**Table S1. Electrical and thermal properties of human skin, BCC and potato used for the numerical simulations.**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Geometry**  Depth (mm) | **Electrical conductivity** | **Thermal conductivity** | **Heat capacitance** | **Density** |
| **Stratum corneum** | 0.1  (Pavšelj et al., 2007) | 0.0165  (Pavšelj et al., 2007) | 0.593  (Park et al., 2016) | 3770  (Rugh & Bharathan, 2005) | 1000  (Rugh & Bharathan, 2005) |
| **Epidermis** | 0.25  (Pavšelj et al., 2007) | 0.21  (Pavšelj et al., 2007) | 0.593  (Park et al., 2016) | 3770  (Rugh & Bharathan, 2005) | 1000  (Rugh & Bharathan, 2005) |
| **Dermis** | 1  (Pavšelj et al., 2007) | 0.21  (Pavšelj et al., 2007) | 0.593  (Park et al., 2016) | 3770  (Rugh & Bharathan, 2005) | 1000  (Rugh & Bharathan, 2005) |
| **BCC** | 2  (Average  measured value) | 0.334  (Luo et al., 2022) | 0.579  (Park et al., 2016) | 3770  (Rugh & Bharathan, 2005) | 1000  (Rugh & Bharathan, 2005) |
| **Fat** | 2  (Rahman et al., 2020) | 0.04  (Ramon et al., 2014) | 0.16  (Rugh & Bharathan, 2005) | 2510  (Rugh & Bharathan, 2005) | 850  (Rugh & Bharathan, 2005) |
| **Muscle** | 4  (Rahman et al., 2020) | 0.1  (Ramon et al., 2014) | 0.42  (Rugh & Bharathan, 2005) | 3770  (Rugh & Bharathan, 2005) | 1050  (Rugh & Bharathan, 2005) |
| **Skull** | 6.6  (Dutta et al., 2016) | 0.065  (Ramon et al., 2014) | 0.16  (Gentilal & Miranda, 2020) | 1700  (Gentilal & Miranda, 2020) | 1500  (Gentilal & Miranda, 2020) |
| **Dura** | 0.5  (Sabbah et al., 2010) | 0.06  (Ramon et al., 2014) | 0.44  (Nagel et al., 2018) | 3364  (Nagel et al., 2018) | 1174  (Nagel et al., 2018) |
| **CSF** | 2  (Sabbah et al., 2010) | 1.54  (Ramon et al., 2014) | 0.5  (Gentilal & Miranda, 2020) | 4200  (Gentilal & Miranda, 2020) | 1000  (Gentilal & Miranda, 2020) |
| **Brain** | 81  (Dutta et al., 2016) | 0.258  (Ramon et al., 2014) | 0.53  (Rugh & Bharathan, 2005) | 3690  (Rugh & Bharathan, 2005) | 1050  (Rugh & Bharathan, 2005) |
| **Electrode** | 0.3mm  ground = 3mm | (Golberg, 2014) | 16  (Golberg, 2014) | 466  (Golberg, 2014) | 8000  (Golberg, 2014) |
| **potato** | 1.5cm slices | 0.15  (Sieni et al., 2018b) | 0.6  (Arroqui et al., 2003) | 3800  (Arroqui et al., 2003) | 1080  (Arroqui et al., 2003) |

**Table S2. Electrode radius parameter influence on BCC scenarios A and B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **BCC Scenario A** |  |  | **BCC Scenario B** |  |
| **Electrode Radius (mm)** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** |
| 0.1 | 25.6 | 12.65 | 38.25 | 20.4 | 35.5 | 55.9 |
| 0.2 | 42.4 | 22.58 | 64.98 | 30.56 | 55.3 | 85.86 |
| 0.3 | 51.66 | 29.19 | 80.85 | 39.95 | 80.78 | 120.73 |
| 0.4 | 56.8 | 39.03 | 95.83 | 41.9 | 93.96 | 135.86 |
| 0.5 | 60.32 | 42.14 | 102.46 | 42.12 | 102 | 144.12 |
| 0.6 | 62.86 | 47.51 | 110.37 | 42.12 | 112 | 154.12 |

