3) The kidneys regulate blood pressure through a hormonal feedback

\[ P_s = \text{systemic pressure} \]
\[ = 100 \text{ mmHg normally} \]

Cocrration of the aorta reduces blood pressure at the kidneys significantly. This results in increased systemic pressure

\[ P_s = 110 \text{ mmHg} \]

\[ \text{pressure drop} \]

\[ P = 80 \text{ mmHg} \]

Assume that you are normal. You donate a kidney. After its surgical removal, what will be your systemic blood pressure \( P_s \)? State your assumptions. Assume linear system

Consider changes from normal values:

\[ 10 = \Delta P_s = -\Delta P_k [G(H_L+H_R)] = 20G(H_L+H_R) \]

\[ \frac{10}{20} = G(H_L+H_R) = 0.5 \]

Assume \( H_L = H_R = H \Rightarrow HG = 0.25 \)

Donation is like cutting at point \( x \) in the first figure. Writing from this figure:

\[ \Delta P_s = \Delta P_k H_R \left( \frac{-G}{1+G H_L} \right) = \frac{-\Delta P_k H_s}{1+G H_L} \]

\[ = \frac{-100 \times 0.25}{1+0.25} = +20 \text{ mmHg} \]

\( \Rightarrow P_s = 120 \text{ mmHg} \)

Note: removing a kidney is like reducing \( P_k \) to zero for that kidney, hence \( \Delta P_k = -P_s \)

Note: this model does not include other feedback which normally exists.

Donation of a kidney does not change blood pressure,