



Figure 11-5 Interplay of renin-angiotensin-aldosterone and atrial natriuretic peptide in maintaining blood pressure homeostasis.

release circulating effectors that act in concert to maintain normal blood pressure. Kidneys influence peripheral resistance and sodium excretion/retention primarily through the renin-angiotensin system.

- *Renin* is a proteolytic enzyme produced by renal juxtaglomerular cells, myoepithelial cells that surround the glomerular afferent arterioles. Renin is released in response to low blood pressure in afferent arterioles, elevated levels of circulating catecholamines, or low sodium levels in the distal convoluted renal tubules. The latter occurs when the *glomerular filtration rate* falls (e.g., when the cardiac output is low), leading to increased sodium resorption by the proximal tubules.
- Renin cleaves *plasma angiotensinogen* to *angiotensin I*, which in turn is converted to *angiotensin II* by angiotensin-converting enzyme (ACE), mainly a product of vascular endothelium. Angiotensin II raises blood pressure by (1) inducing vascular contraction, (2) stimulating aldosterone secretion by the adrenal gland, and (3) increasing tubular sodium resorption. *Adrenal aldosterone* increases blood pressure by increasing sodium resorption (and thus water) in the distal convoluted tubule, which increases blood volume.

- The kidney also produces a variety of vascular relaxing substances (including prostaglandins and NO) that presumably counterbalance the vasopressor effects of angiotensin.

Myocardial natriuretic peptides are released from atrial and ventricular myocardium in response to volume expansion; these inhibit sodium resorption in the distal renal tubules, thus leading to sodium excretion and diuresis. They also induce systemic vasodilation.

KEY CONCEPTS

Blood Pressure Regulation

- Blood pressure is determined by vascular resistance and cardiac output.
- Vascular resistance is regulated at the level of the arterioles, influenced by neural and hormonal inputs.
- Cardiac output is determined by heart rate and stroke volume, which is strongly influenced by blood volume. Blood volume in turn is regulated mainly by renal sodium excretion or resorption.