Physiol-12A09 Describe the role of baroreceptors in the control of systemic arterial pressure.

**Background**

*Baroreceptors* = *free nerve endings that act as stretch mechanoreceptors*, which sense changes in blood pressure and volume

Baroreceptors are part of a negative feedback loop, which regulates blood pressure and volume

Sensor = baroreceptors  
Afferent pathway = autonomic nervous system  
Central controller = medullary vasomotor centre  
Efferent pathway = autonomic nervous system  
Effectors = heart, vessels (arterial + venous systems), kidneys, higher centres (cortex, hypothalamus/pituitary, limbic)

There are 2 types of baroreceptors:
- high pressure baroreceptors (carotid sinus and aortic arch)  
- low pressure baroreceptors (atria, ventricles, large veins, pulmonary vessels)

**High pressure baroreceptor pathway**

\[\downarrow\text{mean arterial pressure and/or }\downarrow\text{pulse pressure }\rightarrow\downarrow\text{carotid sinus and aortic arch baroreceptors }\rightarrow\downarrow\text{firing rate }\rightarrow\text{afferent via CN IX (carotid) and CN X (arch) }\rightarrow\downarrow\text{NTS (via glutamine) }\rightarrow\downarrow\text{CVLM (via glutamine) }\rightarrow\uparrow\text{RVLM (via GABA) }\rightarrow\uparrow\text{sympathetic outflow via intermediolateral tracts of spinal cord}

\uparrow\text{SNS }\rightarrow\uparrow\text{contractility, }\uparrow\text{heart rate, }\uparrow\text{systemic vascular resistance }\rightarrow\uparrow\text{MAP}
Also \( \downarrow \) PSNS \( \rightarrow \) \( \uparrow \) heart rate \( \pm \) \( \uparrow \) contractility \( \rightarrow \) \( \uparrow \) MAP

\( \uparrow \) SNS \( \rightarrow \) acts on kidneys \( \rightarrow \) \( \uparrow \) renin release \( \rightarrow \) \( \uparrow \) RAAS \( \rightarrow \) salt + water retention

\( \uparrow \) renin \( \rightarrow \) \( \uparrow \) ATII \( \rightarrow \) \( \uparrow \) systemic vascular resistance \( \rightarrow \) \( \uparrow \) MAP

Note: MAP = cardiac output \( \times \) systemic vascular resistance

High pressure baroreceptors respond to MAP 60 \( \sim \) 180 mmHg
Most sensitive when MAP \( \approx \) 90 mmHg
Chronic hypertension \( \rightarrow \) set-point resets to higher value

**Low pressure baroreceptor pathway**

Low pressure baroreceptors are involved in the regulation of blood volume

\( \downarrow \) volume \( \rightarrow \) stimulates low pressure baroreceptors \( \rightarrow \) afferent via vagus nerve \( \rightarrow \)

nucleus ambiguus \( \rightarrow \) NTS \( \rightarrow \) CVLM \( \rightarrow \) RVLM \( \rightarrow \) \( \uparrow \) sympathetic tone \( \rightarrow \) cardiac, vascular, renal effects

\( \downarrow \) volume \( \rightarrow \) \( \rightarrow \) \( \uparrow \) ADH release + thirst

\( \uparrow \) volume \( \rightarrow \) directly stimulate release of atrial natriuretic peptide \( \rightarrow \) acts on kidneys

\( \rightarrow \) \( \uparrow \) GFR \( \rightarrow \) natriuresis

*Examiner’s comments* – 63% of candidates passed this question.

Better answers included an accurate description of **high and low pressure baroreceptors** with **accurate anatomical locations** of the receptors, an outline of their role as **stretch receptors** in a **negative feedback system** designed to maintain systemic arterial pressure, and a concise discussion of the **components of the feedback loop**, with **clear descriptions of the afferent and efferent pathways** involved and **effector mechanisms**.