■ SUPPLEMENT ■

Complete Model Equations and Parameters

for

Sex-Specific Computational Models for Blood Pressure Regulation in the Rat

Cardiovascular Function

$$P_{mf} = (\frac{1}{SF_V} \times 7.436 \times V_b - 30.18) \times \epsilon_{aum} \tag{S1}$$

$$P_{ra} = \max\left\{0.2787e^{SF_R \times 0.2281\Phi_{co}} - 0.9119, 0\right\} \tag{S2}$$

$$P_{ma} = \Phi_{co} \times R_{tp} \tag{S3}$$

$$\Phi_{vr} = \frac{P_{mf} - P_{ra}}{R_{vr}} \tag{S4}$$

$$\Phi_{co} = \Phi_{vr} \tag{S5}$$

$$\frac{dvas}{dt} = vas_f - vas_d \tag{S6}$$

$$vas_f = \frac{11.312 \times e^{-\Phi_{co} \times (SF_R \times 0.4714)}}{100000} \tag{S7}$$

$$vas_d = vas \times K_{vd} \tag{S8}$$

$$R_a = R_{ba} \times \epsilon_{aum} \tag{S9}$$

$$R_{ba} = K_{bar}/vas \tag{S10}$$

$$R_{vr} = (8R_{bv} + R_a)/31 \tag{S11}$$

$$R_{tp} = R_a + R_{bv} \tag{S12}$$

$$\varepsilon_{aum} = \frac{4}{5}(a_{chemo} + a_{baro}) \tag{S13}$$

$$a_{chemo} = \frac{1}{4}a_{auto} \tag{S14}$$

$$\frac{da_{baro}}{dt} = \frac{3}{4}\left\{\frac{da_{auto}}{dt} - 0.0000667(a_{baro} - 1)\right\} \tag{S15}$$

$$a_{auto} = 3.0042e^{-0.0107P_{ma}} \tag{S16}$$

Renal Hemodynamics

$$\Phi_{rb} = P_{ma}/R_r \tag{S17}$$

$$\Phi_{gfilt} = P_f \times C_{gcf} \tag{S18}$$

$$P_f = P_{gh} - (P_B + P_{go}) \tag{S19}$$

$$P_{gh} = P_{ma} - \Phi_{rb} \times R_{AA} \tag{S20}$$

$$R_r = R_{AA} + R_{EA} \tag{S21}$$

$$R_{AA} = R_{aa-ss} \times \beta_{rsna} \times \Sigma_{tgf} \times \Sigma_{myo} \times \Psi_{AT1R-AA} \times \Psi_{AT2R-AA} \tag{S22}$$

$$R_{EA} = R_{ea-ss} \times \Psi_{AT1R-EA} \times \Psi_{AT2R-EA} \tag{S23}$$

$$\beta_{rsna} = \frac{2}{1 + e^{-3.16(rsna-1)}} \tag{S24}$$

$$\Sigma_{tgf} = \begin{cases} 0.3408 + \dfrac{3.449}{3.88 + e^{(\Phi_{md-sod} - SF_S \times 3.891)/(SF_S \times -0.9617)}} & \text{in males} \\ 0.3408 + \dfrac{3.449}{3.88 + e^{(\Phi_{md-sod} - SF_S \times 6.591)/(SF_S \times -0.9617)}} & \text{in females} \end{cases} \tag{S25}$$

$$\Sigma_{myo} = 0.75 + \frac{1.2}{1 + 3.8e^{-0.6(P_{gh} - 63.8)}} \tag{S26}$$

$$\Psi_{AT1R-AA} = 0.8 + 0.2092 \times \frac{[AT1R]}{[AT1R]_{eq}} - 0.0092 \div \frac{[AT1R]}{[AT1R]_{eq}} \tag{S27}$$

$$\Psi_{AT1R-EA} = 0.925 + 0.0835 \frac{[AT1R]}{[AT1R]_{eq}} - 0.0085 \div \frac{[AT1R]}{[AT1R]_{eq}} \tag{S28}$$

$$\Psi_{AT2R-AA} = \begin{cases} 0.9 + 0.1e^{-\frac{[AT2R]}{[AT2R]_{eq}} - 1} & \text{in females} \\ 1 & \text{in males} \end{cases} \tag{S29}$$

$$\Psi_{AT2R-EA} = \begin{cases} 0.9 + 0.1e^{-\frac{[AT2R]}{[AT2R]_{eq}} - 1} & \text{in females} \\ 1 & \text{in males} \end{cases} \tag{S30}$$

