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**Manuscript Type:** REVIEW

**Sympathetic nervous system activation and heart failure: Current state of evidence and the pathophysiology in the light of novel biomarkers**

Josip Anđelo Borovac, Domenico D'Amario, Josko Bozic, Duska Glavas

**Abstract**

Heart failure (HF) is a complex clinical syndrome characterized by the activation of at least several neurohumoral pathways that have a common role in maintaining cardiac output and adequate perfusion pressure of target organs and tissues. The sympathetic nervous system (SNS) is upregulated in HF as evident in dysfunctional baroreceptor and chemoreceptor reflexes, circulating and neuronal catecholamine spillover, attenuated parasympathetic response, and augmented sympathetic outflow to the

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### Cardiac Biomarkers and Heart Failure - American College of ...

<https://www.acc.org/latest-in-cardiology/articles...> ▾

One of the first responses to cardiac dysfunction is the **activation** of the **sympathetic nervous system**. Mid-regional proadrenomedullin (MR-proADM) is a precursor to a potent vasodilator with inotropic properties, adrenomedullin, originally isolated from pheochromocytoma cells.

### Established and Emerging Roles of Biomarkers in Heart Failure

<https://www.ahajournals.org/doi/10.1161/CIRCRESAHA.118.312706>

**Activation** of the **sympathetic nervous system** in HF results in an increased circulating concentration of the potent adrenergic neurotransmitter, norepinephrine. Elevated norepinephrine concentrations result in increased **heart** rate, increased myocardial contraction, peripheral vasoconstriction, and ...

**Cited by:** 16      **Author:** Nasrien E. Ibrahim, James L. Januzzi

**Publish Year:** 2018

### The Autonomic Nervous System and Heart Failure ...

<https://www.ahajournals.org/doi/10.1161/CIRCRESAHA.114.302589>

**Activation** of the **sympathetic nervous system** (SNS) and inhibition of the parasympathetic **system** have long been recognized as manifestations of the clinical syndrome of **heart failure** (HF), presumably as a consequence of hemodynamic changes associated with the alteration in cardiac function.

**Cited by:** 297      **Author:** Viorel G. Florea, Jay N. Cohn

**Publish Year:** 2014

### The Sympathetic Nervous System in Heart Failure | JACC ...

[www.onlinejacc.org/content/54/19/1747](http://www.onlinejacc.org/content/54/19/1747) ▾

Nov 03, 2009 · **Heart failure** is a syndrome characterized initially by left ventricular dysfunction that triggers countermeasures aimed to restore cardiac output. These responses are compensatory at first but eventually become part of the disease process itself leading to further worsening cardiac function. Among these responses is the **activation** of the **sympathetic nervous system** (SNS) that provides ...

**Cited by:** 812      **Author:** Filippos Triposkiadis, George Karayannis, G...

**Publish Year:** 2009

### Relevance of Sympathetic Nervous System Activation in ...

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4430650>

Apr 30, 2015 · While acute **sympathetic activation** may be desirable under certain circumstances, it is clear that chronic stimulation of the **sympathetic nervous system** has the potential to augment risk for the MetS through the development of obesity, hyperglycaemia, insulin resistance, and hypertension.

**Cited by:** 189      **Author:** Alicia A. Thorp, Alicia A. Thorp, Markus P. S...

**Publish Year:** 2015

### Cardiac Pathophysiology and the Future of Cardiac ...

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6747383>

Aug 22, 2019 · Holter monitoring in DMD patients routinely reveals average **heart** rates >100 beats per minute, reflecting increased **activation** of the **sympathetic nervous system** and increased adrenergic signaling in the **heart** [6,20,144]. The **heart** expresses an abundance of β-adrenergic receptors (β-AR) in the pacemaker cells, conduction **system**, and the rest ...

**Cited by:** 3      **Author:** Tatyana A. Meyers, DeWayne Townsend

**Publish Year:** 2019

### PATHOPHYSIOLOGY AND THE CARDIORENAL CONNECTION IN ...

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4355214>

Mar 30, 2015 · Despite different pathophysiologies, HFpEF and HFrEF share **activation** of three major neurohormonal systems: the NP **system**, **sympathetic nervous system** (SNS) and the RAAS. The neurohormonal **activation** has laid the foundation of the field of HF **biomarkers**. The initial phase of HF syndrome is usually asymptomatic.

