kidney_CellML1_0_model

1 "environment" component

This component has no equations.

2 "kidney" component

This component has no equations.

3 "perfusion_pressure" component

KD2A

$$\frac{\mathrm{d}(PAR1)}{\mathrm{d}(time)} = \frac{((100 + (PA - 100) * RCDFPC) - PAR1)}{RCDFDP}$$

KD1_KD2_and_KD2A

$$PAR = \begin{cases} RAPRSP; & \text{if } (RAPRSP > 0) \wedge (RFCDFT \leq 0), \\ PAR1; & \text{if } RFCDFT > 0, \\ (PA - GBL) & \text{otherwise.} \end{cases}$$

4 "renal_autoregulatory_feedback_factor" component

KD57_to_KD61

$$RNAUG1T = ((MDFLW - 1) * RNAUGN + 1)$$

KD62_and_KD63

$$RNAUG1 = \begin{cases} RNAULL; & \text{if } RNAUG1T < RNAULL, \\ RNAUUL; & \text{if } RNAUG1T > RNAUUL, \\ RNAUG1T & \text{otherwise.} \end{cases}$$

KD64

$$RNAUG2 = (RNAUG1 - RNAUG3)$$

KD65_to_KD67

$$\frac{\mathrm{d}(RNAUG3)}{\mathrm{d}(time)} = (RNAUG2 - 1) * RNAUAD$$

5 "afferent_arterial_resistance" component

This component has no equations.

6 "autonomic_effect_on_AAR" component

KD10_to_KD12

$$AUMKT = ((AUM - 1) * ARF + 1)$$

KD13

$$AUMK = \begin{cases} 0.8; & \text{if } AUMKT < 0.8, \\ AUMKT & \text{otherwise.} \end{cases}$$

7 "angiotensin_effect_on_AAR" component

KD3_KD7_and_KD8

$$ANMAR1 = ((ANM - 1) * ANMAM + 1)$$

KD8A

$$ANMAR = \begin{cases} ANMARL; & \text{if } ANMAR1 < ANMARL, \\ ANMAR1 & \text{otherwise.} \end{cases}$$

8 "AAR_calculation" component

KD9

$$AAR1 = AARK * PAMKRN * AUMK * RNAUG2 * ANMAR * 40 * MYOGRS$$

9 "atrial_natriuretic_peptide_effect_on_AAR" component

KD21_and_KD22

$$AART = ((AAR1 - ANPX * ANPXAF) + ANPXAF)$$

KD23

$$AAR = \begin{cases} AARLL; & \text{if } AART < AARLL, \\ AART & \text{otherwise.} \end{cases}$$

10 "efferent_arterial_resistance" component

This component has no equations.

11 "autonomic_effect_on_EAR" component

KD14_to_KD16

$$AUMK2 = ((AUMK - 1) * AUMK1 + 1)$$

12 "angiotensin_effect_on_EAR" component

KD3_to_KD5

$$ANMER = ((ANM - 1) * ANMEM + 1)$$

13 "effect_of_renal_autoregulatory_feedback_on_EAR" component

KD17_to_KD19

$$RNAUG4 = ((RNAUG2 - 1) * EFAFR + 1)$$

14 "EAR_calculation" component

KD6

$$EAR1 = 43.333 * EARK * ANMER * RNAUG4 * MYOGRS * AUMK2$$

KD6A

$$EAR = \begin{cases} EARLL; & \text{if } EAR1 < EARLL, \\ EAR1 & \text{otherwise.} \end{cases}$$

15 "total_renal_resistance" component

KD20

$$RR = (AAR + EAR)$$

16 "normal_renal_blood_flow" component

KD24A

$$RFN = \frac{PAR}{RR}$$

17 "actual_renal_blood_flow" component

KD73

$$RBF = REK * RFN$$

18 "glomerular_capillaries" component

This component has no equations.

19 "glomerular_colloid_osmotic_pressure" component

KD68_to_KD71

$$EFAFPR1 = \frac{RFN * (1 - HM1)}{(RFN * (1 - HM1) - GFN)}$$

KD71A

$$EFAFPR = \begin{cases} 1; & \text{if } EFAFPR1 < 1, \\ EFAFPR1 & \text{otherwise.} \end{cases}$$

KD72_to_KD72B

$$GLPC = \begin{cases} (EFAFPR)^{1.35} * PPC * 0.98; & \text{if } GLPCA > 0, \\ (PPC + 4) & \text{otherwise.} \end{cases}$$

20 "glomerular_pressure" component

KD24

$$APD = AAR * RFN$$

KD25

$$GLP = (PAR - APD)$$

21 "glomerular_filtration_rate" component

KD26

$$PFL = ((GLP - GLPC) - PXTP)$$

KD27

$$GFN1 = PFL * GFLC$$

KD28

$$GFN = \begin{cases} GFNLL; & \text{if } GFN1 < GFNLL, \\ GFN1 & \text{otherwise.} \end{cases}$$

KD51

$$GFR = GFN * REK$$

22 "proximal_tubular_and_macula_densa_flow" component

KD29

$$PTFL = GFN * 8$$

KD30_to_KD32

$$MDFLWT = ((PTFL - 1) * MDFL1 + 1)$$

KD33

$$MDFLW = \begin{cases} 0; & \text{if } MDFLWT < 0, \\ MDFLWT & \text{otherwise.} \end{cases}$$

23 "renal_tissue_osmotic_pressure" component

KD79_and_KD80

$$RTSPPC1 = (GLPC * RTPPR - RTPPRS)$$

KD81

$$RTSPPC = \begin{cases} 1; & \text{if } RTSPPC1 < 1, \\ RTSPPC1 & \text{otherwise.} \end{cases}$$

24 "urea_handling" component

This component has no equations.