<u>Renal Function</u>

$$\Phi_{filsod} = \Phi_{gfilt} \times C_{sod} \tag{S31}$$

$$\Phi_{pt-sodreab} = \Phi_{filsod} \times \eta_{pt-sodreab} \tag{S32}$$

$$\Phi_{md-sod} = \Phi_{filsod} - \Phi_{pt-sodreab} \tag{S33}$$

$$\Phi_{dt-sodreab} = \Phi_{md-sod} \times \eta_{dt-sodreab} \tag{S34}$$

$$\Phi_{dt-sod} = \Phi_{md-sod} - \Phi_{dt-sodreab} \tag{S35}$$

$$\Phi_{cd-sodreab} = \Phi_{dt-sod} \times \eta_{cd-sodreab} \tag{S36}$$

$$\Phi_{u-sod} = \Phi_{dt-sod} - \Phi_{cd-sodreab} \tag{S37}$$

$$\eta_{pt-sodreab} = \eta^{eq}_{pt-sodreab} \times \gamma_{filsod} \times \gamma_{AT1R} \times \gamma_{rsna} \tag{S38}$$

$$\eta_{dt-sodreab} = \eta^{eq}_{dt-sodreab} \times \psi_{al} \tag{S39}$$

$$\eta_{cd-sodreab} = \eta^{eq}_{cd-sodreab} \times \lambda_{dt} \times \lambda_{anp} \times \lambda_{al} \tag{S40}$$

$$\gamma_{filsod} = \begin{cases} 0.8 + \dfrac{0.3}{1 + e^{1 + [(\Phi_{filsod} - SF_S \times 113.7)/(SF_S \times 138)]}} & \text{in males} \\ 0.8 + \dfrac{0.3}{1 + e^{1 + [(\Phi_{filsod} - SF_S \times 108.3)/(SF_S \times 138)]}} & \text{in females} \end{cases} \tag{S41}$$

$$\gamma_{AT1R} = 0.92 + \frac{0.136}{1 + e^{-1.7983(\frac{[AT1R]}{[AT1R]_{eq}} - 0.8017)}} \tag{S42}$$

$$\gamma_{rsna} = 0.72 + \frac{0.56}{1 + e^{(1 - rsna)/2.18}} \tag{S43}$$

$$\psi_{al} = \frac{11.55}{1 + 0.1e^{-0.007937 C_{al}}} - 10.5 \tag{S44}$$

$$\lambda_{dt} = \begin{cases} 0.8 + \dfrac{0.275}{1 + e^{\frac{1}{SF_S} \times 2.31(\Phi_{dt-sod} - SF_S \times 2.224)}} & \text{in males} \\ 0.8 + \dfrac{0.2417}{1 + e^{\frac{1}{SF_S} \times 2.86(\Phi_{dt-sod} - SF_S \times 3.699)}} & \text{in females} \end{cases} \tag{S45}$$

