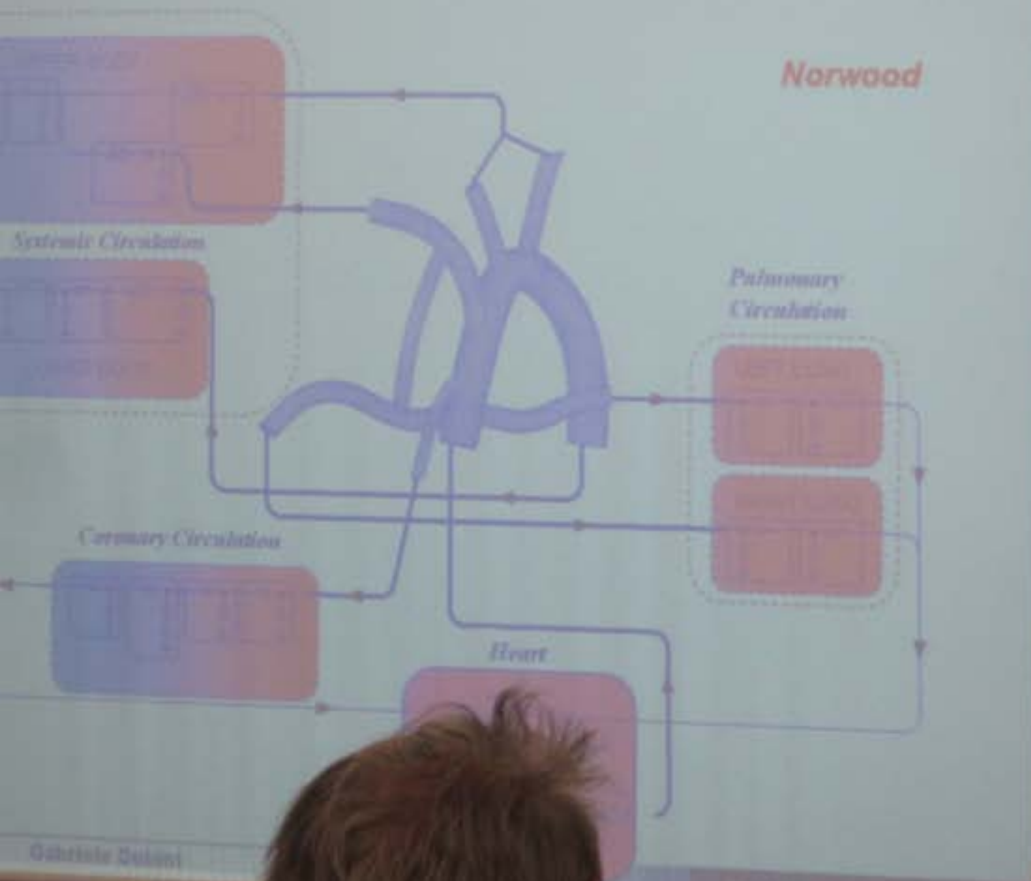
Technology 28: 359-364, 2002





systemic-to-pulmonary shunt (Stage 1)

LaBS



Norwood



Gabriele D'Amico

POLITECNICO DI MILANO





Limitations

- Constant parameters of the circulation lumped-parameter models
- Rigid-walled 3-D models
- Suture effects and disturbances are discarded
- Distortion of pulmonary tree discarded
- Models for short and long-term regulation and adaptation needed for the cardiovascular system (e.g. heart adaptation - cardiac output - changed? New collaterals created? Growth?)