**Cited by:** 13      **Author:** Alessia Buglioni, John C Jr. Burnett

**Publish Year:** 2015

### The kidney in heart failure: an update - PubMed Central (PMC)

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4465636>

Jun 14, 2015 · **Heart** and kidney are closely related in the clinical syndrome of **heart failure** (HF). ... between haemodynamics and GFR. Of particular interest are (modulation of) the RAAS, **sympathetic nervous system** (SNS) **activation**, inflammation, endothelial dysfunction, and anaemia. ... dysfunction have been excluded from randomized clinical trials of ...

**Cited by:** 245      **Author:** Kevin Damman, Jeffrey M. Testani

**Publish Year:** 2015

### The Genetics of Congestive Heart Failure

<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2847583>

Congestive **heart failure** ... **activation** of the **sympathetic nervous system** can be detected, and adrenergic humoral factors and many other compensatory pathways ... The **current state** of genetic insight into human cardiomyopathies and the component traits of **heart failure** have been outlined in the chapters of this monograph.

**Cited by:** 7      **Author:** Calum A. MacRae

**Publish Year:** 2010

### Sympathetic and renin-angiotensin-aldosterone system ...

<https://www.sciencedirect.com/science/article/pii/S0167527319340525>

Background. **Evidence** of **sympathetic** and renin-angiotensin-aldosterone **system activation** provided a rationale for neurohormonal antagonism in **heart failure** with reduced ejection fraction (HFrEF), while no data are available in patients with milder degree of systolic dysfunction.

**Cited by:** 5      **Author:** Giuseppe Vergaro, Alberto Aimo, Concetta ...

**Publish Year:** 2019

### The pathophysiology of myocardial infarction-induced heart ...

<https://www.sciencedirect.com/science/article/pii/S0928468017301724>

A) The normal **heart** is able to pump enough blood for the systemic circulation due to its regular ejection fraction; B) Myocardial infarction (MI) chronically triggers the **activation** of both the **sympathetic nervous system** (SNS) and the renin-angiotensin-aldosterone **system** (RAAS) in order to maintain adequate blood tissue perfusion, and this ...

### Sympathetic Nervous System | Circulation Research

<https://www.ahajournals.org/doi/full/10.1161/circresaha.112.281097>

**Activation** of the **sympathetic nervous system** after myocardial infarction results in the mobilization of hematopoietic stem cells, causing an inflammatory boost that accelerates atherosclerosis. This may have important implications for future therapeutic interventions targeting inflammatory pathways.

### The Brain-Heart Connection in Takotsubo Syndrome: The ...

<https://www.hindawi.com/journals/crp/2020/4150291> ▾

The **current** understanding of the pathogenesis of TTS suggests that **sympathetic nervous system** (SNS) **activation** plays a central role. Specifically, stress can activate the SNS and lead to the over-release of catecholamine, which have toxic effects on myocardial tissue when present at excessive levels.

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Apr 30, 2015 · 4. **Evidence** of **Sympathetic** Dysfunction in Metabolic Conditions. There is substantial **evidence** in support of the **sympathetic nervous system** being exceedingly active in individuals with the MetS and its key metabolic alterations, central obesity, and insulin resistance.

Cited by: 189

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**Cited by:** 840

**Author:** Filippou Triposkiadis, George Karayannis, ...

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The **Sympathetic Nervous System** in Heart Failure Physiology, **Pathophysiology**, and Clinical Implications Article · Literature Review in Journal of the American College ...

## [Chronic Sympathetic Hyperactivity Triggers ...](#)

<https://www.nature.com/articles/s41598-020-64949-7>

May 14, 2020 · **Activation** of the **sympathetic nervous system** (SNS) exerts several effects on the cardiovascular **system**. These include accelerating **heart rate**, ...

**Author:** Humberto C. Joca, Humberto C. Joca, ...

**Publish Year:** 2020

## Sympathetic nervous system

The sympathetic nervous system is one of the two main divisions of the autonomic nervous system, the other being the parasympathetic nervous system.



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