$$\lambda_{anp} = -0.1 \times \hat{C}_{anp} + 1.1 \tag{S46}$$

$$\lambda_{al} = \frac{1}{C_{al}^{eq\,0.06}} C_{al}^{0.06} \tag{S47}$$

$$\Phi_{pt-wreab} = \Phi_{gfilt} \times \eta_{pt-wreab} \tag{S48}$$
$$\Phi_{md-u} = \Phi_{gfilt} - \Phi_{pt-wreab} \tag{S49}$$
$$\Phi_{dt-wreab} = \Phi_{md-u} \times \eta_{dt-wreab} \tag{S50}$$
$$\Phi_{dt-u} = \Phi_{md-u} - \Phi_{dt-wreab} \tag{S51}$$
$$\Phi_{cd-wreab} = \Phi_{dt-u} \times \eta_{cd-wreab} \tag{S52}$$
$$\Phi_{u} = \Phi_{dt-u} - \Phi_{cd-wreab} \tag{S53}$$
$$\eta_{pt-wreab} = \eta^{eq}_{pt-wreab} \times \mu_{pt-sodreab} \tag{S54}$$
$$\eta_{dt-wreab} = \eta^{eq}_{dt-wreab} \times \mu_{dt-sodreab} \tag{S55}$$
$$\eta_{cd-wreab} = \eta^{eq}_{cd-wreab} \times \mu_{cd-sodreab} \times \mu_{adh} \tag{S56}$$
$$\mu_{pt-sodreab} = 0.12 \tanh\left(10\left(\frac{\eta_{pt-sodreab}}{\eta^{eq}_{pt-sodreab}} - 1\right)\right) + 1 \tag{S57}$$
$$\mu_{dt-sodreab} = 0.12 \tanh\left(10\left(\frac{\eta_{dt-sodreab}}{\eta^{eq}_{dt-sodreab}} - 1\right)\right) + 1 \tag{S58}$$
$$\mu_{cd-sodreab} = 0.12 \tanh\left(10\left(\frac{\eta_{cd-sodreab}}{\eta^{eq}_{cd-sodreab}} - 1\right)\right) + 1 \tag{S59}$$
$$\mu_{adh} = 1.0328 - 0.1938 e^{-0.4441 C_{adh}} \tag{S60}$$

Renin-Angiotensin-Aldosterone System

$$R_{sec} = N_{rs} \times \nu_{md-sod} \times \nu_{rsna} \times \nu_{AT1R} \tag{S61}$$
$$\frac{d[PRC]}{dt} = R_{sec} - \frac{\ln(2)}{h_{renin}}[PRC] \tag{S62}$$
$$PRA = [PRC] \times X_{PRC-PRA} \tag{S63}$$
$$\frac{d[AGT]}{dt} = k_{AGT} - PRA - \frac{\ln(2)}{h_{AGT}}[AGT] \tag{S64}$$
$$\frac{d[AngI]}{dt} = PRA - (c_{ACE} + c_{Chym} + c_{NEP})[AngI] - \frac{\ln(2)}{h_{AngI}}[AngI] \tag{S65}$$
$$\begin{aligned}\frac{d[AngII]}{dt} &= (c_{ACE} + c_{Chym})[AngI] - (c_{ACE2} + c_{AII=AIV} + c_{AT1R} + c_{AT2R})[AngII] \\ &\quad - \frac{\ln(2)}{h_{AngII}}[AngII]\end{aligned} \tag{S66}$$
$$\frac{d[Ang(\text{1-7})]}{dt} = c_{NEP}[AngI] + c_{ACE2}[AngII] - \frac{\ln(2)}{h_{Ang(\text{1-7})}}[Ang(\text{1-7})] \tag{S67}$$
$$\frac{d[AngIV]}{dt} = c_{AII=AIV}[AngII] - \frac{\ln(2)}{h_{AngIV}}[AngIV] \tag{S68}$$
$$\frac{d[AT1R]}{dt} = c_{AT1R}[AngII] - \frac{\ln(2)}{h_{AT1R}}[AT1R] \tag{S69}$$
$$\frac{d[AT2R]}{dt} = c_{AT2R}[AngII] - \frac{\ln(2)}{h_{AT2R}}[AT2R] \tag{S70}$$
$$\nu_{md-sod} = \begin{cases} 0.2262 + \dfrac{28.04}{11.56 + e^{(\Phi_{md-sod} - SF_S \times 1.659)/(SF_S \times 0.6056)}} & \text{in males} \\ 0.2262 + \dfrac{28.04}{11.56 + e^{(\Phi_{md-sod} - SF_S \times 4.359)/(SF_S \times 0.6056)}} & \text{in females} \end{cases} \tag{S71}$$
$$\nu_{rsna} = 1.822 - \frac{2.056}{1.358 + e^{(rsna - 0.8662)}} \tag{S72}$$

