a

128-FET device intracellularly interfacing
a cardiac muscle microtissue

C   B

D   A

20 μm ─
40 μm ─   Loop 3
                           Loop 2
E   Loop 1

H

z
y
  x

F   G

y
A 1a   A 2a   A 3a
i   i
ii   ii
iii   iii
A   iv   x
iv   v
v   vi
vi
A 1b   A 2b

Loop 1   Loop 2   Loop 3

b

          A   B   C   D   E   F   G   H
      i
      ii
Loop 1 iii
      iv
      v
      vi

      i
      ii
Loop 2 iii
      iv
      v
      vi

      i
Loop 3 ii
      iii
      iv

100 mV
1 s

c

Counts

50
40
30
20
10
0
  20   40   60   80   100
Action potential
amplitude (mV)

d

Small-scale
conduction velocity
(μm·ms⁻¹)

50
40
30
20
10
0

○ Loop 1
○ Loop 2
○ Loop 3

Units

e

Z-dimension
(μm)

60
40
20
0

4000
2000
0
-2000
Y-dimension
(μm)   -4000

-4000 -2000   0   2000   4000
X-dimension (μm)

f

Distance (mm)

20

15

10

5

0
  0   375   750   1125 1500
Large-scale latency (ms)

○ Loop 1 ○ Loop 2 ○ Loop 3

10.9 μm·ms⁻¹
11.8 μm·ms⁻¹
12.2 μm·ms⁻¹

R² = 0.99
R² = 0.98
R² = 0.97