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**Temporal effects of stress by immobilization and sensitivity of the isolated rat pacemaker to isoproterenol: roles of corticosterone, neuronal uptake, and beta-adrenergic homogeneity.**

[de Paula Brotto MA](http://www.ncbi.nlm.nih.gov/pubmed/?term=de%20Paula%20Brotto%20MA%5BAuthor%5D&cauthor=true&cauthor_uid=12829727)1.

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**Abstract**

A number of diseases and pathological conditions are related to the long-term adaptive response to stress, in particular under conditions of chronic stress when allostasis can shift from a healthy toward a pathological state. Although a vast number of studies have focused on the effects of chronic stress on brain and the immune system, fewer studies have been performed in peripheral tissues. Here, we used the intact isolated right atrium (pacemaker) from the rat to investigate the temporal effects of stress induced by immobilization (restraint stress) on the sensitivity of the pacemaker to the chronotropic response to isoproterenol (i.e., the effect of isoproterenol to increase the frequency of contractions of pacemakers). Immobilization sessions were conducted a specific number of times (1, 3, 7, 9, 11, and 14). We found that the response to stress over time approximates a Gaussian distribution (i.e., normal standard distribution) with no significant effects being detected after either 1 or 14 immobilization sessions, whereas supersensitivity to the chronotropic effect of isoproterenol occurred after 3, 7, 9, and 11immobilization sessions, with a peak effect occurring after seven immobilization sessions. At a cellular level, we determined that both corticosterone and neuronal uptake of catecholamines were directly involved with the observed effects, whereas no alterations in the homogeneity of beta-adrenoceptors were detected in pacemakers of stressed animals. We hypothesize that these adaptations are essentially beneficial in nature, as they should allow the animals to more promptly respond to the demands imposed by the stressful conditions.