**Table S3. Conductivity parameter influence on BCC scenarios A and B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **BCC Scenario A** |  |  | **BCC Scenario B** |  |
| **Conductivity**  **(S/m)** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** |
| 0.05 | 36.68 | 13.95 | 50.63 | 38.95 | 13.58 | 52.53 |
| 0.1 | 46.2 | 21.5 | 67.7 | 39.9 | 28.9 | 68.8 |
| 0.2 | 50.083 | 27.12 | 77.203 | 41.28 | 43.82 | 85.1 |
| 0.3 | 51.001 | 28.35 | 79.351 | 39.2 | 65.8 | 105 |
| 0.334 | 51.02 | 29.35 | 80.37 | 39.95 | 80.78 | 120.73 |
| 0.4 | 52.25 | 31.09 | 83.34 | 36.9 | 90.2 | 127.1 |
| 0.5 | 52.54 | 31.54 | 84.08 | 33.16 | 108.97 | 142.13 |
| 0.6 | 53.2 | 32.78 | 85.98 | 28.7 | 120.3 | 149 |
| 0.7 | 53.28 | 33.01 | 86.29 | 26.35 | 131.7 | 158.05 |
| 0.8 | 53.4 | 33.07 | 86.47 | 24.65 | 143.97 | 168.62 |

**Table S4. Penetration depth parameter influence on BCC scenarios A and B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **BCC Scenario A** |  |  | **BCC Scenario B** |  |
| **Penetration Depth**  **(mm)** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** |
| 0.5 | 38.42 | 15.67 | 54.09 | 26.6 | 43.6 | 70.2 |
| 1 | 51.02 | 29.35 | 80.37 | 39.95 | 80.78 | 120.73 |
| 1.5 | 54.59 | 34.58 | 89.17 | 41.3 | 86.41 | 127.71 |
| 2 | 55.23 | 37.76 | 92.99 | 41.19 | 87.1 | 128.29 |
| 2.5 | 56.34 | 41.508 | 97.848 | 42.02 | 88.5 | 130.52 |

**Table S5. Distance between ground to electrode parameter influence on BCC scenarios A and B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **BCC Scenario A** |  |  | **BCC Scenario B** |  |
| **Distance**  **(mm)** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** |
| 0.5 | 18.21 | 11.32 | 29.53 | 19.4 | 11.2 | 30.6 |
| 1 | 21.34 | 14.97 | 36.31 | 23.12 | 12.08 | 35.2 |
| 1.5 | 25.6 | 17.6 | 43.2 | 36 | 15.7 | 51.7 |
| 5 | 30.87 | 20.5 | 51.37 | 38.1 | 19.56 | 57.66 |
| 2.5 | 36.6 | 23.99 | 60.59 | 39.32 | 50.12 | 89.44 |
| 3 | 45.2 | 25.4 | 70.6 | 39.45 | 75.78 | 115.23 |
| 3.2 | 51.02 | 29.35 | 80.37 | 39.95 | 81.78 | 121.73 |
| 3.5 | 54.83 | 29.88 | 84.71 | 39.6 | 92 | 131.6 |
| 4 | 56.82 | 30.58 | 87.4 | 35.2 | 95.48 | 130.68 |
| 4.5 | 46.4 | 31.95 | 78.35 | 32.1 | 113.2 | 145.3 |
| 5 | 43.23 | 32.02 | 75.25 | 34.89 | 97.6 | 132.49 |
| 5.5 | 40.85 | 32.65 | 73.5 | 29.73 | 86.7 | 116.43 |
| 5 | 39.6 | 32.58 | 72.18 | 28.7 | 85.7 | 114.4 |
| 6.5 | 38.2 | 32.4 | 70.6 | 27.43 | 84.7 | 112.13 |

**Table S6. Ground radius parameter influence on BCC scenarios A and B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **BCC Scenario A** |  |  | **BCC Scenario B** |  |
| **Ground**  **Radius (mm)** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** |
| 1 | 49.56 | 25.8 | 75.36 | 33.81 | 50 | 83.81 |
| 2 | 49.96 | 27.3 | 77.26 | 39.3 | 68.92 | 108.22 |
| 3 | 51.02 | 29.35 | 80.37 | 39.95 | 80.78 | 120.73 |
| 4 | 50.23 | 28.4 | 78.63 | 40 | 81 | 121 |
| 5 | 49.116 | 27.84 | 76.956 | 41.3 | 91.3 | 132.6 |

