

DEVELOPMENTAL ASPECTS OF CARDIAC ADAPTATION TO INCREASED WORKLOAD

Ostadal B¹., Kolar F¹., Ostadalova I¹., Sedmera D¹., Alanova P¹.

¹*Institute of Physiology, Czech Academy of Sciences, Prague, Czech Republic*

The heart is capable of extensive adaptive growth in response to its function, because its performance as a pump is directly determined by the mass of its contractile elements. In agreement with the developmental approach of cardiac adaptation, normal cardiac growth represents the adaptive response to the increased energy demand. Growth response of the cardiac muscle changes significantly during phylogenetic and ontogenetic development. Cold-blooded animals maintain the ability of cardiac myocyte proliferation even in adults; the remarkable potential of cardiac proliferation is often associated with lifelong ability of such species to grow even after reaching sexual maturity. On the other hand, in warm-blooded animals the normal cardiac growth is biphasic: whereas fetal or neonatal cardiac myocytes express proliferative potential (hyperplasia), after birth proliferation substantially declines and the heart growth is accomplished almost exclusively by hypertrophy of cardiac cells. Proliferation of cardiac myocytes peaks during embryonic life and then decreases until birth. After birth, proliferation of cardiomyocytes declines dramatically; the rapid switch from myocyte hyperplasia to hypertrophic growth occurs between day 3 and 4 in rat and mouse heart. The data on the final number of cardiomyocytes in humans vary from 1 month after birth to young adults. Interest in the developmental aspects of cardiac cellular response to the increased workload steadily increases. The main reason seems to be the effort to determine the mechanisms responsible for the plasticity of the immature heart in order to provide new strategies to promote proliferation of adult cardiomyocytes in the injured myocardium.