$$\nu_{AT1R} = \left(\frac{[AT1R]}{[AT1R]_{eq}}\right)^{-0.95} \tag{S73}$$

$$N_{als} = N_{als}^{eq} \times \xi_{k/sod} \times \xi_{map} \times \xi_{AT1R} \tag{S74}$$

$$\frac{dN_{al}}{dt} = \frac{1}{T_{al}}(N_{als} - N_{al}) \tag{S75}$$

$$C_{al} = \begin{cases} 379N_{al} & \text{in females} \\ 395N_{al} & \text{in males} \end{cases} \tag{S76}$$

$$\xi_{k/sod} = \frac{5}{1 + e^{0.265(C_k/C_{sod} - 23.7)}} \tag{S77}$$

$$\xi_{map} = \begin{cases} 70.1054e^{-(0.0425)\times P_{ma}} & \text{if } P_{ma} \le 100 \\ 1 & \text{if } P_{ma} > 100 \end{cases} \tag{S78}$$

$$\xi_{AT1R} = 0.1 + \frac{2.9}{1 + e^{-2\left(\frac{[AT1R]}{[AT1R]_{eq}} - 1.399\right)}} \tag{S79}$$

Miscellaneous

$$rsna_0 = N_{rsna} \times \alpha_{map} \times \alpha_{rap}$$

$$rsna = \begin{cases} rsna_0^{\frac{1}{rsna_0}} & \text{in females} \\ rsna_0 & \text{in males} \end{cases} \tag{S80}$$

$$\alpha_{map} = 0.5 + \frac{1}{1 + e^{(P_{ma} - 103)/15}} \tag{S81}$$

$$\alpha_{rap} = 1 - 0.008P_{ra} \tag{S82}$$

$$\Phi_{win} = \frac{SF_U \times 0.002313}{1 + e^{-0.8(C_{adh} - 4.3404)}} \tag{S83}$$

$$\frac{dV_{ecf}}{dt} = \Phi_{win} - \Phi_u \tag{S84}$$

$$V_b = SF_V \times 4.5479 + \frac{SF_V \times 2.4312}{1 + e^{-(V_{ecf} - SF_V \times 18.1128)\times(\frac{1}{SF_V} \times 0.4744)}} \tag{S85}$$

$$N_{adhs} = \begin{cases} [\max\{(C_{sod} - 140), 0\} + \max\{(\epsilon_{aum} - 1), 0\} - \delta_{ra}]/3 & \text{in males} \\ [\max\{(C_{sod} - 143), 0\} + \max\{(\epsilon_{aum} - 1), 0\} - \delta_{ra}]/3 & \text{in females} \end{cases} \tag{S86}$$

$$\frac{dN_{adh}}{dt} = \frac{1}{T_{adh}}(N_{adhs} - N_{adh}) \tag{S87}$$

$$C_{adh} = 4N_{adh} \tag{S88}$$

$$\frac{d\delta_{ra}}{dt} = 0.2\frac{dP_{ra}}{dt} - 0.0007\delta_{ra} \tag{S89}$$

$$\frac{dM_{sod}}{dt} = \Phi_{sodin} - \Phi_{u-sod} \tag{S90}$$

$$C_{sod} = \frac{M_{sod}}{V_{ecf}} \tag{S91}$$

$$\hat{C}_{anp} = 7.4052 - \frac{6.554}{1 + e^{(P_{ra} - 3.762)/(1)}} \tag{S92}$$

Scaling Factors

Rat Value = Human Value $\times$ SF

Table S1: Baseline values of all model variables and parameters for male (M) and female (F). ADH, antidiuretic hormone; ALD, aldosterone; ANP, atrial natriuretic peptide; CD, collecting duct; DT, distal tubule; MAP, mean arterial pressure; PT, proximal tubule; RSNA, renal sympathetic nerve activity.

