chang_fujita_1999_version03

1 "environment" component

This component has no equations.

2 "imported_variables" component

This component has no equations.

3 "solute_concentrations" component

C_m_Na_diff_eq

$$\frac{\mathrm{d}(C\_m\_Na)}{\mathrm{d}(time)} = -((J\_mc\_Na + J\_ms\_Na))$$

C_s_Na_diff_eq

$$\frac{\mathrm{d}(C\_s\_Na)}{\mathrm{d}(time)} = (J\_ms\_Na - J\_sc\_Na)$$

C_c_Na_diff_eq

$$\frac{\mathrm{d}(C\_c\_Na)}{\mathrm{d}(time)} = (J\_mc\_Na + J\_sc\_Na)$$

C_m_K_diff_eq

$$\frac{\mathrm{d}(C\_m\_K)}{\mathrm{d}(time)} = -((J\_mc\_K + J\_ms\_K))$$

C_s_K_diff_eq

$$\frac{\mathrm{d}(C\_s\_K)}{\mathrm{d}(time)} = (J\_ms\_K - J\_sc\_K)$$

C_c_K_diff_eq

$$\frac{\mathrm{d}(C\_c\_K)}{\mathrm{d}(time)} = (J\_mc\_K + J\_sc\_K)$$

C_m_Cl_diff_eq

$$\frac{\mathrm{d}(C\_m\_Cl)}{\mathrm{d}(time)} = -((J\_mc\_Cl + J\_ms\_Cl))$$

C_s_Cl_diff_eq

$$\frac{\mathrm{d}(C\_s\_Cl)}{\mathrm{d}(time)} = (J\_ms\_Cl - J\_sc\_Cl)$$

C_c_Cl_diff_eq

$$\frac{\mathrm{d}(C\_c\_Cl)}{\mathrm{d}(time)} = (J\_mc\_Cl + J\_sc\_Cl)$$

4 "constants" component

This component has no equations.

5 "mc_sodium_flux" component

J_mc_Na_calculation

$$J\_mc\_Na = (J\_mc\_NaCl + G\_mc\_Na)$$

G_mc_Na_calculation

$$G\_mc\_Na = P\_mc\_Na * \frac{F * (psi\_m - psi\_c)}{RT} * \frac{\left(C\_m\_Na - C\_c\_Na * e^{-(\frac{F}{RT})*(psi\_m - psi\_c)}\right)}{\left(1.0 - e^{-(\frac{F}{RT})*(psi\_m - psi\_c)}\right)}$$

J_mc_NaCl_calculation

$$J\_mc\_NaCl = J\_mc\_NaCl\_max * \frac{\left(\frac{C\_m\_Na}{K\_mc\_Na\_NaCl} * \frac{C\_m\_Cl}{K\_mc\_Cl\_NaCl} - \frac{C\_c\_Na}{K\_mc\_Na\_NaCl} * \frac{C\_c\_Cl}{K\_mc\_Cl\_NaCl}\right)}{\left(\left(1.0 + \frac{C\_m\_Na}{K\_mc\_Na\_NaCl} * \frac{C\_m\_Cl}{K\_mc\_Cl\_NaCl}\right) * \left(1.0 + \frac{C\_c\_Na}{K\_mc\_Na\_NaCl}\right) * \left(1.0 + \frac{C\_c\_Cl}{K\_mc\_Cl\_NaCl}\right) + \left(1.0 + \frac{C\_c\_Na}{K\_mc\_Na\_NaCl} * \frac{C\_c\_Cl}{K\_mc\_Cl\_NaCl}\right) * \left(1.0 + \frac{C}{K\_mc}\right.\right.}$$

6 "mc_potassium_flux" component

J_mc_K_calculation

$$J\_mc\_K = (J\_mc\_KCl + G\_mc\_K)$$

G_mc_K_calculation

$$G\_mc\_K = P\_mc\_K * \frac{F * (psi\_m - psi\_c)}{RT} * \frac{\left(C\_m\_K - C\_c\_K * e^{-(\frac{F}{RT})*(psi\_m - psi\_c)}\right)}{\left(1.0 - e^{-(\frac{F}{RT})*(psi\_m - psi\_c)}\right)}$$

J_mc_KCl_calculation

$$J\_mc\_KCl = J\_mc\_KCl\_max * \frac{\left(\frac{C\_m\_K}{K\_mc\_K\_KCl} * \frac{C\_m\_Cl}{K\_mc\_Cl\_KCl} - \frac{C\_c\_K}{K\_mc\_K\_KCl} * \frac{C\_c\_Cl}{K\_mc\_Cl\_KCl}\right)}{\left(\left(1.0 + \frac{C\_m\_K}{K\_mc\_K\_KCl} * \frac{C\_m\_Cl}{K\_mc\_Cl\_KCl}\right) * \left(1.0 + \frac{C\_c\_K}{K\_mc\_K\_KCl}\right) * \left(1.0 + \frac{C\_c\_Cl}{K\_mc\_Cl\_KCl}\right) + \left(1.0 + \frac{C\_c\_K}{K\_mc\_K\_KCl} * \frac{C\_c\_Cl}{K\_mc\_Cl\_KCl}\right) * \left(1.0 + \frac{C\_m\_K}{K\_mc\_K\_KCl}\right) * (\right.}$$

