**Supplemental data**

1. **Voltage-gated ion channel models**

The equation for the voltage-gated ion channel’s steady-state and their time constants are stated below. The time constant were converted from room temperature (20 **°**C) to body temperature (37 **°**C) by the Q12 factor (see table below). The Q10 values were adopted from the Tigerholm et al study (2012)

|  |  |
| --- | --- |
|  | Q10 factor |
| Sodium channels | 2.5 |
| Potassium channel | 3.3 |
| HCN | 3 |

GMax: the maximum conductance of for each channel and are presented in table 2 in the paper.

ENa: 70 mV (reversal potential of sodium)

EK: -82 mV (reversal potential of potassium)

V: membrane potential

**Aδ model**

All the ion channel models were adopted from the Tigerholm et. al. study (2012).

1. NaTTXs

2. NaTTXr:

3. NaP:

4. HCN:

5. KDr:

7. KM:

**Aβ** **model**

1. NaTTXs:

The dynamic properties of NaTTXs: was adopted from Watanabe et. al. study (2002). This current consists of the sodium subunit Nav1.6.

if abs(v+22) > 1e-6) else =2.88

if abs(v-22) > 1e-6) else =0.8928

if tm > 0.02 else tm = 0.02

if abs(v+45) > 1e-6) else = 0.0450

if abs(v-45) > 1e-6) else = 0.0150

if th > 0.5 else th = 0.5

if ts > 10 else ts = 10

2. NaP:

The dynamic properties of NaP: was adopted from Jankelowitz, et. al. study (2007

3.HCN: The dynamic equations are the same as for the Aδ model

4.KDr: The dynamic equations are the same as for the Aδ model

5.KM: The dynamic equations are the same as for the Aδ model

1. **Equivalent electrical circuit**

Both of the nerve fiber models are based on the previous published model by Tigerholm et. al. (2014). In the Tigerholm model the two ionic currents, potassium and sodium, are balanced individual to generate a specific resting potential. The sum of all the current when the membrane potential is the resting potential is equal to either a sodium pump or a potassium pump. The HCN current mediate both a sodium and a potassium current and is therefore divided as two resistors in the equivalent circuit scheme.

* 1. **Aδ model**

The Aδ model is an unmyelinated axon model and the equivalent circuit for one compartment are show in the figure below.



*Supplemental data Figure 1. The equivalent circuit for one compartment of the Aδ model.*

*Three sodium channel (NaP, NaTTXs and NaTTXr) and two potassium channels (KDr and KM) was implemented. Also the HCN current was implemented.*

*VNa=70 mV*

*VK=-82 mV*

*Cnode= 1* μF/cm2

*PumpNa=0.00006672 mA/cm2*

*PumpK=-0.00001707 mA/cm2*

**2.2 Aβ model**

**2.2.1 Node of Ranvier**

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*Supplemental data Figure 2. The equivalent circuit for one compartment of the Aδ model*

*Tow sodium channel (Nap and NaTTXs) and one potassium channels ( KM) was implemented.*

*VNa=70mV*

*VK=-82 mV*

*Cnode=1*μ*F/cm2*

*PumpNa= 0.004062 mA/cm2*

*PumpK=* -*0.000309 mA/cm2*

**2.2.1 JUXTAPARANODE**

**A close up of a logo

Description automatically generated**

*Supplemental data Figure 3. The equivalent circuit for one compartment of the Aδ model*

*Two potassium channels (KDr and KM) was implemented. Also the HCN current was implemented.*

*VNa=70mV*

*VK=-82 mV*

*CJP= 0.0141μ*F/cm2

*PumpNa=0.003380 mA/cm2*

*PumpK= -0.000886 mA/cm2*

**3. Reference**

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