Symbol	Description	Units	Baseline M Value	Baseline F Value
	Cardiovascular Function			
P_{mf}	Mean filling pressure	$mmHg$	7.28	7.26
P_{ra}	Right atrial pressure	$mmHg$	0	0
P_{ma}	Mean arterial pressure	$mmHg$	103	103
Φ_{vr}	Venous return	$\frac{ml}{min}$	15.0	9.57
Φ_{co}	Cardiac output	$\frac{ml}{min}$	15.0	9.57
vas	Vascularity	–	1	1
vas_f	Vascularity formation rate	–	1×10^{-5}	1×10^{-5}
vas_d	Vascularity destruction rate	–	1×10^{-5}	1×10^{-5}
K_{vd}	Vascularity destruction coefficient	–	1×10^{-5}	1×10^{-5}
K_{bar}	Coefficient relating basic arterial resistance to vascularity	$\frac{mmHg}{ml/min}$	5.69	8.91
R_a	Arterial resistance	$\frac{mmHg}{ml/min}$	5.69	8.91
R_{ba}	Basic arterial resistance	$\frac{mmHg}{ml/min}$	5.69	8.91
R_{vr}	Resistance to venous return	$\frac{mmHg}{ml/min}$	0.485	0.759
R_{bv}	Basic venous resistance	$\frac{mmHg}{ml/min}$	1.17	1.83
R_{tp}	Total peripheral resistance	$\frac{mmHg}{ml/min}$	6.86	10.7
ε_{aum}	Autonomic multiplier effect	–	1	1
a_{chemo}	Chemoreceptor activity	–	0.25	0.25
a_{baro}	Baroreceptor activity	–	1	1
a_{auto}	Autonomous system activity	–	1	1
	Renal Hemodynamics			
Φ_{rb}	Renal blood flow	$\frac{ml}{min}$	3.60	2.30
Φ_{gfilt}	Glomerular filtration rate	$\frac{ml}{min}$	1.22	0.833
C_{gcf}	Glomerular capillary filtration coefficient	$\frac{ml/min}{mmHg}$	0.068	0.047
P_f	Net filtration pressure	$mmHg$	17.9	17.7
P_{gh}	Glomerular hydrostatic pressure	$mmHg$	63.9	63.7
P_B	Bowman hydrostatic pressure	$mmHg$	18	18
P_{go}	Glomerular osmotic pressure	$mmHg$	28	28
R_r	Renal vascular resistance	$\frac{mmHg}{ml/min}$	28.6	44.8
R_{AA}	Afferent arteriolar resistance	$\frac{mmHg}{ml/min}$	10.9	17.0
R_{EA}	Efferent arteriolar resistance	$\frac{mmHg}{ml/min}$	17.7	27.8
β_{rsna}	Effect of RSNA on afferent arteriolar resistance	–	1	1
Σ_{tgf}	Tubuloglomerular feedback signal	–	1	1
Σ_{myo}	Myogenic response	–	1	1
$\Psi_{AT1R-AA}$	Effect of AT1R-bound Ang II on afferent resistance	–	1	1
$\Psi_{AT1R-EA}$	Effect of AT1R-bound Ang II on efferent resistance	–	1	1
$\Psi_{AT2R-AA}$	Effect of AT2R-bound Ang II on afferent resistance	–	1	1
$\Psi_{AT2R-EA}$	Effect of AT2R-bound Ang II on efferent resistance	–	1	1
	Renal Function			
Φ_{filsod}	Filtered Na^+ load	$\frac{\mu eq}{min}$	174	122
$\Phi_{pt-sodreab}$	Proximal tubule Na^+ reabsorption rate	$\frac{\mu eq}{min}$	140	61.1
Φ_{md-sod}	Macula densa Na^+ flow	$\frac{\mu eq}{min}$	34.9	61.1
$\Phi_{dt-sodreab}$	Distal tubule Na^+ reabsorption rate	$\frac{\mu eq}{min}$	17.4	30.5
Φ_{dt-sod}	Distal tubule Na^+ flow	$\frac{\mu eq}{min}$	17.4	30.5
$\Phi_{cd-sodreab}$	Collecting duct Na^+ reabsorption rate	$\frac{\mu eq}{min}$	16.2	29.3
Φ_{u-sod}	Urine Na^+ flow	$\frac{\mu eq}{min}$	1.22	1.22
$\eta_{pt-sodreab}$	Fractional proximal tubule Na^+ reabsorption	–	0.80	0.50
$\eta_{dt-sodreab}$	Fractional distal tubule Na^+ reabsorption	–	0.50	0.50
$\eta_{cd-sodreab}$	Fractional collecting duct Na^+ reabsorption	–	0.93	0.96

