



**Application number/Title: 37721** - Understanding the Role of the Brain and Cardiovascular Factors in Hypertension-Affect Relationships

**Applicant PI:** Professor Arno Villringer

**Applicant institution:** Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig, Germany

**Keywords provided by the Applicant PI to describe the research project:**  
brain, emotion, heart, hypertension, mri, vascular-risk-factors

**Application Lay Summary:**

Hypertension is the leading single risk factor globally for disability and death. Its high global prevalence continues to rise with population growth and aging. Hypertension also often co-occurs in people with mood/affective disorders, which in turn increases their risk of developing cardiovascular disease. In spite of its immense relevance for public health, causes of the most common form of hypertension, essential hypertension, are largely unknown. Recently, psychosocial factors, including stress, anxiety, depression, and well-being, have gained increased attention as proposed risk factors for essential hypertension. However, evidence for a causal role of psychosocial factors in essential hypertension is inconclusive and the brain-body mechanisms underlying hypertension-affect interactions remain poorly understood.

We aim to investigate to what extent changes in blood pressure (BP) relate to (subclinical) alterations in emotional processing and affect, and to what degree this relationship may be influenced by brain or cardiovascular factors.

By conducting our research within a large population-based cohort, our results will be relevant for a comprehensive understanding of the multidirectional relationship between hypertension, mental health, the cardiovascular system, and the brain. Understanding the role of emotional factors in hypertension is vital to pave roads for appropriate and evidence-based prevention and intervention strategies in hypertension management, which will consequently also lower the risk of other chronic diseases, such as cardiovascular disease or stroke.

Our main research questions (RQs) for the proposed project are:

1. Is elevated BP related to cross-sectional and longitudinal changes in affect?

2. Which brain structures or functions influence the relationship between BP and affect?

3. How is the relationship between BP and affect influenced by (secondary) vascular disease?

4. Are there potential sex differences in the relationships identified in RQs 1-3?

In RQ1, we aim to test whether BP relates to self-reported affect (e.g. depression, anxiety).

In RQ2, we aim to assess if brain responses to emotion (e.g. amygdala activity) relate to BP levels. Additionally, we will test whether the BP-affect relationship is influenced by brain structure (e.g. volume, vasculature) or brain function (resting-state fMRI) in regions associated with emotion and cardiovascular regulation (e.g. amygdala, medial-frontal regions).

In RQ3, we aim to examine how the BP-affect relationship is influenced by vascular disease markers (e.g. cerebral white matter lesions, atherosclerosis).

In RQ4, sex differences in the relationships identified in RQs 1-3 will be assessed.

We estimate a duration of 24 months for the proposed research.