Listing 1: NeuroML File for EGL-19 Voltage-Gated Calcium Channel.

```
<?xml version="1.0" encoding="UTF-8"?>
<neuroml xmlns="http://www.neuroml.org/schema/neuroml2"
         xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
         xsi:schemaLocation="http://www.neuroml.org/schema/neuroml2  https://raw.
             github.com/NeuroML/NeuroML2/master/Schemas/NeuroML2/NeuroML_v2beta.xsd
             "
         id="ca_boyle">

    <ionChannel id="ca_boyle" conductance="10pS" type="ionChannelHH" species="ca">

        <notes>Ca channel from Boyle and Cohen 2008</notes>

        <gateHHtauInf id="e" instances="2">

            <timeCourse type="fixedTimeCourse" tau="0.100027 ms"/>
            <steadyState type="HHSigmoidVariable" rate="1" scale="6.74821 mV"
                midpoint="-3.3568 mV"/>

        </gateHHtauInf>

        <gateHHtauInf id="f" instances="1">

            <timeCourse type="fixedTimeCourse" tau="150.88 ms"/>

            <!-- Note!!!

                f gate is "inactivation" a/c B&C 2008 p172
                but the scale value from Table A1 (kf) is positive (5mV), i.e.
                    steady
                state is zero for v << midpoint and 1 for v >> midpoint
                Couple this with a very slow time course & the ion channel never
                conducts as e^2 x f is always ~0

                Using -5.03176mV NOT 5mV for k/scale to make this INACTIVATION

                This is suggested by the value used here:
                https://github.com/openworm/muscle_model/blob/master/BoyleCohen2008
                    /MatlabSupport/Main_Version/data/input.csv#L20

                see also
                https://github.com/openworm/muscle_model/blob/master/BoyleCohen2008
                    /PythonSupport/Main_Version/compareToNeuroML2.py
            -->
            <steadyState type="HHSigmoidVariable" rate="1" scale="-5.03176 mV"
                midpoint="25.1815 mV"/>

        </gateHHtauInf>

        <customHGate id="h" instances="1" alpha="0.282473" ca_half="6.41889e-8 mM"
            k="-1.00056e-8 mM"/>

    </ionChannel>
```

```
45      <ComponentType name="customHGate"
46                     extends="gateHHtauInf"
47                     description="Custom gate for h">
48
49          <Parameter name="alpha" dimension="none"/>
50          <Parameter name="k" dimension="concentration"/>
51          <Parameter name="ca_half" dimension="concentration"/>
52
53
54          <Constant name="SEC" dimension="time" value="1s"/>
55
56
57          <Exposure name="tau" dimension="time"/>
58          <Exposure name="inf" dimension="none"/>
59
60          <Requirement name="caConc" dimension="concentration"/>
61
62          <Dynamics>
63
64              <DerivedVariable name="rateScale" exposure="rateScale" dimension="none"
                     value="1"/>
65
66              <DerivedVariable name="inf" dimension="none" exposure="inf" value="1 /
                    (1 + (exp( (ca_half - caConc) / k)))"/>
67
68
69              <DerivedVariable name="tau" dimension="time" exposure="tau" value="0 *
                    SEC"/>
70              <DerivedVariable name="q" exposure="q" dimension="none" value="inf"/>
71              <DerivedVariable name="fcond" exposure="fcond" dimension="none" value="
                    1 +((q-1) * alpha)"/>
72
73          </Dynamics>
74      </ComponentType>
75
76  </neuroml>
```