γ_{filsod}	Effect of the filtered Na^+ load on fractional PT Na^+ reabsorption	–	1	1
γ_{AT1R}	Effect of AT2R-bound Ang II on fractional PT Na^+ reabsorption	–	1	1
γ_{rsna}	Effect of RSNA on fractional PT Na^+ reabsorption	–	1	1
ψ_{al}	Effect of ALD on fractional DT Na^+ reabsorption	–	1	1
λ_{dt}	Effect of DT Na^+ outflow on fractional CD Na^+ reabsorption	–	1	1
λ_{anp}	Effect of ANP on fractional CD Na^+ reabsorption	–	1	1
λ_{al}	Effect of ALD on fractional CD Na^+ reabsorption	–	1	1
$\Phi_{pt-wreab}$	Proximal tubule water reabsorption rate	$\frac{ml}{min}$	1.05	0.417
Φ_{md-u}	Macula densa ultrafiltrate flow	$\frac{ml}{min}$	0.171	0.417
$\Phi_{dt-wreab}$	Distal tubule water reabsorption rate	$\frac{ml}{min}$	0.102	0.250
Φ_{dt-u}	Distal tubule ultrafiltrate flow	$\frac{ml}{min}$	0.0682	0.168
$\Phi_{cd-wreab}$	Collecting duct water reabsorption rate	$\frac{ml}{min}$	0.0532	0.152
Φ_{u}	Urine flow	$\frac{ml}{min}$	0.0150	0.0150
$\eta_{pt-wreab}$	Fractional proximal tubule water reabsorption	–	0.86	0.50
$\eta_{dt-wreab}$	Fractional distal tubule water reabsorption	–	0.60	0.60
$\eta_{cd-wreab}$	Fractional collecting duct water reabsorption	–	0.78	0.91
$\mu_{pt-sodreab}$	Effect of osmotic gradient in PT	–	1	1
$\mu_{dt-sodreab}$	Effect of osmotic gradient in DT	–	1	1
$\mu_{cd-sodreab}$	Effect of osmotic gradient in CD	–	1	1
μ_{adh}	Effect of ADH on CD fractional water reabsorption	–	1	1
	Renin-Angiotensin-Aldosterone System			
R_{sec}	Normalized renin secretion rate	–	1	1
$[PRC]$	Plasma renin concentration	$\frac{fmol}{ml\cdot min}$	17.3	17.3
PRA	Plasma renin activity	$\frac{fmol}{ml\cdot min}$	136	114
$[AGT]$	Angiotensinogen concentration	$\frac{fmol}{ml}$	5.76×10^5	5.76×10^5
$[AngI]$	Angiotensin I concentration	$\frac{fmol}{ml}$	90	75
$[AngII]$	Angiotensin II concentration	$\frac{fmol}{ml}$	6.0	6.0
$[Ang(1\text{-}7)]$	Angiotensin (1-7) concentration	$\frac{fmol}{ml}$	50	25
$[AngIV]$	Angiotensin IV concentration	$\frac{fmol}{ml}$	1.29	1.29
$[AT1R]$	AT1R-bound Angiotensin II concentration	$\frac{fmol}{ml}$	20	20
$[AT2R]$	AT2R-bound Angiotensin II concentration	$\frac{fmol}{ml}$	6.8	6.8
$X_{PRC\text{-}PRA}$	Ratio of PRA to [PRC]	–	7.83	6.60
k_{AGT}	AGT production rate	$\frac{fmol}{ml\cdot min}$	801	780
c_{ACE}	Reaction rate of Ang converting enzyme	$\frac{1}{min}$	0.0968	0.116
c_{Chym}	Reaction rate of chymase	$\frac{1}{min}$	0.0108	0.0128
c_{NEP}	Reaction rate of neutral endopeptidase	$\frac{1}{min}$	0.0127	0.00767
c_{ACE2}	Reaction rate of Ang converting enzyme 2	$\frac{1}{min}$	2.67×10^{-3}	4.33×10^{-4}
$c_{AII=AIV}$	Reaction rate of conversion of Ang II to Ang IV	$\frac{1}{min}$	0.298	0.298
c_{AT1R}	Reaction rate of binding of Ang II to AT1R	$\frac{1}{min}$	0.197	0.197
c_{AT2R}	Reaction rate of binding of Ang II to AT2R	$\frac{1}{min}$	0.0657	0.0657
h_{renin}	Half life of renin	min	12	12
h_{AGT}	Half life of AGT	min	600	600
h_{AngI}	Half life of Ang I	min	0.5	0.5
h_{AngII}	Half life of Ang II	min	0.66	0.66
$h_{Ang(1-7)}$	Half life of Ang (1-7)	min	30	30
h_{AngIV}	Half life of Ang IV	min	0.5	0.5
h_{AT1R}	Half life of AT1R-bound Ang II	min	12	12
h_{AT2R}	Half life of AT2R-bound Ang II	min	12	12
ν_{md-sod}	Effect of macula densa Na^+ flow on renin secretion rate	–	1	1
ν_{rsna}	Effect of RSNA on renin secretion rate	–	1	1
ν_{AT1R}	Effect of AT1R-bound Ang II on renin secretion rate	–	1	1
N_{als}	Normalized ALD secretion rate	–	1	1
N_{al}	Normalized ALD concentration	–	1	1
C_{al}	Aldosterone concentration	$\frac{ng}{l}$	395	379
T_{al}	Time constant for ALD hormone secretion	min	30	30
$\xi_{k/sod}$	Effect of K to Na^+ concentration ratio on ALD secretion rate	–	1	1
ξ_{map}	Effect of MAP on ALD secretion rate	–	1	1

