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## **Synchronization of tubular pressure oscillations in coupled nephrons**

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The kidney plays an essential role in regulating the blood pressure and a number of its functions operate at the functional unit of the kidney, the nephron. To understand the impacts of internephron coupling on the overall nephrons' dynamics, we develop a mathematical model of a tubuloglomerular feedback (TGF) system, a negative feedback mechanism for nephron's fluid capacity. Specifically, each model nephron represents a rigid thick ascending limb only and is assumed to interact with nearby nephrons through vascular and hemodynamic coupling along the pre-glomerular vasculature. We conduct a bifurcation analysis by deriving a characteristic equation obtained via a linearization of the model equations. Numerical solutions for the model equations are consequently obtained to validate the predictions of the characteristic equation. The model results show that the coupled-TGF system with two different coupling effects can produce in-phase as well as anti-phase (out-of-phase) synchronization of tubular pressure oscillations in two coupled nephrons, as has been observed in experimental studies.

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