7 "mc_chloride_flux" component

J_mc_Cl_calculation

$$J\_mc\_Cl = (J\_mc\_NaCl + J\_mc\_KCl + G\_mc\_Cl)$$

G_mc_Cl_calculation

$$G\_mc\_Cl = P\_mc\_Cl * \frac{-1.0 * F * (psi\_m - psi\_c)}{RT} * \frac{\left(C\_m\_Cl - C\_c\_Cl * e^{-(\frac{-1.0*F}{RT})*(psi\_m - psi\_c)}\right)}{\left(1.0 - e^{-(\frac{-1.0*F}{RT})*(psi\_m - psi\_c)}\right)}$$

8 "sc_sodium_flux" component

J_sc_Na_calculation

$$J\_sc\_Na = -3.0 * J\_a$$

J_a_calculation

$$J\_a = J\_a\_max * \frac{1.0}{\left(1.0 + \left(\frac{K\_Na\_ATPase}{C\_c\_Na}\right)^{3.0}\right)}$$

9 "sc_potassium_flux" component

J_sc_K_calculation

$$J\_sc\_K = (2.0 * J\_a + G\_sc\_K)$$

G_sc_K_calculation

$$G\_sc\_K = P\_sc\_K * \frac{F * (psi\_s - psi\_c)}{RT} * \frac{\left(C\_s\_K - C\_c\_K * e^{-(\frac{F}{RT})*(psi\_s - psi\_c)}\right)}{\left(1.0 - e^{-(\frac{F}{RT})*(psi\_s - psi\_c)}\right)}$$

10 "sc_chloride_flux" component

J_sc_Cl_calculation

$$J\_sc\_Cl = G\_sc\_Cl$$

G_sc_Cl_calculation

$$G\_sc\_Cl = P\_sc\_Cl * \frac{-1.0 * F * (psi\_s - psi\_c)}{RT} * \frac{\left(C\_s\_Cl - C\_c\_Cl * e^{-(\frac{-1.0*F}{RT})*(psi\_s-psi\_c)}\right)}{\left(1.0 - e^{-(\frac{-1.0*F}{RT})*(psi\_s-psi\_c)}\right)}$$

11 "ms_sodium_flux" component

J_ms_Na_calculation

$$J\_ms\_Na = G\_ms\_Na$$

G_ms_Na_calculation

$$G\_ms\_Na = P\_ms\_Na * \frac{F * (psi\_m - psi\_s)}{RT} * \frac{\left(C\_m\_Na - C\_s\_Na * e^{-(\frac{F}{RT})*(psi\_m-psi\_s)}\right)}{\left(1.0 - e^{-(\frac{F}{RT})*(psi\_m-psi\_s)}\right)}$$

12 "ms_potassium_flux" component

J_ms_K_calculation

$$J\_ms\_K = G\_ms\_K$$

G_ms_K_calculation

$$G\_ms\_K = P\_ms\_K * \frac{F * (psi\_m - psi\_s)}{RT} * \frac{\left(C\_m\_K - C\_s\_K * e^{-(\frac{F}{RT})*(psi\_m-psi\_s)}\right)}{\left(1.0 - e^{-(\frac{F}{RT})*(psi\_m-psi\_s)}\right)}$$

13 "ms_chloride_flux" component

J_ms_Cl_calculation

$$J\_ms\_Cl = G\_ms\_Cl$$

G_ms_Cl_calculation

$$G\_ms\_Cl = P\_ms\_Cl * \frac{-1.0 * F * (psi\_m - psi\_s)}{RT} * \frac{\left(C\_m\_Cl - C\_s\_Cl * e^{-(\frac{-1.0*F}{RT})*(psi\_m-psi\_s)}\right)}{\left(1.0 - e^{-(\frac{-1.0*F}{RT})*(psi\_m-psi\_s)}\right)}$$

14 "total_transepithelial_sodium_flux" component

J_Na_calculation

$$J\_Na = (J\_mc\_Na + J\_ms\_Na)$$

15 "total_transepithelial_potassium_flux" component

J_K_calculation

$$J\_K = (J\_mc\_K + J\_ms\_K)$$

16 "total_transepithelial_chloride_flux" component

J_Cl_calculation

$$J\_Cl = (J\_mc\_Cl + J\_ms\_Cl)$$

17 "osmolarities" component

Osm_m_calculation

$$Osm\_m = (C\_m\_Na + C\_m\_K + C\_m\_Cl + C\_m\_Imp)$$

Osm_c_calculation

$$Osm\_c = (C\_c\_Na + C\_c\_K + C\_c\_Cl + C\_c\_Imp)$$

Osm_s_calculation

$$Osm\_s = (C\_s\_Na + C\_s\_K + C\_s\_Cl + C\_s\_Imp)$$

18 "mc_transepithelial_volume_flux" component

J_mc_v_calculation

$$J\_mc\_v = L\_mc\_v * RT * (Osm\_m - Osm\_c)$$

19 "ms_transepithelial_volume_flux" component

J_ms_v_calculation

$$J\_ms\_v = L\_ms\_v * RT * (Osm\_m - Osm\_s)$$

20 "sc_transepithelial_volume_flux" component

J_sc_v_calculation

$$J\_sc\_v = L\_sc\_v * RT * (Osm\_s - Osm\_c)$$

21 “total_transepithelial_volume_flux” component

J_v_calculation

$$J\_v = (J\_mc\_v + J\_ms\_v)$$