ξ_{AT1R}	Effect of AT1R-bound Ang II on ALD secretion rate	$-$	1	1
		Miscellaneous		
$rsna$	Renal sympathetic nerve activity	$-$	1	1
α_{map}	Effect of MAP on RSNA	$-$	1	1
α_{rap}	Effect of right atrial pressure on RSNA	$-$	1	1
Φ_{win}	Water intake	$\frac{ml}{min}$	0.0150	0.0150
Φ_{sodin}	Na^+ intake	$\frac{\mu eq}{min}$	1.22	1.22
V_{ecf}	Extracellular fluid volume	ml	46	36
V_b	Blood volume	ml	15	12
T_{adh}	Time constant for ADH secretion	min	6	6
N_{adhs}	Normalized ADH secretion rate	$-$	1	1
N_{adh}	Normalized ADH concentration	$-$	1	1
C_{adh}	Antidiuretic hormone concentration	$\frac{\mu units}{min}$	4	4
δ_{ra}	Effect of right atrial pressure on ADH secretion rate	$-$	1	1
M_{sod}	Total amount of Na^+	μeq	6540	5340
C_{sod}	Plasma Na^+ concentration	$\frac{\mu eq}{ml}$	143	147
$\hat{C}_{anp}$	Normalized atrial natriuretic peptide concentration	$-$	1	1
C_K	Plasma K concentration	$\frac{\mu eq}{ml}$	5	5
		Scaling Factors		
SF_S	Human to rat sodium flow scaling factor	$\frac{\mu eq}{meq}$	9.69	9.69
SF_U	Human to rat urine flow scaling factor	$\frac{ml}{l}$	15	15
SF_V	Human to rat volume scaling factor	$\frac{ml}{l}$	3	2.4
SF_R	Human to rat resistance scaling factor	$\frac{l}{ml}$	0.343	0.537