**Table S7. Voltage parameter influence on BCC scenarios A and B**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | **BCC Scenario A** |  |  | **BCC Scenario B** |  |
| **Voltage**  **(V)** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** | **BCC electroporated volume** | **Healthy electroporated volume** | **Total electroporated volume** |
| 250 | 15.7 | 9.8 | 25.5 | 11.052 | 6.8 | 17.852 |
| 500 | 52.052 | 29.2 | 81.252 | 39.15 | 80.78 | 119.93 |
| 750 | 65.9 | 51.23 | 117.13 | 42.12 | 126.87 | 168.99 |
| 1000 | 75.43 | 66.6 | 142.03 | 42.12 | 166.11 | 208.23 |

**Table S8. Electrode radius parameter influence on potato electroporation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Simulation** | **Experiment** | |
| **Electrode Radius (mm)** |  | **Darkness intensity** | **Electroporated area** |
| 0.1 | 19.3 |  |  |
| 0.2 | 31.2 |  |  |
| 0.3 | 48.5 |  |  |
| 0.4 | 60.3 |  |  |
| 0.5 | 70.5 |  |  |
| 0.6 | 80.7 |  |  |

**Table S9. Conductivity parameter influence on potato electroporation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Simulation** | **Experiment** | |
| **Conductivity**  **(S/m)** | **Electroporated Volume** | **Darkness intensity** | **Electroporated area** |
| 0.05 | 48.7 |  |  |
| 0.5 | 47.7 |  |  |
| 1.2 | 48.47 |  |  |
| 1.5 | 48.63 |  |  |
| 2 | 48.9 |  |  |

**Table S10. Penetration depth parameter influence on potato electroporation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Simulation** | **Experiment** | |
| **Penetration Depth**  **(mm)** | **Electroporated Volume** | **Darkness intensity** | **Electroporated area** |
| 0.5 | 25.85 | 0.016591 | 58.2 |
| 1 | 48.5 | 0.021158 | 65.25 |
| 1.5 | 59.59 | 0.025186 | 88.4 |
| 2 | 80.9 | 0.047256 | 125.6 |
| 2.5 | 97.5 |  |  |

**Table S11. Distance between ground to electrode parameter influence on potato electroporation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Simulation** | **Experiment** | |
| **Distance**  **(mm)** | **Electroporated Volume** | **Darkness intensity** | **Electroporated area** |
| 0.5 | 22.3 |  |  |
| 1 | 25.3 |  |  |
| 1.5 | 30.5 |  |  |
| 2 | 37.7 |  |  |
| 2.5 | 43.68 |  |  |
| 3 | 48 |  |  |
| 3.2 | 48.47 |  |  |
| 3.5 | 44.8 |  |  |
| 4 | 38.9 |  |  |
| 4.5 | 39.2 |  |  |

**Table S12. Ground radius parameter influence on potato electroporation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Simulation** | **Experiment** | |
| **Ground**  **Radius (mm)** | **Electroporated Volume** | **Darkness intensity** | **Electroporated area** |
| 1 | 51.466 |  |  |
| 2 | 48.79 |  |  |
| 3 | 48.47 |  |  |
| 4 | 47.66 |  |  |
| 5 | 47.443 |  |  |

**Table S13. Voltage parameter influence on potato electroporation**

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Simulation** | **Experiment** | |
| **Voltage**  **(V)** | **Electroporated Volume** | **Darkness intensity** | **Electroporated area** |
| 250 | 15.12 | 0.017966 | 20.8 |
| 500 | 48.8 | 0.021158 | 65.25 |
| 750 | 80.24 | 0.0318 | 90.3 |
| 1000 | 95.7 |  |  |

**Table S14. Frequency, number of pulses and pulse length parameters influence on potato electroporation**

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | **Experiment** | |  | **Experiment** | |  | **Experiment** | |
| **Frequency**  **(Hz)** | **Darkness intensity** | **Electroporated area** | **Number of pulses** | **Darkness intensity** | **Electroporated area** | **Pulse**  **Length** | **Darkness intensity** | **Electroporated area** |
| **1** | 0.011777 | 38.5 | **20** | 0.017329 | 59 | **20** | 0.009855 | 33.417 |
| **4** | 0.021158 | 65.25 | **40** | 0.021158 | 65.25 | **40** | 0.021158 | 65.25 |
| **8** | 0.021246 | 65.27 | **80** | 0.0215 | 73.61 | **80** | 0.021668 | 102.36 |
|  |  |  | **160** | 0.015755 | 101.73 | **160** | 0.020574 | 117.52 |

**Figure 10. Pairwise t-test of 10 BCC excised tissues**