25 "glomerular_urea_concentration" component

KD53_and_KD54

$$\frac{\mathrm{d}(PLUR)}{\mathrm{d}(time)} = (URFORM - UROD)$$

26 "plasma_urea_concentration" component

KD55

$$PLURC = \frac{PLUR}{VTW}$$

27 "renal_peritubular_capillaries" component

This component has no equations.

28 "peritubular_capillary_pressure" component

KD74_to_KD77

$$RCPRS = ((RFN - 1.2) * RFABX + 1.2) * RVRS$$

29 "peritubular_capillary_reabsorption_factor" component

KD78

$$RABSPR = (((GLPC + RTSPRS) - RCPRS) - RTSPPC)$$

KD82

$$RFAB1 = RABSPR * RABSC$$

KD83

$$RFAB = RFAB1$$

KD84_to_KD86

$$RFABD1 = ((RFAB - 1) * RFABDM + 1)$$

KD87

$$RFABD = \begin{cases} 0.0001; & \text{if } RFABD1 < 0.0001, \\ RFABD1 & \text{otherwise.} \end{cases}$$

30 "sodium_and_potassium_handling" component

This component has no equations.

31 "distal_tubular_Na_delivery" component

KD34

$$DTNAI = MDFLW * CNA * 0.0061619$$

32 "Na_reabsorption_into_distal_tubules" component

KD113_to_KD115_and_KD36

$$DTNARA1 = \frac{AMNA * RFABD * DTNAR}{DIURET} * ((ADHMK - 1) * AHMNAR + 1)$$

KD37

$$DTNARA = \begin{cases} DTNARL; & \text{if } DTNARA1 < DTNARL, \\ DTNARA1 & \text{otherwise.} \end{cases}$$

33 "angiotensin_induced_Na_reabsorption_into_distal_tubules" component

KD108_to_KD111

$$DTNANG1 = ((ANM - 1) * ANMNAM + 1) * 0.1$$

KD112

$$DTNANG = \begin{cases} 0; & \text{if } DTNANG1 < 0, \\ DTNANG1 & \text{otherwise.} \end{cases}$$

34 "distal_tubular_K_delivery" component

KD101_and_KD102

$$DTKI = \frac{DTNAI * CKE}{CNA}$$

35 "effect_of_physical_forces_on_distal_K_reabsorption" component

KD99_and_KD100

$$RFABK = (RFABD - 1) * RFABKM$$

36 "effect_of_fluid_flow_on_distal_K_reabsorption" component

KD88_to_KD90

$$MDFLK1 = ((MDFLW - 1) * MDFLKM + 1)$$

KD90A

$$MDFLK = \begin{cases} 0.1; & \text{if } MDFLK1 < 0.1, \\ MDFLK1 & \text{otherwise.} \end{cases}$$

37 "K_reabsorption_into_distal_tubules" component

KD104_to_KD107

$$\frac{\mathrm{d}(DTKA)}{\mathrm{d}(time)} = \left(\frac{KODN}{VUDN} * 0.0004518 - DTKA\right) * 1.0$$

38 "K_secretion_from_distal_tubules" component

KD94_to_KD96

$$ANMKE1 = ((ANM - 1) * ANMKEM + 1)$$

KD97

$$ANMKE = \begin{cases} ANMKEL; & \text{if } ANMKE1 < ANMKEL, \\ ANMKE1 & \text{otherwise.} \end{cases}$$

KD91_to_KD93_and_KD98

$$DTKSC = \frac{\left(\frac{CKE}{4.4}\right)^{CKEEX} * AMK * 0.08 * MDFLK}{ANMKE}$$

39 "urinary_excretion" component

This component has no equations.

40 "normal_Na_excretion" component

KD35

$$NODN1 = ((DTNAI - DTNARA) - DTNANG)$$

KD38

$$NODN = \begin{cases} 0.00000001; & \text{if } NODN1 < 0.00000001, \\ NODN1 & \text{otherwise.} \end{cases}$$

41 "normal_K_excretion" component

KD103

$$KODN1 = (((DTKI + DTKSC) - DTKA) - RFABK)$$

KD103A

$$KODN = \begin{cases} 0; & \text{if } KODN1 < 0, \\ KODN1 & \text{otherwise.} \end{cases}$$

42 "normal_urea_excretion" component

KD52

$$DTURI = (GFN)^2 * PLURC * 3.84$$

43 "normal_osmolar_and_water_excretion" component

KD40_to_KD42

$$OSMOPN1 = (DTURI + 2 * (NODN + KODN))$$

KD44

$$OSMOPN = \begin{cases} 0.6; & \text{if } OSMOPN1 > 0.6, \\ OSMOPN1 & \text{otherwise.} \end{cases}$$

44 "normal_urine_volume" component

KD43

$$OSMOP1T = (OSMOPN1 - 0.6)$$

KD45

$$OSMOP1 = \begin{cases} 0; & \text{if } OSMOP1T < 0, \\ OSMOP1T & \text{otherwise.} \end{cases}$$

KD46_to_KD48

$$VUDN = \left(\frac{OSMOPN}{600 * ADHMK} + \frac{OSMOP1}{360} \right)$$

45 "actual_Na_excretion_rate" component

KD39

$$NOD = NODN * REK$$

46 "actual_K_excretion_rate" component

KD116

$$KOD = KODN * REK$$

47 "actual_urea_excretion_rate" component

KD56

$$UROD = DTURI * REK$$

48 "actual_urine_volume" component

KD49

$$VUD = VUDN * REK$$

49 "parameter_values" component

This component has no equations.