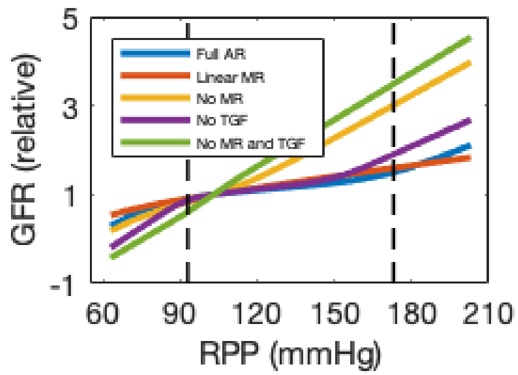

Figure S1: Renal autoregulation. Following the same experimental protocol as in Ref. (14), renal perfusion pressure is perturbed from its baseline value of 103 mmHg within a wide range. Male GFR is plotted as relative change from baseline value for full autoregulation, no myogenic response, no TGF, and no myogenic response and TGF. Dashed vertical lines are at the end points of the autoregulatory range of 90-170 mmHg. Female GFR curves are the same.

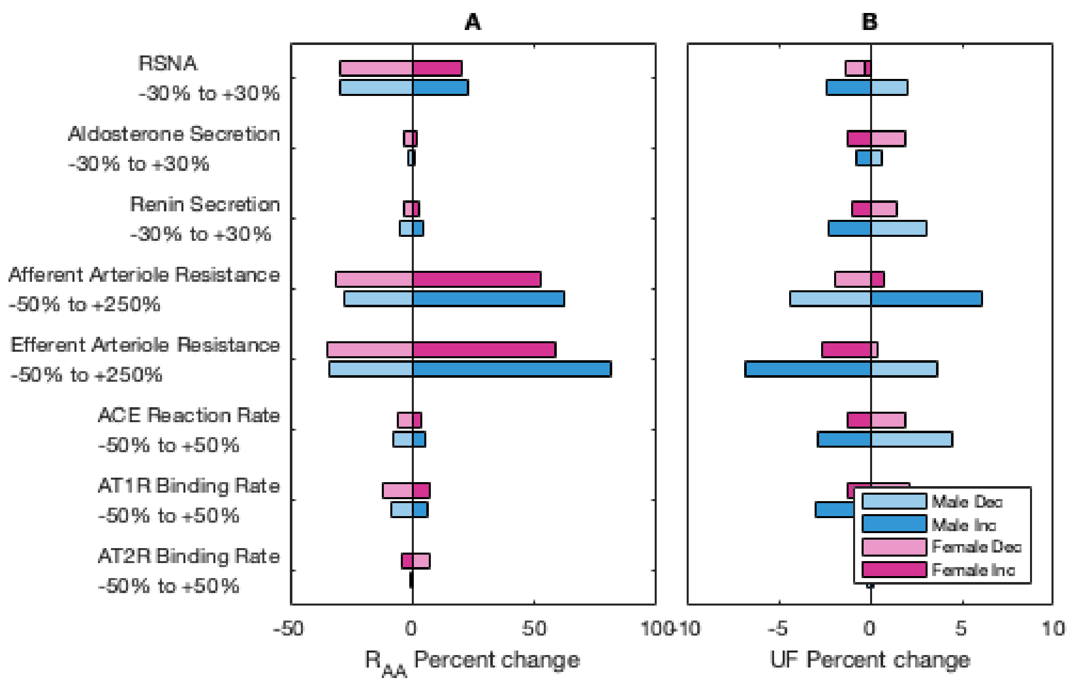

Figure S2: Sensitivity analysis. Percent change in afferent arteriolar resistance and urine flow due to various perturbations.