Sodium current reduction unmasks a structure-dependent substrate for arrhythmogenesis in the normal ventricles

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SUPPORTING FILE S1

Figure S1:

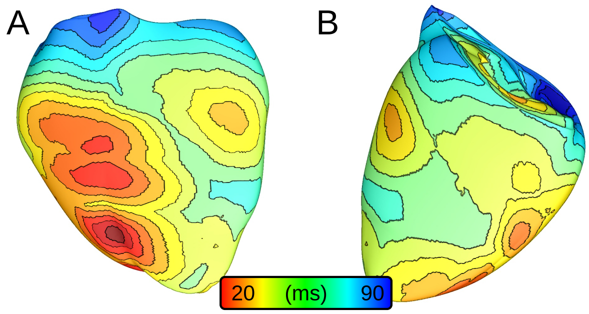

Figure S2:

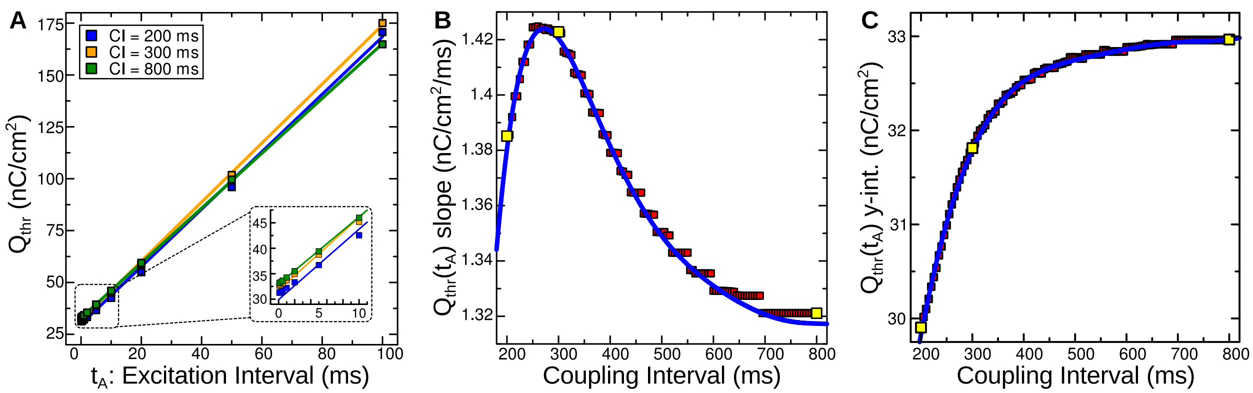

Table S1:

Mesh Resolution (*μm*)	**Conduction Velocity Along Wedge (*cm/s*)**	**Percent Difference (compared to highest-resolution model)**
500	19.24	42.5%
250	30.60	8.79%
125	33.09	1.37%
62.5	33.55	N/A

Table S2:

Category	**Parameter(s)**	**Value**
Geometry	# of degrees of freedom (nodes)	843,507
	# tetrahedral elements	4,744,512
	mean element edge length	261.76 *μm*
Monodomain conductivity (mS/mm)	longitudinal (σ_{mL})	0.1845
	transverse (σ_{mT})	0.02376
	normal (σ_{mN})	0.02376
Computation	# of Intel X5660 CPUs @ 2.80 *GHz*	12
	wall time to simulate 1 second	2*h*07*m*

Appendix:

```
################################################################
# Pseudocode for calculation of cardiac safety factor (SF)     #
# as described in Boyle, Park et al. (2013).                   #
#                                                              #
# This is an improved version of the formulation presented in  #
# Boyle & Vigmond (2010) Biophys J. Note that a correction to  #
# that paper was published in the December 2013 issue of the   #
# same journal (please see: http://goo.gl/DdHz0e).             #
#                                                              #
# The process outlined here is for a single node but can be    #
# extended to deal with arbitrary geometry, as in the paper.   #
################################################################

BEGIN CalcSF

    SET Vm   = read_file( Vm_file )          # transmembrane voltage data over time
    SET Iion = read_file( Iion_file )        # ionic current data over time

    SET dt = 0.1                             # global time step between data values
    SET last_act = ...                       # the previous activation time for this node

    # First, compute Im = Cm dVm/dt + Iion:
    SET Im = compute_Im( Vm, Iion, dt )
    # Note 1: current units: uA/cm^2, voltage units: mV
    # Note 2: reduces to a simple sum since Cm = 1 uF/cm^2
    # Note 3: use forward differencing to compute dVm/dt

    # Second, identify the first interval during which Vm is
    # above some empirically-defined threshold, e.g. -85 mV:
    SET Vm_thr =  -85
    SET i_depol = -1
    SET i_repol = -1
    FOREACH Vm_i in Vm,
        IF i_depol < 0 AND Vm_i-1 < Vm_thr AND Vm_i >= Vm_thr,
                SET i_depol = i
        END IF
        IF i_repol < 0 AND Vm_i-1 >= Vm_thr AND Vm_i < Vm_thr,
                SET i_repol = i
        END IF
    END FOREACH
    # Note 4:  To avoid spurious Vm crossings, it may be necessary to validate by ensuring
    #          that Vm stays above/below V_thr for some length of time (e.g., 1 ms)

    # Finally, calculate SF as a maximization over the identified trans-threshold interval:
    set SFmax = -1
    FOREACH i FROM i_depol+1 TO i_repol,
        SET Qnet = integrate( Im, i_depol, i, dt )
        # Note 5: a simple numerical integrator is OK (e.g., rectangle/trapezoid methods)

        SET Qthr = Qthr_tA_CI( dt * (i - i_depol), dt*i_depol - last_act )
        # Note 6: see text + Fig. S2 for detailed information on estimating Qthr(tA,CI)

        IF Qnet / Qthr > SFmax,
                set SFmax = Qnet / Qthr
        END IF
    END FOREACH

    # All done!
    print SFmax

END CalcSF
```